Bicicletas e Saúde

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Riscos vs. Benefícios

- Riscos
  - Mortes por bicicleta vs carros
  - Efeitos da poluição
- Benefícios
  - Atividade física
- Prevenção?
  - Uso de capacetes
  - Ciclistas vs. Pedestres
  - Comportamentos
  - Tipos de vias
- Benefícios/riscos na balança

Mortalidade por Bicicleta no Brasil

2000-2010

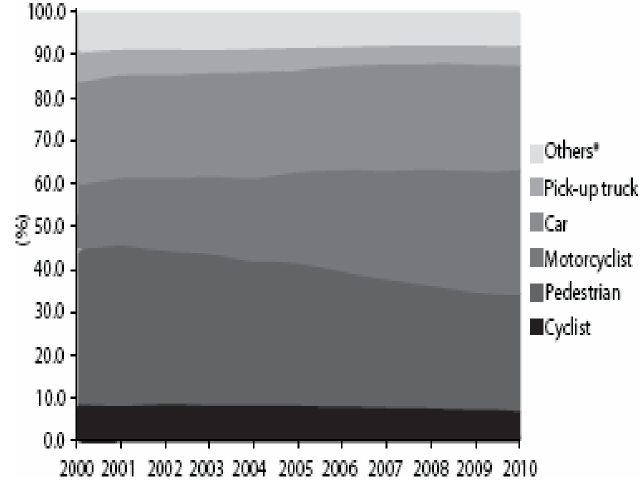
-390 mil casos de acidentes por transporte terrestre

-32 mil casos de acidentes de bicicleta , 8 casos/dia

-Mortes nas metrópoles, grandes e médias cidades

-Fins de semana mais frequentes

-Trauma craniano: 40% das mortes

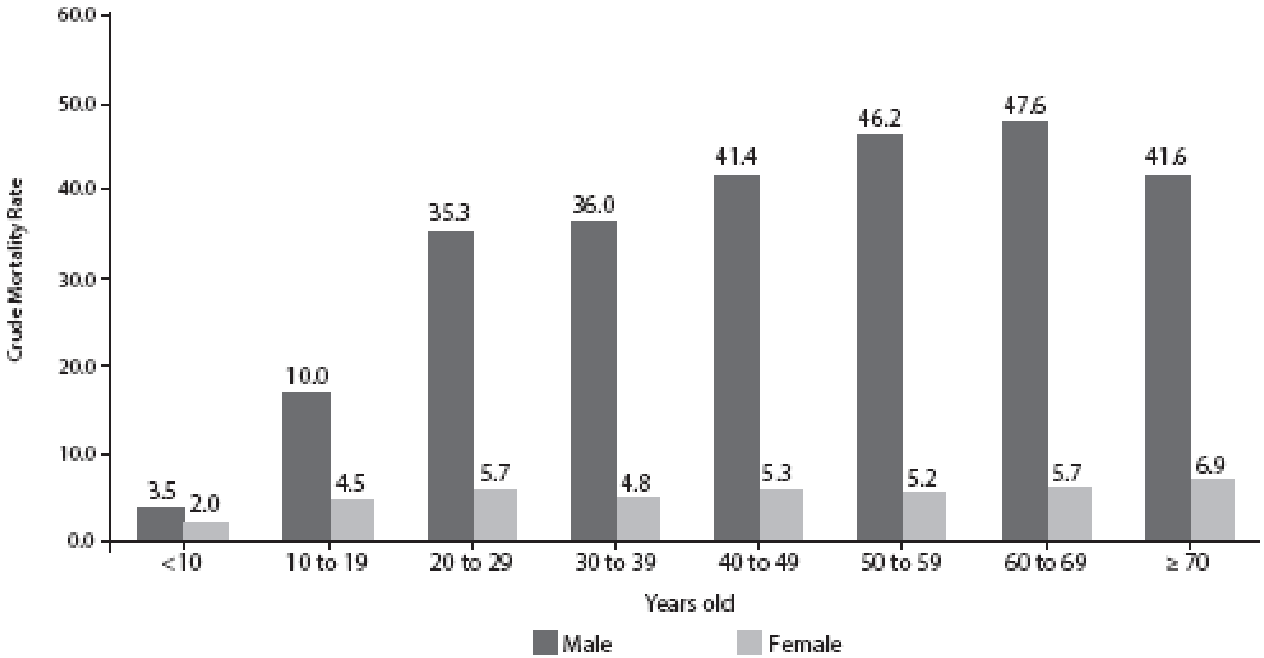


*Three-wheeled vehicle, heavy traffic vehicle, bus and other land transport accidents.
*Triciclo, transporte pesado, ônibus e outros acidentes de transporte terrestre.

Figure 1 - Proportional mortality (%) according to cause of death in relation to the total number of deaths by traffic accidents. Brazil, 2000 to 2010.

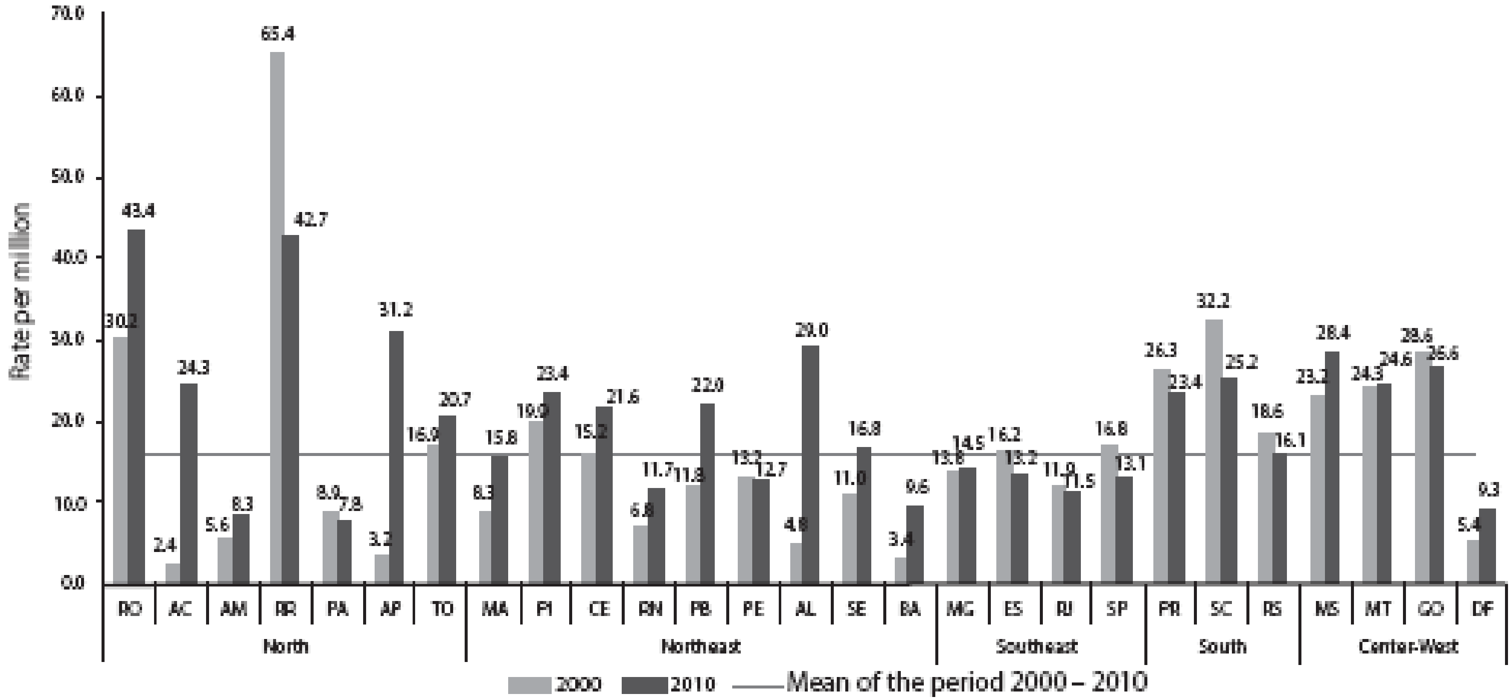
***Figura 1** - Mortalidade proporcional (%) segundo causa básica do óbito em relação ao total de óbitos por acidentes de transporte terrestre. Brasil, 2000 a 2010.*

Mortalidade por Bicicleta no Brasil



Garcia L, 2013 Revista Brasileira Epidemiologia

Mortalidade por Bicicleta no Brasil

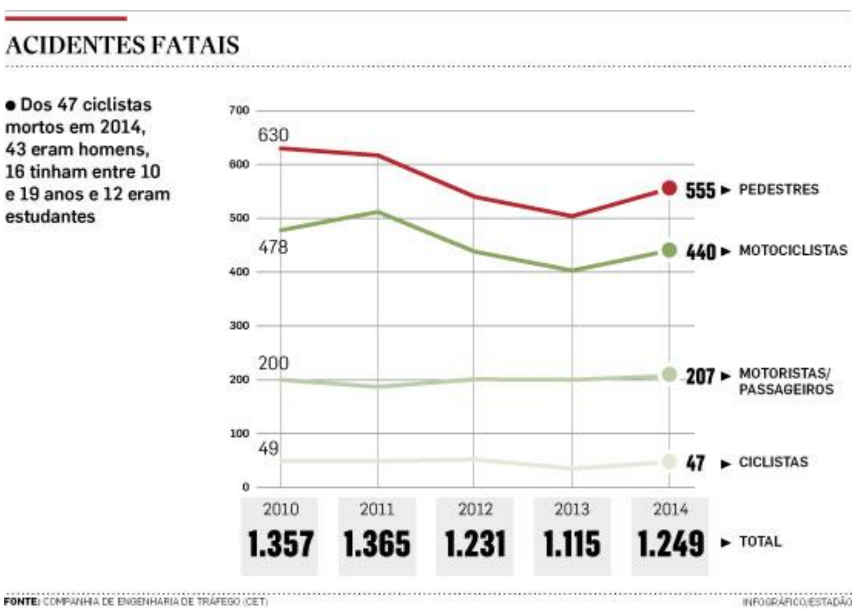


*Age-standardized mortality rates through direct metod, using WHO world standard population.
**Taxas de mortalidade padronizadas por idade pelo método direto, tendo como padrão a população mundial padrão da OMS.*

Garcia L, 2013 Revista Brasileira
Epidemiologia

Acidentes fatais em SP

Acidentes fatais em SP

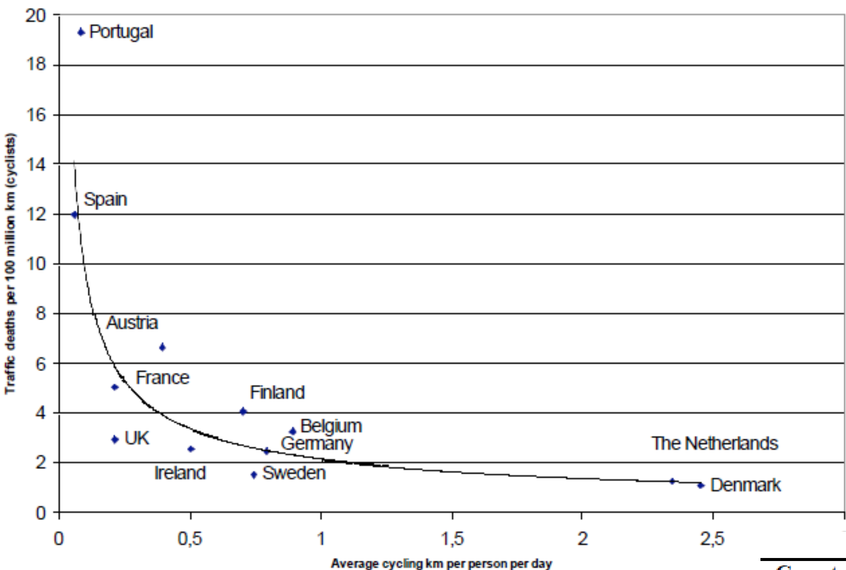


Acidentes fatais em Londres: 1992-2006

- Média 16/ano
- Range 8-21/ano

- Ou
- 20.5-11.1 mortes por cada 100 .000 estimados ciclistas

Safety in numbers effect!



Adapted from IRTAD-OECD http://www.internationaltransportforum.o

Country	Year	Walking	Cycling
Austria	2005	21	4
Belgium	1999	16	8
Denmark	2003	16	15
Finland	2005	22	9
France	1994	19	3
Germany	2002	23	9
Latvia	2003	30	5
Netherlands	2006	22	25
Norway	2001	22	4
UK	2006	24	2
USA	2001	9	1
Sweden	2006	23	9

% de viagens feitas por bicicleta

Ciclismo e exposição à poluição

Table 1. Air pollution exposures during cycling and car driving.

City	Study design	Pollutant	Mean concentration car (μg/m^3)	Mean concentration cycling (μg/m^3)	Ratio car/cycle	Reference
Amsterdam	Two inner-city routes traveled for about 1 hr in January and May 1990 (*n* = 55 and 41)	CO BTEX	4,833 332	1,730 99	2.8 3.4	van Wijnen et al. 1995
Copenhagen	Two cars and two cyclists on a 7.6-km inner-city route in the morning of two days in summer 1998	BTEX TSP	44 44	150 75	0.3 0.6	Rank et al. 2001
London	Three routes from the center (one central, two to more outward sections) in July 1999 and February 2000 (*n* = 96 cycle trips and 54 car trips)	$PM_{2.5}$ EC	37 29	28 18	1.32 1.6	Adams et al. 2001
London	Two short (~ 1 km) routes (one heavy traffic, one mixed) traveled in spring 2003 during early morning, lunchtime, and afternoon	EC	39	25	1.6	Gegisian 2003
London	Two short (~ 1 km) routes (one heavy traffic, one mixed) traveled in spring 2003 during early morning, lunchtime, and afternoon	$PM_{2.5}$ UFP CO	38 99,736 1,300	34 93,968 1,100	1.12 1.06 1.18	Kaur et al. 2005
Huddersfield, UK	7-mile journey from village to Huddersfield, cycle along a major highway and a separate bicycle path (six samples in September/October 1996)	Abs	7.6	2.7 6.3	2.6 1.2	Kingham et al. 1998
11 Dutch cities	Simultaneous cycle and car drives between same start and end points in afternoon in 11 large Dutch cities, ~ 12 routes in each city; sampling duration, ~ 3 hr/city (1 day per city in autumn 2006)	UFP $PM_{2.5}$	25,545 49	24,329 45	1.05 1.11	Boogaard et al. 2009
Arnhem, the Netherlands	2-hr morning rush hour exposures of cyclists and car and bus passengers on an urban route in a medium-size city	UFP $PM_{2.5}$ Abs	40,351 78 8.8	44,258 72 6.0	0.91 1.09 1.48	Zuurbier et al. 2010
Mean	Simple mean of ratios from applicable studies	$PM_{2.5}$ EC and Abs UFP			1.16 1.65 1.01	

Abbreviations: Abs, absorbance (10^{-5} m), a marker for (diesel) soot; BTEX, sum of benzene, toluene, ethylbenzene and xylene; CO, carbon monoxide; EC, elemental carbon, equivalent to (diesel) soot; TSP, total suspended dust; UFP, ultrafine particle count (per cubic centimeter).

Correção a ser feita: ventilação minuto ca. 2x maior em ciclistas! Massa inalada de particulado é maior! Hartog et AL, 2010

Mortalidade atribuída a poluição: bicicleta vs carro

Table 3. Potential mortality impact of cycling compared with car driving, for 0.5- and 1-hr commute, estimated for $PM_{2.5}$ and BS.[a]

Travel mode	Duration of travel (hr/day)	$PM_{2.5}$/BS concentration (μg/m^3)	Inhaled dose (μg/day)	Total dose[b] for car or bicycle (μg/day)	Equivalent change in $PM_{2.5}$ or BS (μg/m^3)	RR mortality, equal toxicity[c]	RR mortality, traffic 5× more toxic
$PM_{2.5}$							
Car	0.5	40.0	12.0	246			
Cycle	0.5	34.5	22.8	257	0.9	1.005	1.026
Car	1.0	40.0	24.0	252			
Cycle	1.0	34.5	45.5	274	1.8	1.010	1.053
BS							
Car	0.5	30.0	9.0	126			
Cycle	0.5	18.2	12.0	129	0.2	1.001	1.006
Car	1.0	30.0	18.0	132			
Cycle	1.0	18.2	24.0	138	0.5	1.002	1.012

RR, relative risk.
[a]Supplemental Material, Table 2 (doi:10.1289/ehp.0901747), gives details on calculations and assumptions. [b]Total dose includes other time periods. [c]RR for cycling versus car driving.

Dirigir carro/pedalar 0.5 a 1 h dia
Hartog et al

Pedestres vs. ciclistas

Changes in walking and biking to work in New York and California.

New York State (not including New York City)	2006	2011	% Change
Number walking	192,802	194,875	+1.08%
Number biking	16,326	14,212	−12.95%
New York City			
Number walking	355,154	380,678	+7.19%
Number biking	19,953	30,206	+51.39%
California			
Number walking	440,702	445,440	+1.08%
Number biking	128,960	176,659	+36.99%

"Safety in numbers"

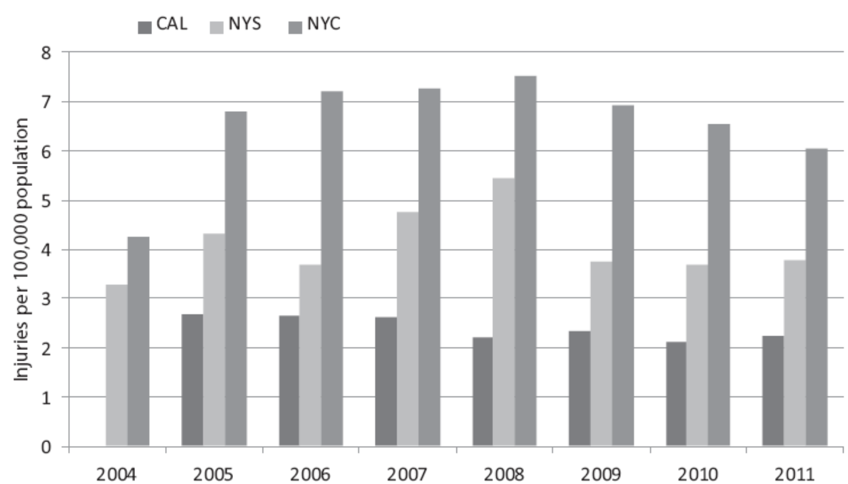


Fig. 1. Pedestrians injured by cyclists, 2004–2011.

Uso do capacete

- Cochrane Review, Helmets for preventing head and facial injuries in bicyclists. Thompson DC, Rivara FP, Thompson R. Cochrane Database Syst Rev. 2000;(2):CD001855

- Capacetes provocam uma redução de 63 a 88% do risco de trauma cranio-encefálico , e 65% dos traumas faciais altos.
- A segurança é igual para todos os tipos de acidentes, incluindo os com veículos motorizados.
- Não se conhece a eficácia para os traumas de pescoço
- Lei em alguns países obriga uso de capacete para ciclistas.
- Alguma controvérsia: diminuiria o número de ciclistas, segurança das vias mais importante ? (ex Holanda, ninguem anda de capacete…)

Segurança e comportamento na bicicleta

Terzano et al

Den Haag (Haia) 2013

Usar celular

Escutar música com fone

Conversar

Maior risco de acidentes

Coloca outras pessoas em risco

https://www.facebook.com/bikemap/videos/vb.6515037646/10152570161182647/?type=2&theater

Facebook/ Bikemap

TIPO DE VIAS VS RISCO DE ACIDENTES: “numbers in safety”

TABLE 4—Comparison of Route Types and Other Infrastructure Characteristics of the Injury Sites to Randomly Selected Control Sites Within the Same Trip Routes: Vancouver and Toronto, Canada; 2008–2009

Variable	No. Injury Sites/No. Control Sites	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Major street route, parked cars[a]			
No bike infrastructure	155/114	1.00 (Ref)	1.00 (Ref)
Shared lane	9/7	0.78 (0.25, 2.41)	0.71 (0.21, 2.45)
Bike lane	25/28	0.53 (0.26, 1.07)	0.69 (0.32, 1.48)
Major street route, no parked cars			
No bike infrastructure	112/118	0.65* (0.44, 0.97)	0.63* (0.41, 0.96)
Shared lane	13/12	0.66 (0.24, 1.82)	0.60 (0.21, 1.72)
Bike lane	35/46	0.47* (0.26, 0.83)	0.54 (0.29, 1.01)
Local street route			
No bike infrastructure	89/116	0.44* (0.28, 0.70)	0.51* (0.31, 0.84)
Designated bike route	52/57	0.53* (0.30, 0.94)	0.49* (0.26, 0.90)
Designated bike route with traffic calming	49/47	0.59 (0.32, 1.07)	0.66 (0.35, 1.26)
Off-street route			
Sidewalk or other pedestrian path	52/47	0.73 (0.42, 1.28)	0.87 (0.47, 1.58)
Multiuse path, paved	64/56	0.75 (0.42, 1.34)	0.79 (0.43, 1.48)
Multiuse path, unpaved	12/11	0.63 (0.21, 1.85)	0.73 (0.23, 2.28)
Bike path	21/21	0.54 (0.20, 1.45)	0.59 (0.20, 1.76)
Cycle track	2/10	0.12* (0.03, 0.60)	0.11* (0.02, 0.54)

Teschkle et al 2012, Am J Epi

Ganhos em mortalidade

Table 6. Summary of impact on all-cause mortality for subjects shifting from car to bicycle.

Stressor	Relative risk	Gain in life years[a]	Gain in life days/ months per person[a]
Air pollution	1.001 to 1.053	–1,106 to –55,163 (–28,135)	–0.8 to –40 days (–21 days)
Traffic accidents	0.996 to 1.010[b] 0.993 to 1.020[b]	–6,422 to –12,856 (–9,639)	–5 to –9 days (–7 days)
Physical activity	0.500 to 0.900	564,764 to 111,027 (337,896)	14 to 3 months (8 months)

[a]Applied to the 500,000 subjects 18–64 years of age making the shift, with standard life table calculations (Miller and Hurley 2003). Numbers in parentheses are the averages of the life gains (a minus sign indicates a loss of life years). [b]We have applied age group–specific relative risks in the life table calculations; for the range, see Supplemental Material, Table 5 (doi:10.1289/ehp.0901747). The 0.996 to 1.010 figure is for the 7.5-km distance, and 0.993 to 1.020 is for the 15-km distance.

HARTOG ET AL, 2010

ATIVIDADE FÍSICA E CICLISTAS

- ACSM E AHA

adultos saudáveis de 18-65 anos

atividade física moderada a intensa 30min/dia, 5x/semana

Ou atividade física intensa 3x/semana, 20min

Pedalar 5x/dia para o trabalho, 30min, 15km/h= meta atingida

Impacto positivo em mortalidade CV, diabetes, obesidade, câncer de colón, depressão, osteoporose etc

Benefícios em mortalidade, todas as causas

Table 5. Potential impact of physical activity on all-cause mortality in various reviews[a] and cohort studies.

Source	Definition of physical activity	Relative risk[b]	Comments
Reviews			
Lee and Skerrett 2001	Meeting moderate physical activity recommendation (1,000 kcal/week)	0.70–0.80	Review, excluding papers examining only two levels of physical activity
Kesaniemi et al. 2001	Expending of 1,000 kcal/week	0.70	Based on a symposium; invited experts reviewed the existing literature
Bauman 2004	Meeting physical activity recommendation	0.70	Review of peer-reviewed studies published between 2000 and 2003
Bucksch and Schlicht 2006	Different definitions of physical activity	0.70–0.87 (moderate) 0.46–0.92 (vigorous)	Review
Warburton et al. 2006	Meeting physical activity recommendation	0.65–0.80	Review
Vogel et al. 2009	Different definitions including moderate exercise (4,100–7,908 kJ/week), vigorous exercise, and different distances walked	0.50–0.77	Review of adult cohort studies with a mean > 60 years of age
Studies on cycling			
Andersen et al. 2000	Cycling to work for 3 hr/week	0.55–0.72	Based on a Danish cohort, adjusted for leisure time physical activity (among others)
Hu et al. 2004	Walking and cycling to work	0.71–0.79	Based on a Finnish cohort study among subjects with type 2 diabetes; estimates without adjusting for other domains in physical activity
Matthews et al. 2007	Cycling to work (MET-hours/day)	0.66–0.79	Based on a Chinese women cohort in Shanghai, adjusted for other physical activity
Overall summary		0.50–0.90	

[a]Reviews used are often overlapping (reviewing the same evidence). [b]Comparing physically active with physically less active.

RISCOS E BENEFICIOS/ IDADE

Supplement Material, Table 5 **Analysis of life years gained /lost from shifting to bicycle use for a 7.5 km distance travelled per age group**

Stressor	Age category	Baseline mortality rate[a]	Mean Relative risk	Gain in life years [a]	Loss or gain in days / months per person*
Air pollution	18-39	238	1.03	-4153	-3 days
	40-64	1932	1.03	-26 019	-19 days
	65+	22 660	1.03	-83 788	-2 months
Traffic accidents	18-39	238	Age 18-29: 0.996 Age 30-39: 1.009	-806	-0.6 days
	40-64	1932	Age 40-49: 1.010 Age 50-59: 1.005 Age 60-64: 1.005	-4731	-3 days
	65+	22 660	Age 65-69: 1.004 Age 70-79: 1.010 Age 80+: 1.003	-14 532	-11 days
Physical activity	18-39	238	0.70	41 580	1 month
	40-64	1932	0.70	263 517	6 months
	65+	22 660	0.70	1 062 527	2 years

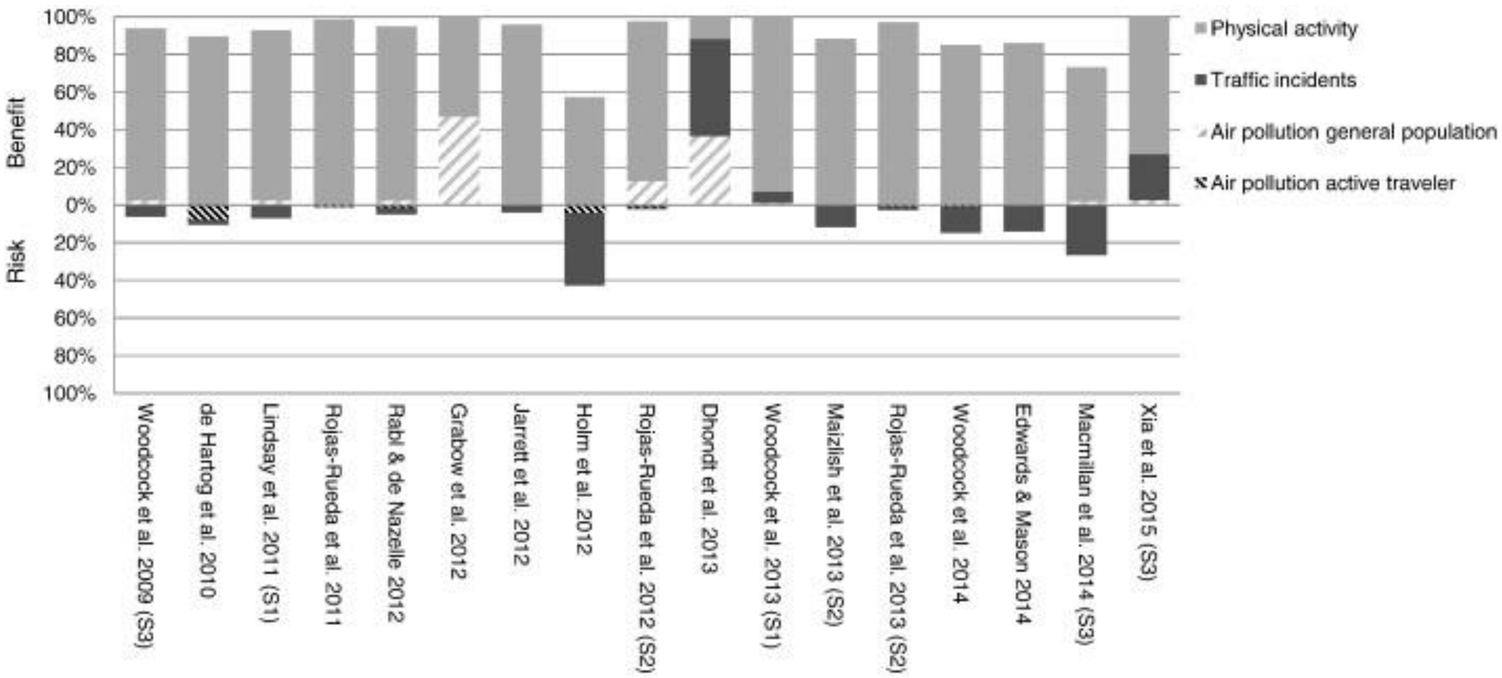
Riscos vs Benefícios / idade

Table 4. Traffic deaths per age category per billion passenger kilometers by bicycle and by car in the Netherlands.[a]

Age category (years)	Bicycle	Car	Ratio
< 15	4.9	0.6	8.6
15–20	5.4	7.4	0.7
20–30	4.2	4.6	0.9
30–40	3.9	2.0	2.0
40–50	6.6	1.0	6.9
50–60	9.6	1.2	7.9
60–70	18.6	1.6	11.7
70–80	117.6	7.6	15.4
> 80	139.6	8.1	17.1
Total average (all ages)	12.2	2.2	5.5
Total average (20–70 years of age)	8.2	1.9	4.3

Data from CBS (2008).
[a]Estimated as age-specific and traffic mode–specific number of traffic deaths divided by amount of kilometers driven per age and traffic mode in the Netherlands for the year 2008.

Transporte ativo: Benefícios bem maiores do que os riscos!!!

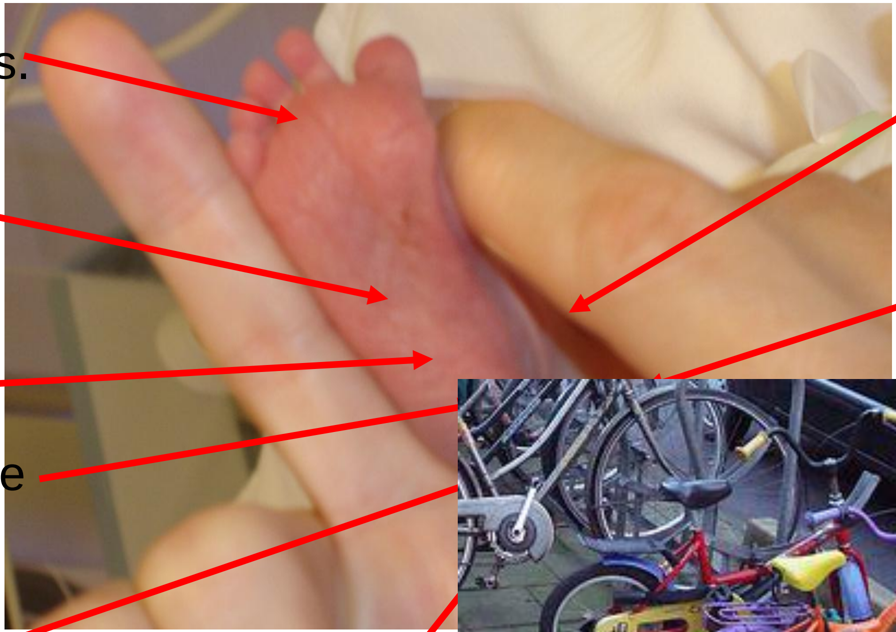


(S)=active transportation mode shift scenario.

[a] The health pathway contribution was calculated based on estimated change in health pathway exposure distribution and is comparing health benefits with health risks. Each health pathway contribution is expressed as a proportion of the overall estimated health impact of the scenario. If the study estimated multiple active transport scenarios, the health impact was calculated for the most conservative scenario (scenario with the smallest benefit-risk ratio or benefit-cost ratio).

Mueller, 2015 Preventive Medicine, EUROPA, EUA, AUSTRALIA E NOVA ZELANDIA PRECISAMOS DE ESTUDOS BRASILEIROS

Obrigada pela atenção!



•Não queima combustíveis fosseis.

•Não emite gases tóxicos (HC, CO, NOx, MP etc).

•Vida útil longa

•Manutenção e uso e auto regulada com custo baixo

•Não necessita reposição

•Não requer CNH e pode e deve ser utilizado em qualquer idade

•Não emite gases do efeito estufa.

•Não necessita troca de óleo.

•Maior uso, . melhor eficiência

•Não contribui para a destruição da camada de ozônio.

•**Isenção de taxas de uso:** IPVA, IPTU*, Pedágio, Seguros, Exame médico,estacionamento etc

Slide de Raimundo Nobrega, com adaptações