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NZ Transportation Conference 2023
Trinity Wharf, Tauranga, New Zealand

The Health and Wellbeing Impacts of Public Transport

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Public Transport Research Group
Monash Institute of Transport Studies
Monash University, Australia



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Introduction

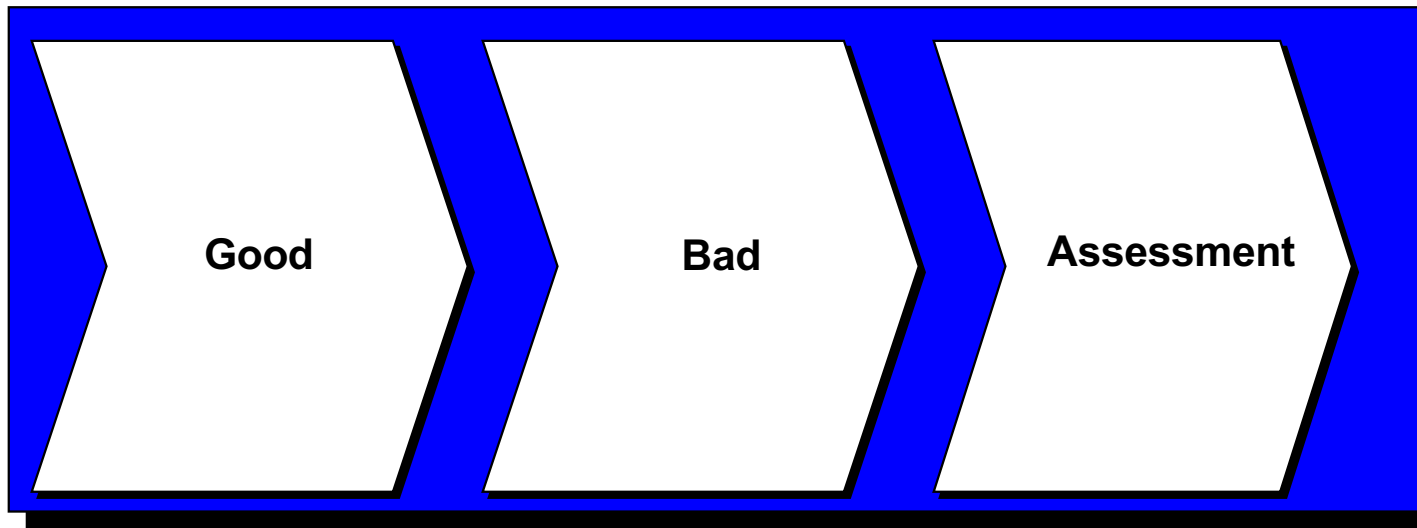
Good

Bad

Assessment



This presentation looks at the good & bad of PT & Health



With much assistance from Monash students:

Nawodya Jayasekera:

Jayasekera N and Currie G (2015) "Health Impacts of Public Transport" Department of Civil Engineering final year project 2015

Clara Jessop:

Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

and Dr Rumana Sarker – Revisions 2023

Introduction

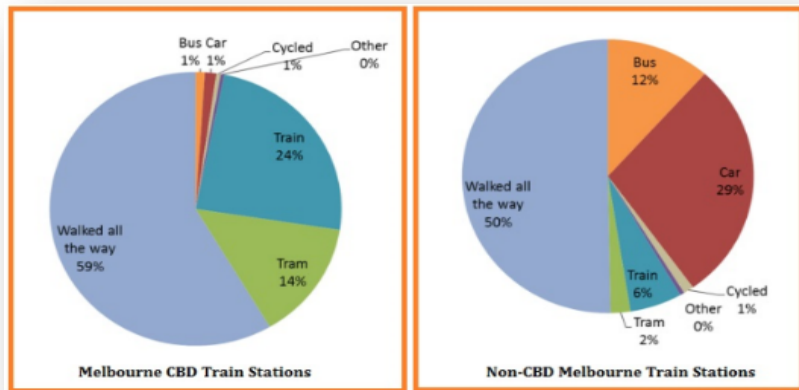
Good

Bad

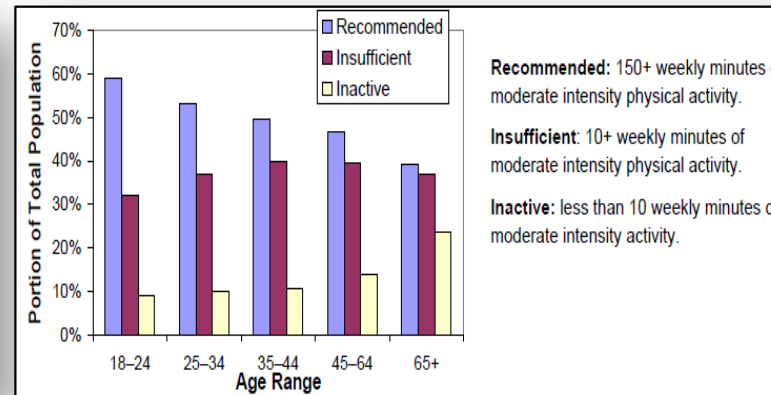
Assessment



PT use needs walking; physical activity is good for health...



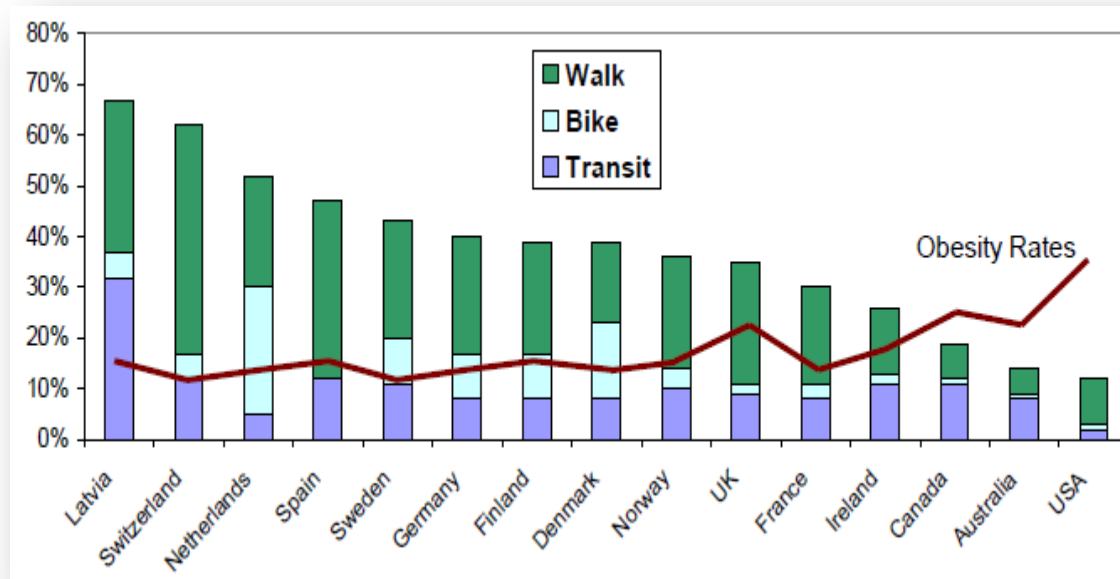
*Access modes to train stations in Melbourne.
(PTV OD Survey, 2011-2012)*



*Physical Activity Statistics in United State
(CDC 2007)*

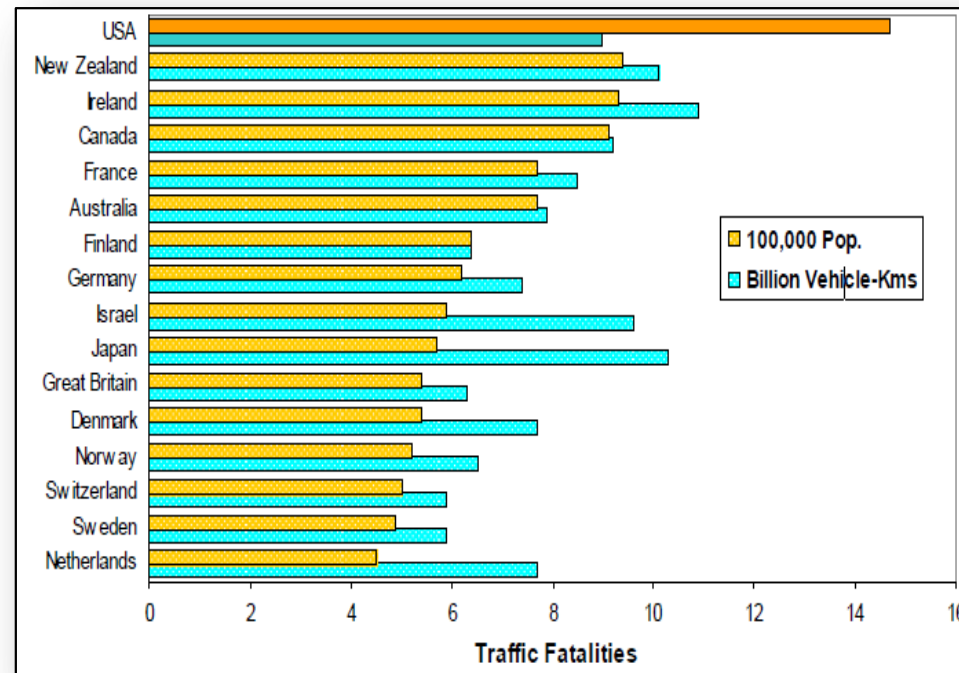


...and links well PT share and obesity rates



Mode Split Versus National Obesity Rate
(Bassett, et al 2008)

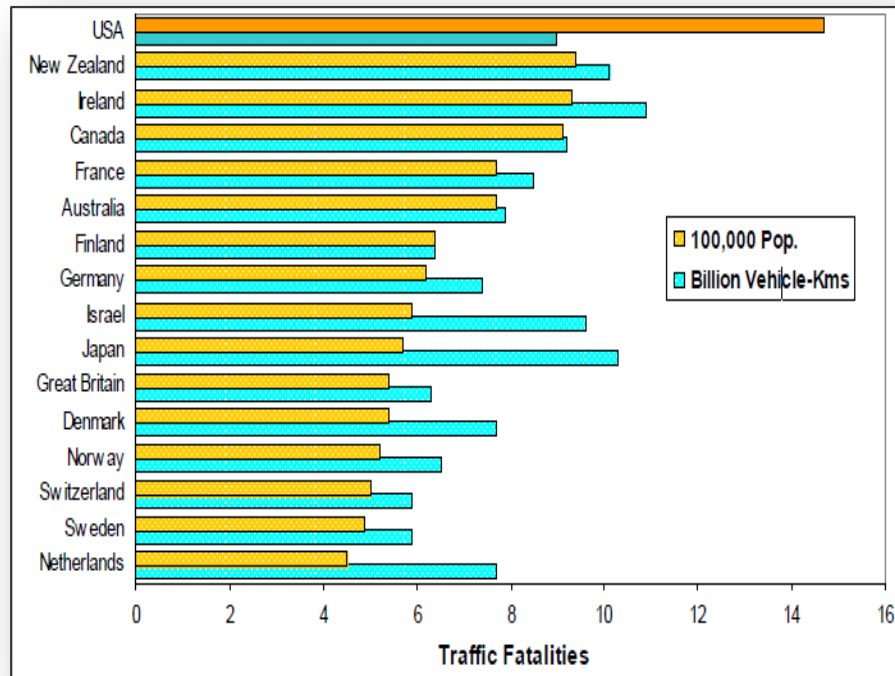
Traffic fatalities are linked with increasing car use...



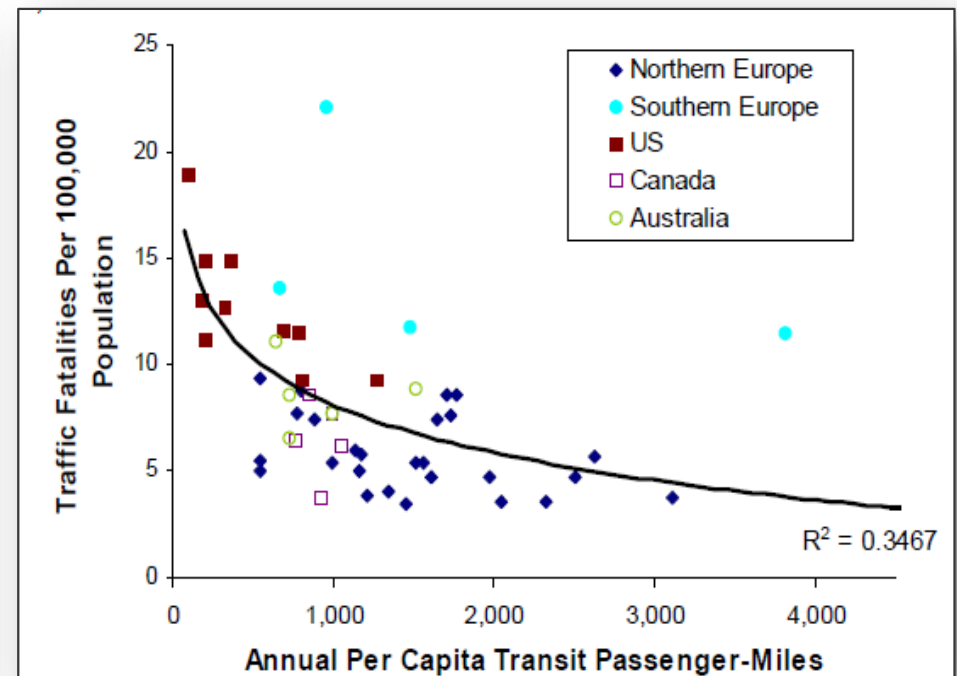
International Traffic Fatalities

(Wikipedia 2009; based on WHO and OECD data)

...and less fatalities link with higher PT use

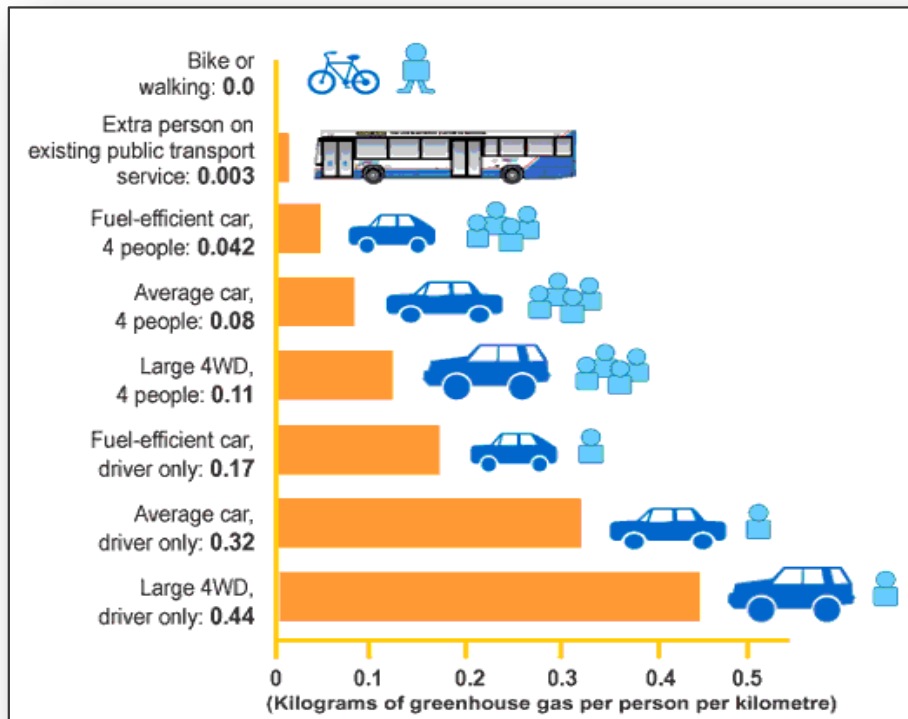


International Traffic Fatalities
(Wikipedia 2009; based on WHO and OECD data)



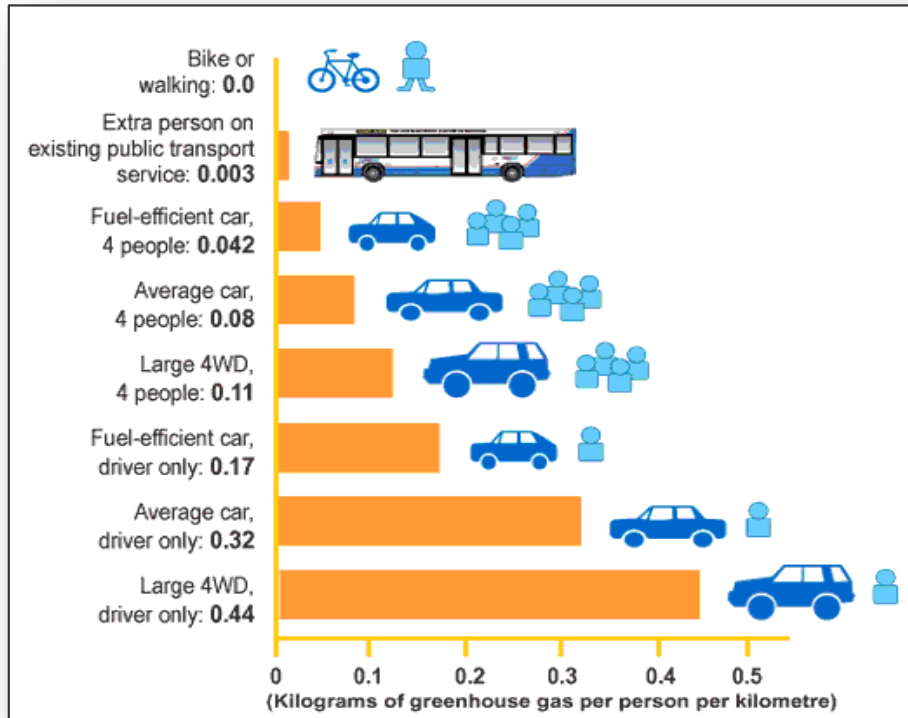
International Traffic Fatality rates compared with Transit Travel (Kenworthy and Laube 2000)

PT is said to pollute less than car traffic...



*Greenhouse gas emissions from different transport modes
((Transport State Transit, 2014)*

...and lower emissions have been linked to positive health outcomes

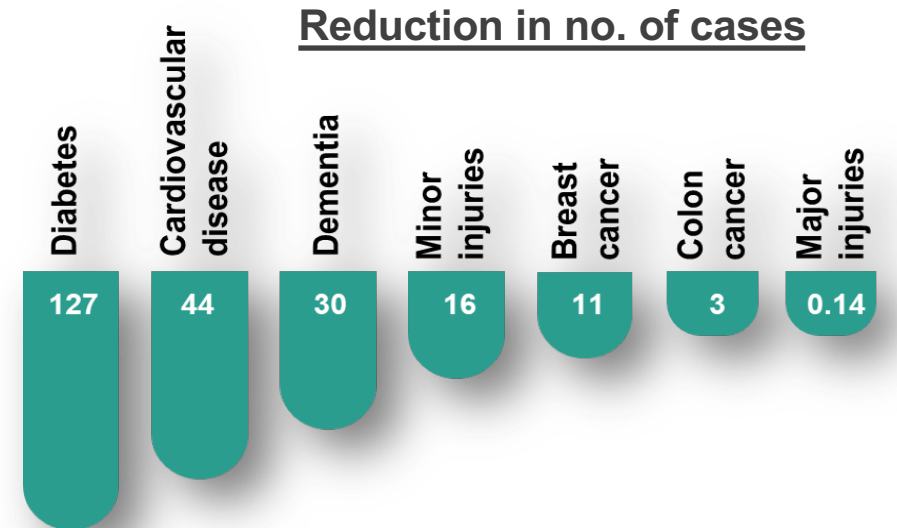
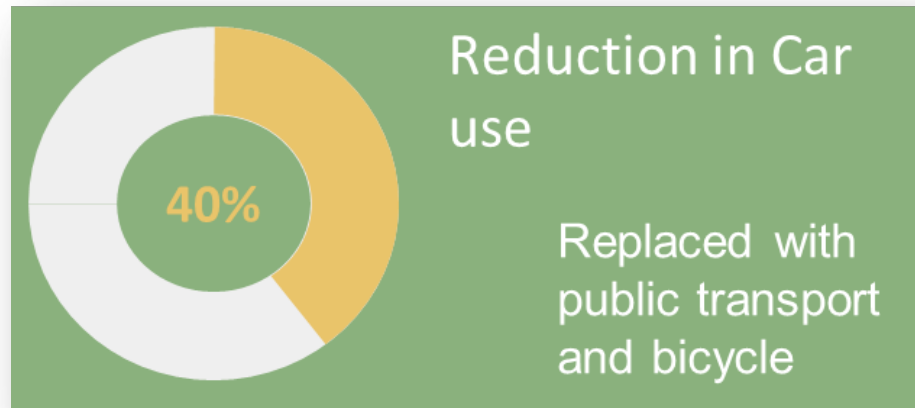


*Greenhouse gas emissions from different transport modes
(Transport State Transit, 2014)*

	Change in disease burden	Change in premature deaths
Cardiovascular Dis.	6-15%	724-1895
Diabetes	6-15%	73-189
Depression	2-6%	<2
Dementia	2-6%	38-132
Breast cancer	2-5%	15-48
Colon Cancer	2-6%	17-53

*Change caused in diseases and premature deaths from forecast
reduction in Greenhouse Gas Emissions
(Maizlish 2011)*

...modal shift to public transport initiates positive health outcomes



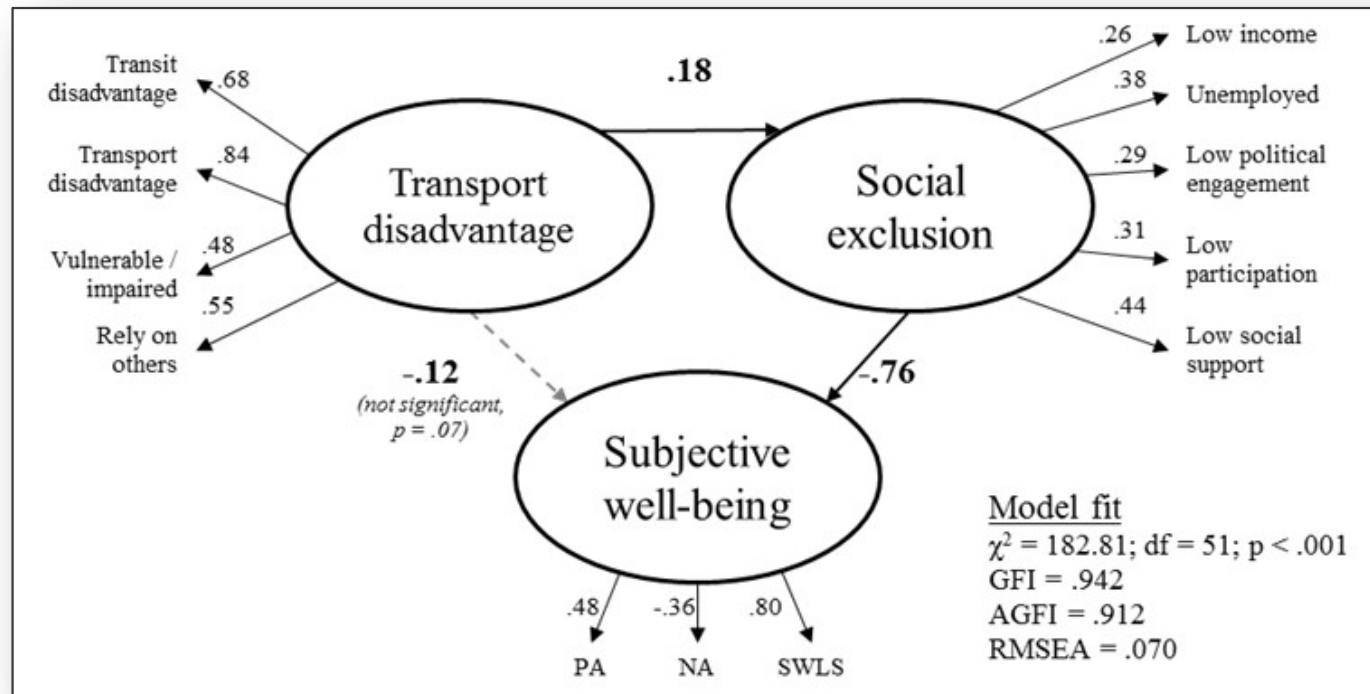
Morbidity results (cases/year)

This change has reduced PM_{2.5} exposure and resulted in annual reductions of

- 7 cases of low birth weight
- 6 of preterm birth
- 1 of cardiovascular disease
- 1 of lower respiratory tract infection

This study is based on the data from the 2009 traffic conditions reported by Barcelona City Council. 8 scenarios were developed to compare the reduction of car uses with the 'business as usual' scenarios. (*Rueda et al., 2013*)

PT is mobility, notably for the disadvantaged; this links indirectly to well being through social inclusion



Transport Disadvantage, Social Exclusion and Well Being
(Currie and Delbosc, 2010)

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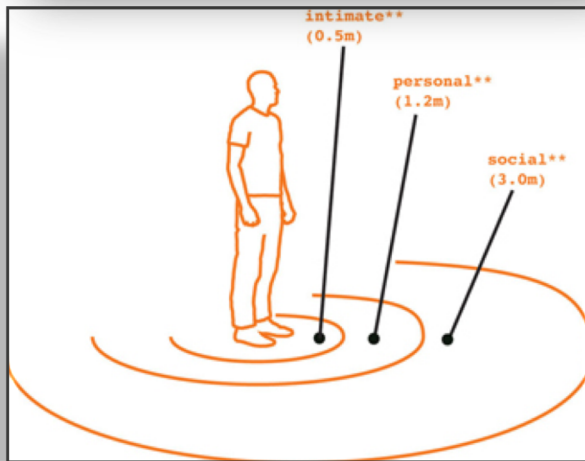
Public transport causes accidents and injury



The key driver of PT behaviour is anxiety; this cant be healthy



Crowding, personal space can have physiological impact...



Personal Space – A Psychology Primer

- **Personal Space Theory**
 - 'the personal "bubble" that surrounds a person, into which others may not intrude' Sommer, 1969
- **Personal Space Invasion, Crowding, Inter Personal Distance (IPD) Discomfort**
 - Those with low IPD – feel more crowded, uncomfortable, ill at ease, Worchel and Tedley (1976)
 - IPD is a better predictor of physiological stress than the density of passengers in a rail carriage, Evans and Wener (2007)
 - invasion of personal space has been shown to lead to greater:
 - self-reported anxiety (Greenberg & Firestone, 1977)
 - physiological stress (Nicosia, Hyman, Karlin, Epstein & Aiello, 1979)
 - under extreme exposure can lead to long-term physical or mental illness (Cox, Houdmont & Griffiths, 2008)

... particularly for women



Some evidence that stress/anxiety issues are greater for car travel...

Evidence on Stress/Mental Health and Travel

- Direct rail services vs indirect (transfer) based services linked to reduced commuter stress (Christl, et al., 2009)
- Reduced crowding on trains linked to reduced stress (Litman, 2015).
- Sweden in 2011, researchers compared private and public transport commuters and stress levels (Medical News, 2011).
 - car users were worse off than PT users
 - However both groups of commuters suffered from more everyday stress, poorer sleep quality and exhaustion and the symptoms would increase with journey time

...more evidence that stress/anxiety issues are greater for car travel



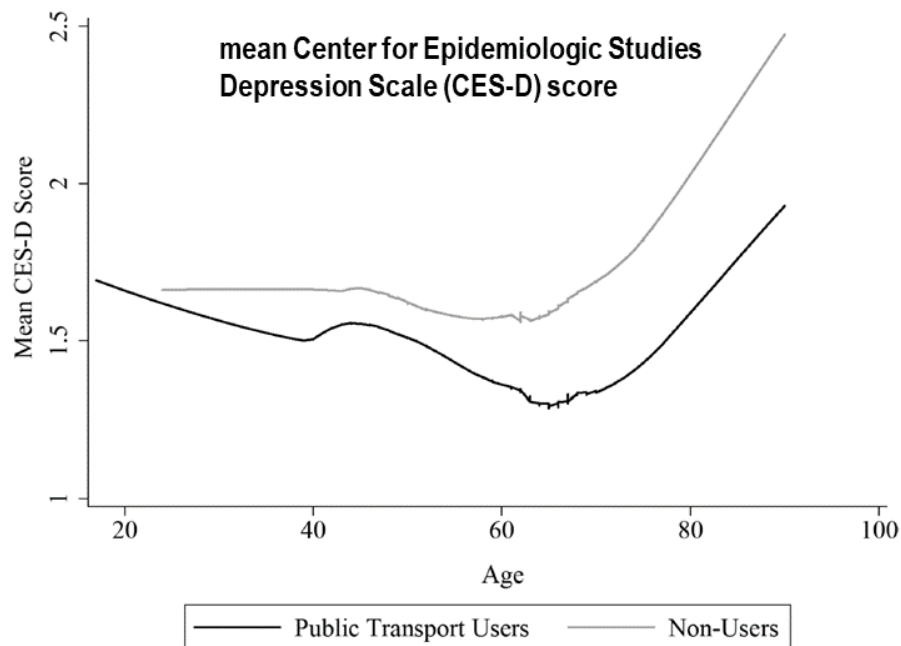
- **Train commuting is less stressful** and creates **less negative mood** than commuting by car (Wener & Evans, 2011).
- **Commuting with car** requires **significantly more effort**, and is significantly **less predictable** than commuting by train (Wener & Evans, 2011)
- Paradoxically, **drivers have less control** over their commute than commuters on other modes (Legrain et al., 2015)



Image credit: ivanko80, reddit

Some evidence that PT use can lower depression and improve social engagement among older adults

18,453 participants residing in England, **aged ≥ 50 years**, who were surveyed at one or more time points between 2002 and 2014 (English Longitudinal Study of Ageing (ELSA))



- using public transport **reduces feelings of loneliness** ($\beta -0.794$, 95%CI -1.528 to -0.061)
- **increases volunteering at least monthly** ($\beta 0.237$, 95%CI 0.059 to 0.414)
- **increases regular contact with children** ($\beta 0.480$, 95%CI 0.208 to 0.752) and **friends** ($\beta 0.311$, 95%CI 0.109 to 0.513).

Reinhard E, Courtin E, van Lenthe FJ et al. J Epidemiol Community Health 2018;72:361–368.

Image credit: Getty Images

Accessibility matters..



- Those living about 200–500 m from the closest bus stop have a lower mental health score compared to those who lives < 200 m from a stop.
- Not using the public transport at all is associated with a lower Mental Component Score (MCS)

Chiatti et al.,2017. Access to public mobility services and health in old age: A cross-sectional study in three Swedish cities, Journal of Transport & Health,Volume 7, Part B, Pages 218-226,ISSN 2214-1405;
image credit: Nottingham post

Does PT always help with air quality?...



...or noise



Is disease exposure a problem? ; mixed and weak evidence...

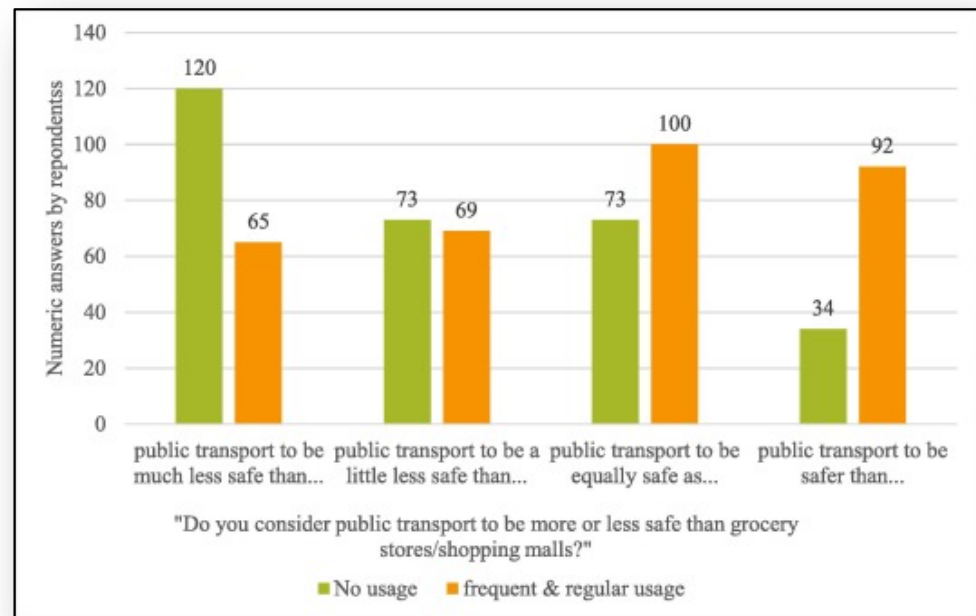
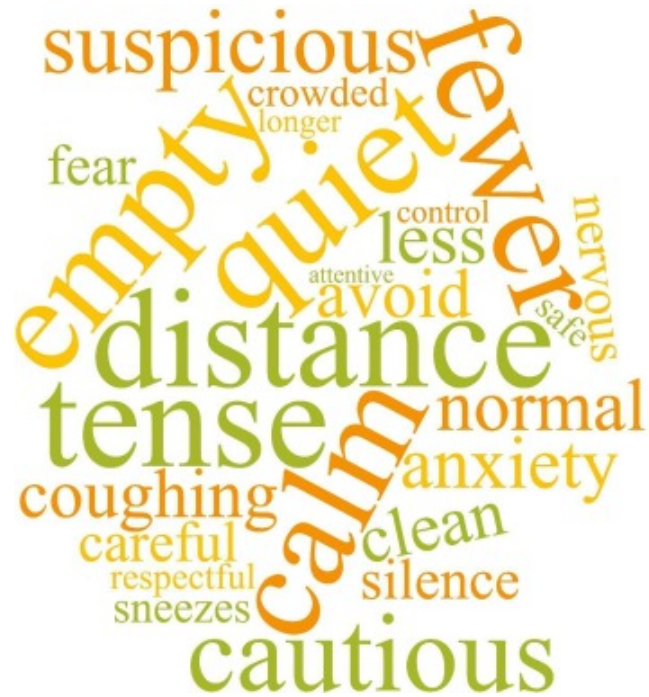


Evidence on Disease Exposure and PT

- Poor conclusive evidence of disease exposure on PT as major concern (Mohr, et al., 2012)
- More conclusive evidence of fear of contamination as a major concern (Weil Cornell Medical School, 2015)
- Lima, Peru
 - Minibuses; may be a potential setting for tuberculosis transmission (Atenstaedt, 2007)
- Ethiopia
 - Long distance train could be location for malaria transmission but no evidence of this on the train was found (Atenstaedt, 2007).
- UK
 - increase in respiratory infections like colds and flus, among people who have ridden in a bus or tram (Troko et al., 2011).
- Thailand
 - levels of bacteria were raised (greater than 550m3) in Thailand buses ; Luksamijarulkul et al. (2004)
- Reynolds et al. (2005)
 - 61% and 41% of the armrests/handles in public buses detected protein and bodily fluids
- Montero et al. 2001
 - 'poor ventilation' (windows closed, no air conditioning) due to low outside temperature, as a main factor causing the transmission of tuberculosis on bus/train
- McAnulty 2006
 - crowding of passengers in public buses might trigger the spread of TB and meningococcal disease

Impact of COVID-19 on the safety perception of PT...

“Following the COVID-19 outbreak, how would you describe the atmosphere in public transport?”



(Sträuli et al., 2022)

Impact of COVID-19 on the safety perception of PT...

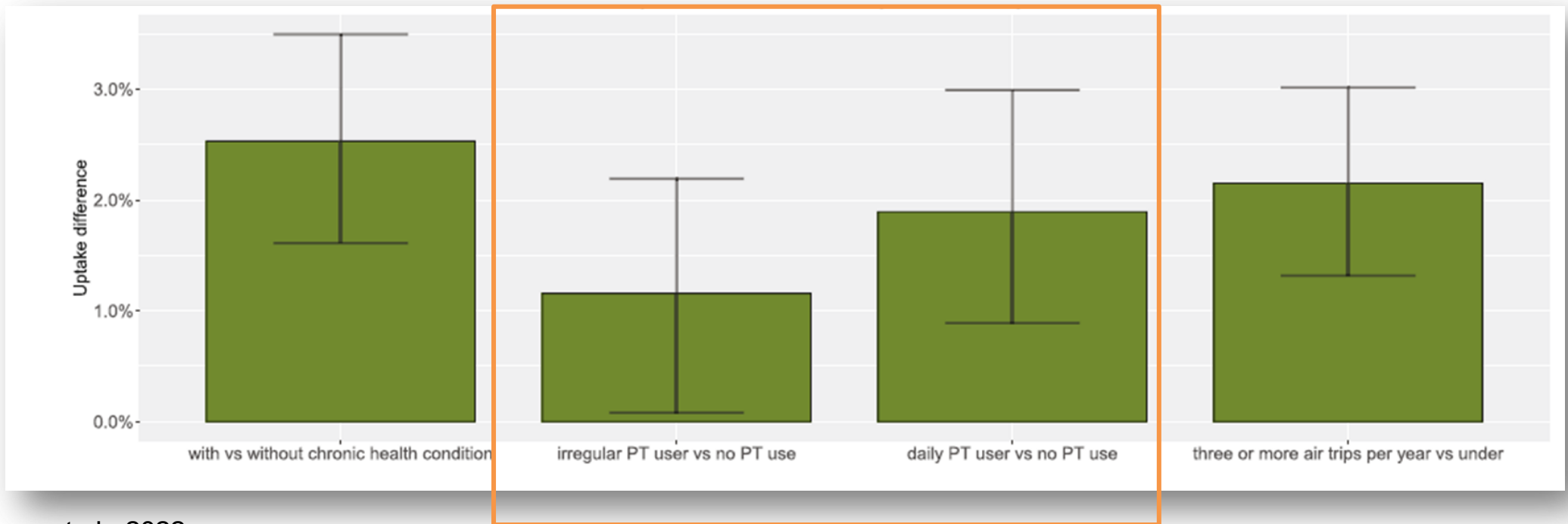


Image credit: Monash Lens, Mamamia

- women report a much higher reduction of public transport use due to a higher degree of fear of COVID -19 infection in public transport. (Schaefer et al., 2021, Currie et al 2021)
- They reported greater vulnerability, perceived risk, fear, and preventive behaviour than men. (Yildirim et al., 2021, Currie et al 2021)

Herd immunity: Predicting COVID-19 vaccination uptake

Exposure to infection risks on public transport or air travel similarly raises the willingness to be vaccinated



Hess et al., 2022

Is disease exposure good in building resistance to infection? ; no evidence...



Evidence on Disease Exposure and PT as a Means of Building Public Resistance to Infection

None!

Introduction

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Assessment



An evaluation approach of positive and negative effects was developed...

- Aims to make an objective assessment of net impacts
 - Concerns:
 - Positive impacts on health; and
 - Negative impacts on health
 - Key concerns:
 - Direct vs Indirect effects
 - Likelihood of a health effect occurring
 - Scale of impact of it does occur
 - Strength of evidence if it does occur
- } A risk management framework

Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

...including weighting of influences based on secondary evidence and some value judgements...

Key components:

- Direct vs Indirect effects
- Likelihood of a health effect occurring
- Scale of impact of it does occur
- Strength of evidence if it does occur
 - Share of papers noting issue
 - Strength of evidence

Definition	Scale
Indirect	1
Direct	2

Probability	Scale
Very low	1
Low	2
Medium	3
High	4
Very high	5

Positive Impact	Scale	Negative Impact
No mental or physical change	1	Behavioral change
Slight behavioral change	2	Minor injury/disease
Slight improvement in health	3	Notable injury/disease
Notable improvement in health	4	Serious Injury/disease
Significant improvement in health	5	Death

Percentage of Papers	Scale
<15%	1
15 – 30%	2
30 – 50%	3
50 – 75%	4
>75%	5

Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

...to create a weighted number of positive and negative effects; high numbers = bigger effect

$$Impact(I) = d * y * i * x * s$$

I = Impact (positive and also negative)

d = direct/indirect

y = likelihood

i = impact scale

x = paper share

s = strength of evidence

$$\text{Net Impact} = (\Sigma PI - \Sigma NI) / n$$

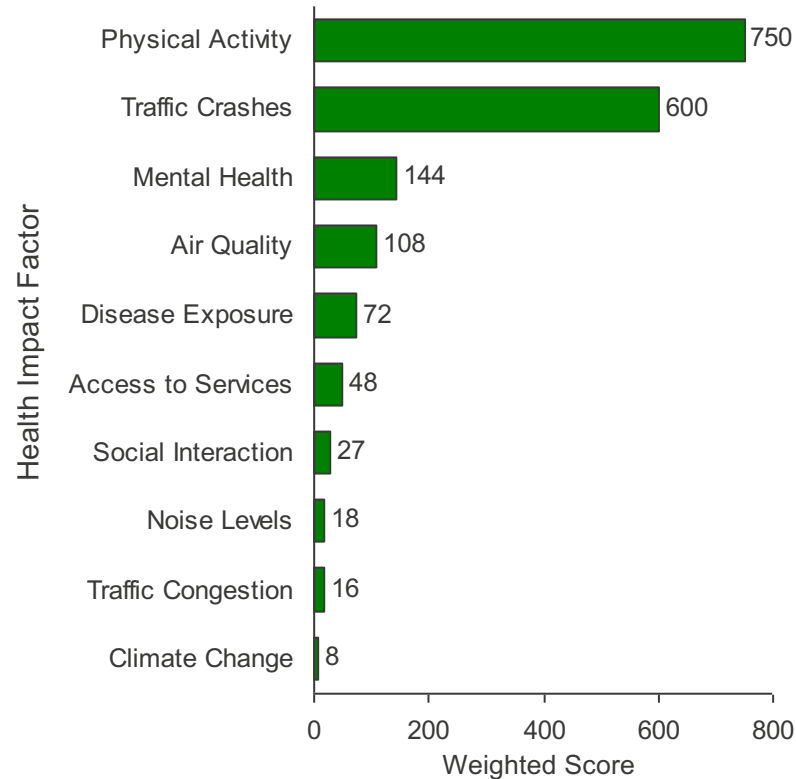
Positive

Negative

Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

Positive impacts were dominated by physical activity improvements and traffic crash reduction

Positive Health Impacts

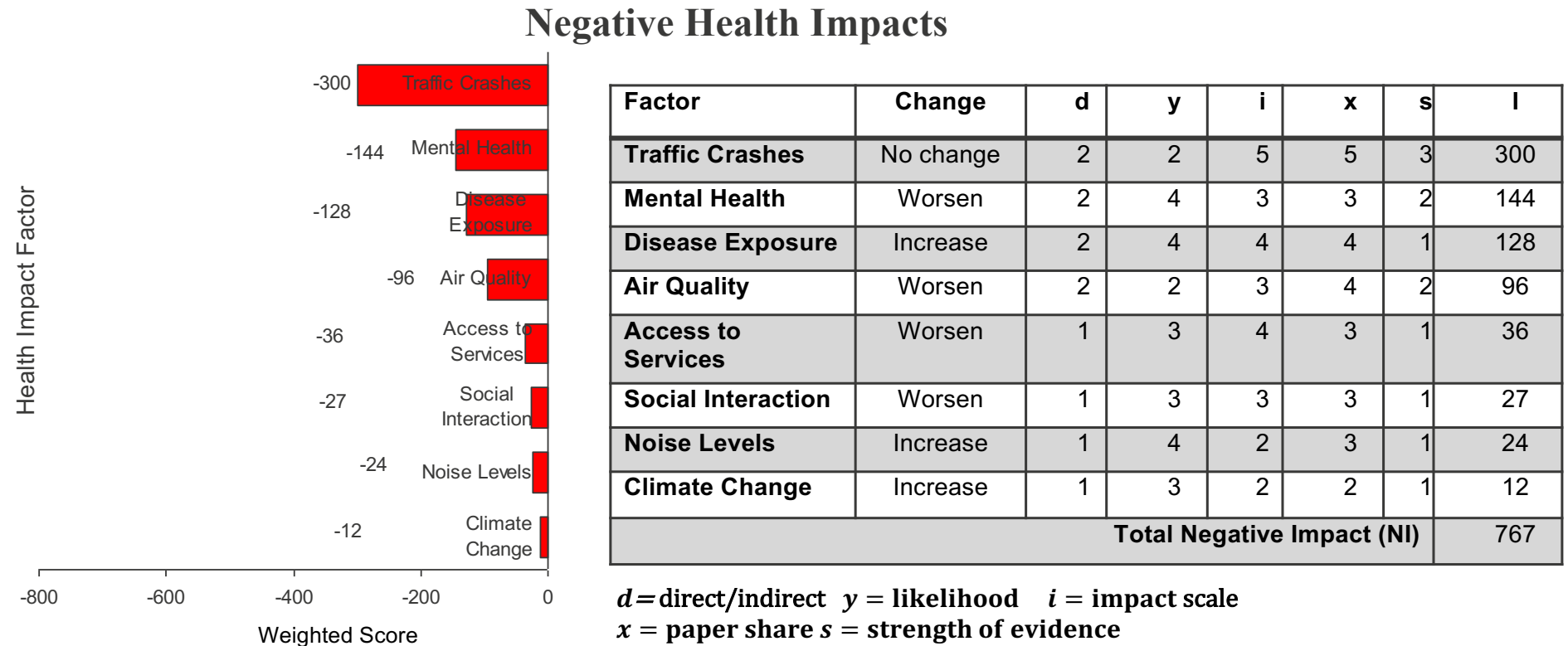


Factor	Change	d	y	i	x	s	I
Physical Activity	Increase	2	5	5	5	3	750
Traffic Crashes	Decrease	2	4	5	5	3	600
Mental Health	Improve	2	3	4	3	2	144
Air Quality	Improve	2	3	3	3	2	108
Disease Exposure	Increase	2	3	3	4	1	72
Access to Services	Improve	1	4	4	3	1	48
Social Interaction	Increase	1	3	3	3	1	27
Noise Levels	Decrease	1	3	2	3	1	18
Traffic Congestion	Decrease	1	4	2	2	1	16
Climate Change	Decrease	1	2	2	2	1	8
Total Positive Impact (PI)							1,791

d = direct/indirect *y* = likelihood *i* = impact scale
x = paper share *s* = strength of evidence

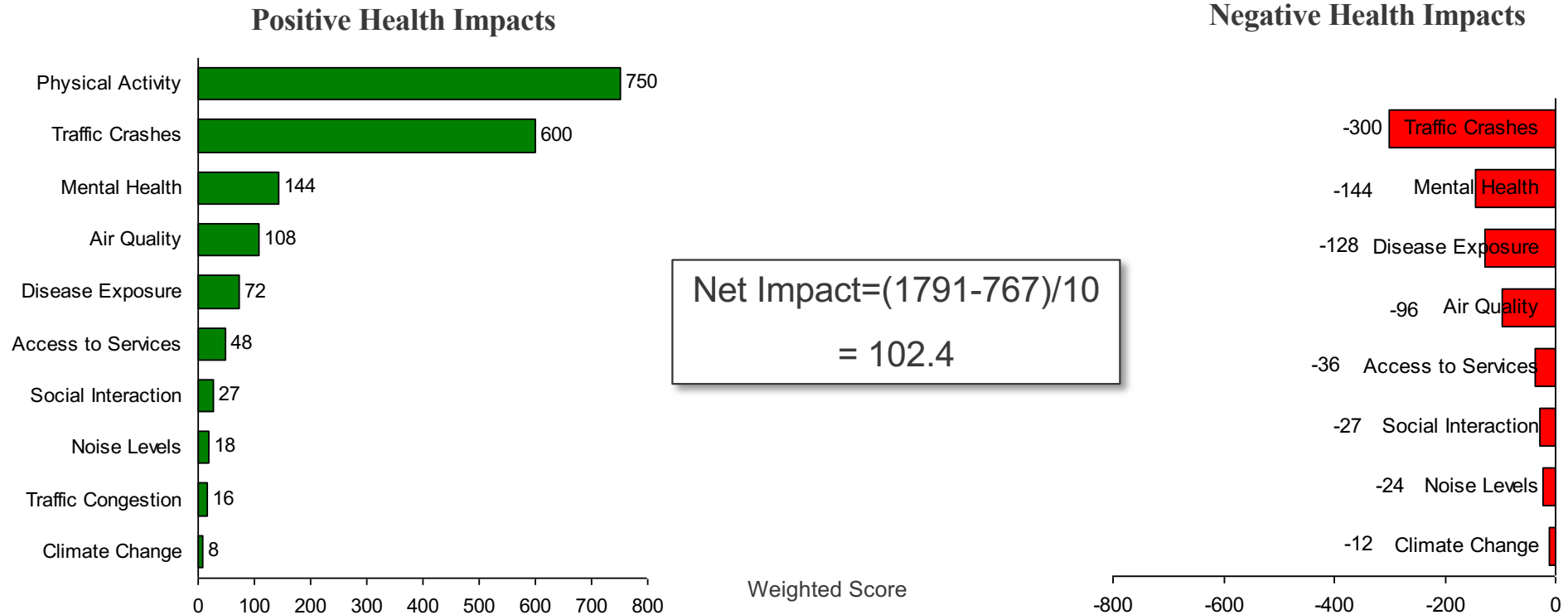
Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

Negative impacts were dominated by traffic crashes, anxiety and health and disease exposure



Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

Net Impacts are highly positive



d = direct/indirect y = likelihood i = impact scale x = paper share s = strength of evidence

Jessop C and Currie G (2015) "Understanding the Health Impacts of Using Public Transport" Department of Civil Engineering final year project 2015

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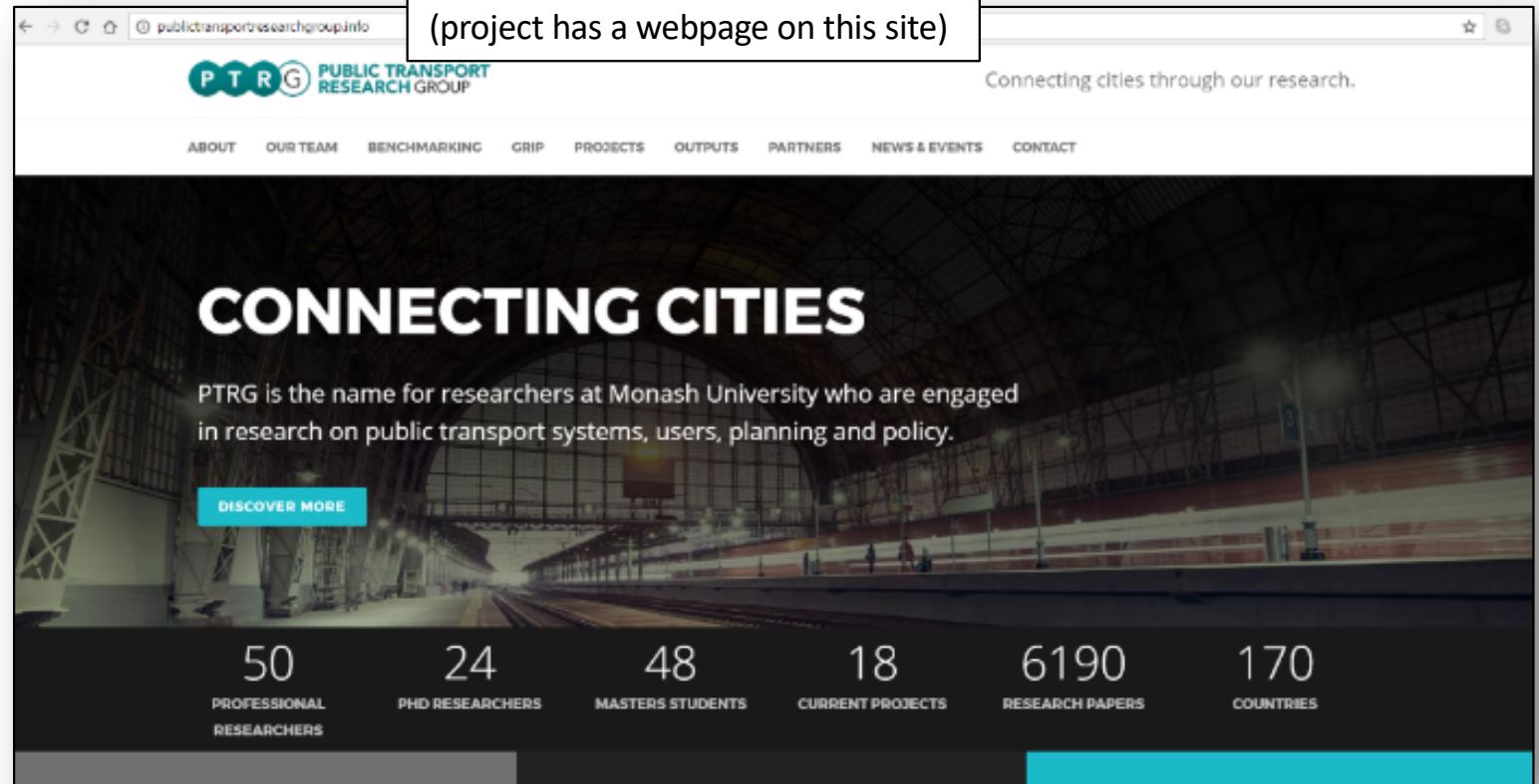


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Connect with us on



W: ptrg.info
(project has a webpage on this site)



References (RS)

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