



# Do people prefer cycling policy aiming at extending or saving lives? An experimental survey study

Igor Radun<sup>a,b,\*</sup>, Jenni Radun<sup>c</sup>, Mitri Kitti<sup>d,e</sup>, Heikki Kauppi<sup>e</sup>, Timo Lajunen<sup>f</sup>, Jake Olivier<sup>g,h</sup>

<sup>a</sup> Department of Psychology and Logopedics, Faculty of Medicine, University of Helsinki, Helsinki, Finland

<sup>b</sup> Department of Psychology, Stress Research Institute, Stockholm University, Stockholm, Sweden

<sup>c</sup> Turku University of Applied Sciences, Turku, Finland

<sup>d</sup> Department of Economics, Aalto University, Finland

<sup>e</sup> Department of Economics, University of Turku, Finland

<sup>f</sup> Department of Psychology, Norwegian University of Science and Technology, Trondheim, Norway

<sup>g</sup> School of Mathematics and Statistics, UNSW Sydney, Australia

<sup>h</sup> Transport and Road Safety Research Centre, UNSW Sydney, Australia

## ARTICLE INFO

### Keywords:

Vision Zero  
Moving beyond Zero  
Ethics  
Traffic safety  
Cost benefit analysis

## ABSTRACT

We investigated the preference between transport policies aiming at extending vs. saving lives. In a  $2 \times 2$  experimental survey study participants randomly received one of four possible policy combinations. The saving lives policy included saving five (250 life-years saved) or ten (500 life-years saved) lives of cyclists who are about 30 years of age. The extending lives policy through the promotion of cycling and associated health benefits was set to extend lives by two ratios (10:1 or 20:1) in relation to life-years saved of the life-saving strategy. Participants were representative of Finnish-speaking residents older than 15 years ( $N = 1025$ ). In total, 45.5% of the participants preferred a policy aimed at saving lives, 36% preferred an extending lives policy, and 18.2% were undecided. These figures remained essentially the same independent of the benefit-to-cost ratio of cycling (in terms of saved life years) and whether the saving life policy meant saving five or ten lives. Women and the elderly preferred a policy aimed at saving lives, while cyclists preferred an extending lives policy. The results are discussed in the context of Vision Zero and a new transport paradigm called Vision Plus.

## 1. Introduction

Vision Zero has been an important if not a dominant paradigm in road traffic safety policy making worldwide since it was developed by Swedish researchers and adopted by the Swedish Parliament in 1997 (Kristianssen et al. 2018). The main goal of this paradigm is that no one should be killed or seriously injured as a consequence of road crashes. This goal is supposed to be achieved by designing a safe road transport system and in large part shifts the injury prevention responsibility from road users to road traffic system designers.

Although there is a wide consensus that Vision Zero represents a noble initiative (ITF 2016), some traffic safety stakeholders are skeptical about whether the ultimate goal of zero fatalities can and will ever be achieved (Whitelegg and Haq, 2007). Recent developments are not going in favor of Vision Zero as, for example, the EU target of halving the number of road deaths by 2020 in comparison to the 2010 baseline has not been met (Adminaité-Fodor et al. 2021). The reduction of road

fatalities has been too slow. Furthermore, it is unclear how large investments in traffic safety should be in order to reach Vision Zero. It is possible, according to Elvik (1999), that if the entire hypothetical Vision Zero program is implemented, the benefits achieved in eliminating road traffic-related mortality might be seriously undermined or even exceeded by the increase in general mortality due to fewer resources available to control other causes of death.

Twenty years after the adoption of Vision Zero, another initiative, Moving Beyond Zero, has also emerged in Sweden. Instead of (only) focusing on Vision Zero (i.e., achieving the ultimate goal of zero fatalities), Moving Beyond Zero proposes that transportation-related policies should also take into account health benefits associated with active travel (i.e., cycling and walking). For example, recent studies show that cycling is associated with a lower risk of all-cause mortality (Celis-Morales et al., 2017; Kelly et al. 2014). This represents a completely different approach as Vision Zero even abandons a classical cost benefit approach to road safety.

\* Corresponding author at: Department of Psychology and Logopedics, Faculty of Medicine, P.O. Box 21, 00014 University of Helsinki, Finland.  
E-mail address: [igor.radun@helsinki.fi](mailto:igor.radun@helsinki.fi) (I. Radun).

The Moving Beyond Zero paradigm (plussavio in Finnish; Vision Plus in the rest of the text) has received some political support, for example, from Karolina Skog, a former Swedish Minister for the Environment. In Finland, this paradigm has been mentioned in the Ministry of Transport and Communications’ publication “The walking and cycling promotion program” [Kävelyn ja pyöräilyn edistämishjelma].

There is a clear ethical difference between these two paradigms. While Vision Zero represents a noble initiative (i.e., no deaths and no serious injuries), Vision Plus adopted a more pragmatic approach (i.e., focus on extending lives instead of (only) focusing on preventing road fatalities). The difference between these two paradigms is visible in a statement by well-known Finnish politician and cycling activist, Otso Kivekäs, in the context of the promotion of electric bikes: “Even if the deaths of elderly men riding electric bikes have increased, the effects of cycling on health are positive, because cycling can lead to more healthy life years” (Salmela, 2018). This viewpoint accepts some road fatalities (as collateral damage) as long as the benefits (i.e., more healthy life-years) are larger. An immediate question that follows is how large the benefit-to-cost ratio (B/C ratio) has to be for society to accept an increase in fatalities. Is it enough that the ratio is slightly above one or does it have to be much larger?

Cycling related injuries represent a significant proportion of all road trauma and their number is naturally expected to grow with the promotion of cycling and increasing number of people using this mode of transportation (Beck et al., 2017). Any increase in fatalities and serious injuries is in direct contrast with Vision Zero. On the other hand, Vision Plus, as we understand it, postulates that no traffic safety measure should reduce cycling or interfere with its promotion. Therefore, it is unclear whether Vision Plus paradigm will receive more attention in the future and whether and in which form it can coexist with Vision Zero.

Given the above consideration, the aim of this study was to examine whether people prefer Vision Plus or Vision Zero. As mentioned, although these two paradigms might not be mutually exclusive, we have created an experimental survey study in which our participants received one of four possible scenarios and had to choose between a cycling-related policy aimed at either extending or saving lives. It was a 2 by 2 design: the B/C ratio was either 10:1 or 20:1 and the number of saved cyclists’ lives was five or ten.

## 2. Methods

The data for the study were gathered in 2021 as part of the annual traffic safety survey of the Finnish Road Safety Council (Liikenneturva). The market research company Kantar was responsible for the data collection. Participants were recruited from the company’s online panel of people over the age of 15 who respond to surveys on a regular basis. The sample (N = 1025) was representative of Finnish residents aged between 15 and 79 years. Data were weighted by age, gender, and area. We used this weight variable in all analyses.

Most of the questions included in the survey were created by Liikenneturva to serve their traffic safety work; however, we were allowed to include two different sets of questions. The first set of questions was about whether Finns prefer the Vision Zero or the Vision Plus policy. It included the scenario question and several attitudinal questions. The second set was about the usage of personal cars for emergency driving to emergency departments. Here, we report the results of the first set of questions; the second set will be reported elsewhere. No specific ethical approval was obtained for this study.

## 3. Scenarios

Participants were first presented with an introduction: “Imagine two transport policies whose realization costs society equally. Policy A increases cycling and thus exercise, which directly improves health and increases life expectancy. Policy B increases road safety for cycling and thereby reduces deaths from cycling crashes.”

Participants then had to choose between the two policies (the answer ‘I cannot say’ was also possible) in only one of four possible scenarios (Table 1). This was one version of the scenario: “If you must choose between these two policies, which one would you choose? Measured in life-years saved, the ratio between strategies is 10:1.”

“Policy A: every year in Finland the lives of 1,250 people are extended by two years (in total 2,500 life-years are saved);” “Policy B: every year in Finland five lives of people who are about 30 years of age are saved (in total 250 life-years are saved).”

The adopted approach is a variation of the stated preference techniques. Instead of having multiple preference tasks made by each participant, we opted for an independent sample with a single task for each participant. One reason for our choice was the limited space we had in the survey. We also wanted to avoid a situation that repeated preference task with many variations in parameters might reveal our aim regarding this question to participants and possibly have an effect on the way they respond.

## 4. Rationale behind the values in the scenario

Based on three publications (BMA 1992; Hillman 1992, 1993) authored by one author, it is often claimed that the health benefits of cycling outweigh the risks by a ratio of 20:1. However, a recent analysis of these publications showed that none of them provided calculations in support of this ratio (Radun et al. 2019). On the other hand, a systematic review found that “Estimated health benefit–risk or benefit–cost ratios of a mode shift to active transportation ranged between – 2 and 360 (median = 9)” (Mueller et al. 2015). Therefore, we selected 10:1 and 20:1 ratios for the extending lives variable in the scenario.

Although there are different estimations about how much longer cyclists live compared to non-cyclists, it is widely accepted among cycling advocates that on average cyclists live two years longer (ECF 2018). Therefore, we used two years of life extended across all scenarios.

During the last ten years, on average 24 (range 19–31) cyclists have died in Finland (Liikenneturva 2021). Since no single traffic safety policy can eliminate all cyclists’ fatalities, the saving lives variable included saving five or ten lives of cyclists who are about 30 years of age.

## 5. Randomization and statistical analysis

The sample was stratified by age (7 categories: 15–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75–79), gender, and province (Helsinki metropolitan area, South, West, and North and East Finland) and then randomly divided into four subsamples (around 255 participants in each). The subsamples were therefore similar with regard to age, gender,

**Table 1**  
Four different scenarios used in this study.

		Saving lives policy	
		5 people would be saved	10 people would be saved
Extending lives policy	10:1 B/C ratio	Vision Plus: extends lives of 1,250 people by two years (in total 2,500 life-years are saved) Vision Zero: saves 5 lives of people who are about 30 years of age (in total 250 life-years are saved)	Vision Plus: extends lives of 2,500 people by two years (in total 5,000 life-years are saved) Vision Zero: saves 10 lives of people who are about 30 years of age (in total 500 life-years are saved)
	20:1 B/C ratio	Vision Plus: extends lives of 2,500 people by two years (in total 5,000 life-years are saved) Vision Zero: saves 5 lives of people who are about 30 years of age (in total 250 life-years are saved)	Vision Plus: extends lives of 5,000 people by two years (in total 10,000 life-years are saved) Vision Zero: saves 10 lives of people who are about 30 years of age (in total 500 life-years are saved)

and province.

Multinomial regression was used to assess factors associated with preference choice (policy extending lives, policy saving lives, or “I cannot say”). We first assessed whether the B/C ratio and the number of saved cyclists interacted with the outcome variable, and then tested a model with only main effects. The final model also included several background variables (age, gender, province, and whether a participant identifies as a cyclist or not).

### 6. Results

Overall 45.5% of the participants preferred a policy aimed at saving lives, 36% preferred an extending lives policy, and 18.2% were undecided. Detailed distributions across four scenarios are presented in Table 2.

The B/C ratio and the number of saved cyclists did not interact with the outcome variable ( $\chi^2 = 0.432$ , d.f. = 2,  $p = 0.806$ ). In the model with only main effects included, again no relationship was observed both for the B/C ratio ( $\chi^2 = 0.585$ , d.f. = 2,  $p = 0.746$ ) and the number of saved cyclists ( $\chi^2 = 1.582$ , d.f. = 2,  $p = 0.453$ ). In the model with four background variables included, we found that those who did not consider themselves to be cyclists were more likely to prefer saving over extending lives (OR = 1.86, 95% CI: 1.40–2.47). These non-cyclists were also more likely to be undecided than to choose an extending lives policy (OR = 1.73, 95% CI: 1.19–2.51). Women preferred saving over an extending lives policy (OR = 1.36, 95% CI: 1.03–1.80). Age was related to the preference for saving an over extending lives policy (OR = 1.01, 95% CI: 1.004–1.02) and being undecided over an extending lives policy (OR = 1.03, 95% CI: 1.02–1.04). Regarding the province, compared to residents of North and East Finland those living in West Finland preferred saving over an extending lives policy (OR = 1.56, 95% CI: 1.04–2.34) and were more often undecided compared to an extending lives policy (OR = 2.44, 95% CI: 1.44–4.13). Complete results can be found in the supplementary materials.

Fig. 1 shows that the large majority (79.8%) of the respondents believed that Vision Zero represents a good goal while a similar proportion (73.5%) believed it will never be achieved. Even more (84.1%) respondents agreed that every life is equally precious and that no monetary value can be put on human life (81.1%).

### 7. Discussion

Our experimental manipulation did not produce any variation in the outcome (i.e., preference between Vision Zero and Vision Plus). This suggests people have a preference for either saving or an extending lives transport policy regardless of the parameters we included in the scenarios. In order to observe differences between scenarios or to ‘change’ people’s preference, the parameters should be then much higher. This may be unrealistic considering the potential number of saved cyclists – no single safety intervention can save all cyclists that annually die in Finland, on average 24 (range 19–31). On the other hand, the cost-to-benefit ratio is not fixed and is dependent on many factors such as the cycling infrastructure, legislation and enforcement, the traffic safety

**Table 2**  
Participants’ preference between Vision Zero and Vision Plus in four scenarios.

		Saving lives policy 5 people would be saved	10 people would be saved
Extending lives policy	10:1 B/C ratio	Vision Plus: 92 (36.1%) Vision Zero: 116 (45.5%) Don’t know: 47 (18.4%)	Vision Plus: 88 (34.2%) Vision Zero: 118 (45.9%) Don’t know: 51 (19.8%)
	20:1 B/C ratio	Vision Plus: 100 (38.5%) Vision Zero: 120 (46.2%) Don’t know: 40 (15.4%)	Vision Plus: 88 (34.8%) Vision Zero: 116 (45.8%) Don’t know: 49 (19.4%)

culture, and who and how much one cycles, which leaves a potential to increase the 20:1 ratio in the real world.

It is reasonable to speculate that had the B/C ratio been much larger (e.g., 100:1), the preference for an extending lives strategy would also have been larger. However, with the promotion of cycling, more people will cycle and that unfortunately means more cyclists will die in traffic crashes unless the promotion of cycling is accompanied with effective safety measures. Accordingly, more people might (again) prefer a saving lives policy.

Although an individual crash risk might be lower when more people cycle (i.e., the safety in numbers phenomenon or Smeed’s Law), an increase in the absolute number of fatalities might be inevitable. Investments in the cycling infrastructure in the Netherlands have led to more cycling and have reduced both the absolute number of cycling deaths occurring in collisions with motor vehicles and have also made cycling safer for such crashes considering cycling deaths per billion km (Schepers et al. 2017). However, cycling deaths per billion km have been going up for single crashes resulting in the fact that the overall number of cyclist deaths has somewhat increased during the last decade (Statistics Netherlands 2021). This development in one of the most cycling friendly countries in the world raises several questions relevant for the discussion about Vision Plus and Vision Zero.

Should we promote cycling on the basis of the health benefits it provides without making it first as safe as possible in terms of safe cycling infrastructure? Should we be satisfied with the overall cycling-related health benefits on the societal level while accepting an inevitable increase in cyclist deaths? Should we be content to make an individual risk lower in terms of cycling deaths per billion km while accepting an increase in cycling deaths as collateral damage? We do not have answers to these questions; however, our view is that the promotion of cycling should not ignore ‘collateral’ damage even if the overall B/C ratio in terms of life-years saved on a societal level is ‘large’ enough. Neither should investments in the safe cycling infrastructure exclude the promotion of other measures aimed at injury prevention such as bicycle helmets. It is often claimed that legislation or even the promotion of bicycle helmets aimed at preventing serious head injuries can make cycling less popular and can lead to health loss, although this assertion has been challenged and remains unproven (Hoye 2018).

If we are to achieve zero cyclist deaths, more work has to be done even in the Netherlands. Different measures aimed at improving the safety of all cyclists or specific demographic groups can and should be applied. Our results show that different demographic groups have different preferences between a saving and an extending lives policy. The fact that women and the elderly preferred saving lives might be related to their higher level of empathy (Beadle and de la Vega, 2019; O’Brien et al. 2013). On the other hand, cyclists preferred an extending lives policy. It might be surprising at first that cyclists would not opt for a transport policy aiming at reducing the number of cyclist deaths; however, it is possible they are more aware of the environmental and not only the health benefits of cycling and took that into account when making their choice. This is pure speculation on our part and requires future investigations.

As with any other scenario type study, it is possible that some respondents did not read the scenario’s introduction or failed to understand the task. The choice of saving lives of cyclists who are about 30 years of age might have produced some unforeseen bias among different age groups. Future studies could in addition to using different B/C ratios and the number of saved lives also change the age of saved people in similar scenarios. This also applies to the selected two years of life extension. Finally, saving lives in our scenarios was not explicitly defined as Vision Zero.

Our study has been conducted in Finland, a country with a population of 5.5 million. Finland has a relatively good cycling infrastructure and cycling culture (e.g., early age when children learn to cycle; Cordovil et al., 2022). However, distance cycled per capita per year has been declining during 1998–2017 (Schepers et al., 2017), while there

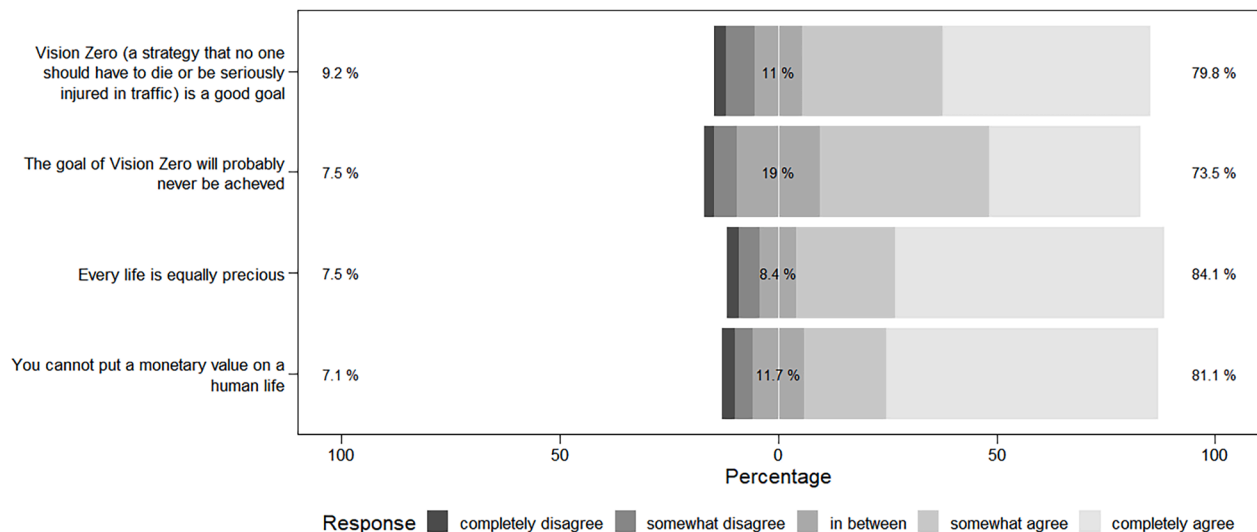


Fig. 1. Distribution of responses to the question: “How much do you agree with the following statements?”.

was no real reduction in cycling fatalities during the last ten years (Liikenneturva 2021). Given that these parameters are culturally dependent, it is possible that the results obtained in other parts of the world would be significantly different.

In conclusion, to our knowledge this is the first study that has experimentally tested the preference between transport policies aiming at saving or extending lives. While the large majority of people believed Vision Zero represents a good goal, when presented with a choice, many preferred extending over saving lives.

#### CRediT authorship contribution statement

**Igor Radun:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Jenni Radun:** Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Mitri Kitti:** Conceptualization, Methodology, Formal analysis, Writing – review & editing. **Heikki Kauppi:** Conceptualization, Methodology, Writing – review & editing. **Timo Lajunen:** Conceptualization, Methodology, Writing – review & editing. **Jake Olivier:** Methodology, Formal analysis, Writing – review & editing.

#### Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: IR had financial support from the organizations listed in the manuscript’s acknowledgements; no other relationships or activities that could appear to have influenced the submitted work.

#### Acknowledgments

This study has been part of a five-year research project created by IR and supported by several organizations, including the Automobile and Touring Club of Finland (ATCF), the Finnish Crash Data Institute (OTI), the Henry Ford foundation, *Katsastustoiminnan Tukisäätiö*, *Kuorma-autoliikenteen Volvo Säätiö*, *Liikenneturva*, *Liikenneturvallisuuden Edistämissäätiö*, *Rahtarit*, *Liikennelääketieteen säätiö*, and the Transport Workers’ Union AKT. This funding has been greatly appreciated. We also thank Liikenneturva for kindly allowing us to include our questions in their annual survey.

#### References

- Adminaité-Fodor, D., Carson, J., Jost, G., 2021. Ranking EU progress on road safety. 15th Road Safety Performance Index Report. European Transport Safety Council.
- Beadle, J.N., de la Vega, C.E., 2019. Impact of Aging on Empathy: Review of Psychological and Neural Mechanisms. *Front. Psychiatry*. 10, 331. <https://doi.org/10.3389/fpsy.2019.00331>.
- BMA–British Medical Association, 1992. *Cycling: Towards Health and Safety*. University Press, Oxford, UK.
- Beck, B., Cameron, P.A., Fitzgerald, M.C., Judson, R.T., Teague, W., Lyons, R.A., Gabbe, B.J., 2017. Road safety: serious injuries remain a major unsolved problem. *Med J Aust*. 207 (6), 244–249.
- Whitelegg, J., Haq, G., 2007. *Vision Zero: time to put an end to death and serious injury on our roads*. Stockholm Environment Institute.
- Celis-Morales CA, Lyall DM, Welsh P, et al. 2017. Association between active commuting and incident cardiovascular disease, cancer, and mortality: prospective cohort study. *BMJ*. 357:j1456. doi: 10.1136/bmj.j1456.
- Cordovil, R., Mercê, C., Branco, M., Lopes, F., et al., 2022. Learning to Cycle: A Cross-Cultural and Cross-Generational Comparison. *Frontiers in public health* 10, 861390.
- ECF–European Cyclists’ Federation. 2018. *Cycling facts and figures*. Available at: <https://ecf.com/resources/cycling-facts-and-figures>.
- Elvik, R., 1999. Can injury prevention efforts go too far? Reflections on some possible implications of Vision Zero for road accident fatalities. *Accid Anal Prev*. 31, 265–286. [https://doi.org/10.1016/S0001-4575\(98\)00079-7](https://doi.org/10.1016/S0001-4575(98)00079-7).
- Hillman, M., 1993. Cycling and the promotion of health. *Policy Studies*. 14, 49–58. <https://doi.org/10.1080/01442879308423639>.
- Hillman, M., 1992. In: *Cycling and the promotion of health*. PTRC Education and Research Services Ltd., London, pp. 25–36.
- Hoye, A., 2018. Recommend or mandate? A systematic review and meta-analysis of the effects of mandatory bicycle helmet legislation. *Accid Anal Prev*. 120, 239–249. <https://doi.org/10.1016/j.aap.2018.08.001>.
- Irf, 2016. *Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System*. OECD Publishing, Paris.
- Kelly, P., Kahlmeier, S., Götschi, T., Orsini, N., Richards, J., Roberts, N., Scarborough, P., Foster, C., 2014. Systematic review and meta-analysis of reduction in all-cause mortality from walking and cycling and shape of dose response relationship. *Int J Behav Nutr Phys Act*. 11 (1) <https://doi.org/10.1186/s12966-014-0132-x>.
- Kristianssen, A.C., Andersson, R., Belin, M.A., Nilsen, P., 2018. Swedish Vision Zero policies for safety - A comparative policy content analysis. *Safety Science*. 103, 260–269. <https://doi.org/10.1016/j.ssci.2017.11.005>.
- Liikenneturva–Central Organization for Traffic Safety in Finland. 2021. *Pyöräilijöiden henkilövahingot tieliikenteessä [Cycling injuries]*. Available at: <https://www.liikenneturva.fi/tutkimukset/pyorailijoiden-henkilovahingot-tieliikenteessa>.
- Mueller, N., Rojas-Rueda, D., Cole-Hunter, T., de Nazelle, A., Dons, E., Gerike, R., Götschi, T., Int Panis, L., Kahlmeier, S., Nieuwenhuijsen, M., 2015. Health impact assessment of active transportation: A systematic review. *Prev Med*. 76, 103–114. <https://doi.org/10.1016/j.ypmed.2015.04.010>.
- O’Brien, E., Konrath, S.H., Gruhn, D., Hagen, A.L., 2013. Empathic Concern and Perspective Taking: Linear and Quadratic Effects of Age Across the Adult Life Span. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*. 68 (2), 168–175.
- Radun, I., Kaistinen, J., Olivier, J., Pless, B., 2019. The Alleged 20:1 Benefit-to-cost Ratio of Cycling: Missing Analyses and Uncritical Citations. *PsyArXiv*. <https://doi.org/10.31234/osf.io/h5uxg>.
- Salmela J. Onko pyöräily entistä vaarallisempaa, kun vauhdit kasvavat ja pyöriä on enemmän? Mittasimme, kuinka lujaa Helsingissä poljetaan [Is cycling more

- dangerous as speed increases and when there are more bikes? We measured the speed of pedaling in Helsinki]. *Helsingin Sanomat*, 2.5.2018. <https://www.hs.fi/kotimaa/art-2000005663544.html>.
- Schepers, P., Stipdonk, H., Methorst, R., Olivier, J., 2017. Bicycle fatalities: Trends in crashes with and without motor vehicles in The Netherlands. *Transportation Research Part F-Traffic Psychology and Behaviour*. 46, 491–499. <https://doi.org/10.1016/j.trf.2016.05.007>.
- Statistics Netherlands. 2021. 610 traffic deaths in 2020. Available at: <https://www.cbs.nl/en-gb/news/2021/15/610-traffic-deaths-in-2020>.