Health and Transport: Bridging the Gap

Audrey de Nazelle

“Moving Active Transportation to Higher Ground: Opportunities for Accelerating the Assessment of Health Impacts”
Washington DC, April 13 2015
UP IN THE AIR — A protester holding her bicycle aloft to stop traffic in Paris during an anti-pollution demonstration. As air conditions worsen, authorities have asked motorists not to drive in the city on the weekend.
- Why? Opportunities for planning cities for health, but what is the evidence base?

- Purpose: help decision-makers design urban policies that promote health

- Methods:
  - Conceptual and quantitative integrated frameworks
  - Research gaps
TRANSPORTATION, AIR POLLUTION AND PHYSICAL ACTIVITIES
an integrated health risk assessment programme of climate change and urban policies
**Conceptual Framework**

- **Built and Natural Environment**
  - Land use design, urban design, transportation network, greenspace

- **Behaviors**
  - Travel, physical activity, social interaction, diet

- **Environmental Quality**
  - Air pollution, noise, heat, UV, traffic hazards

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Review

*Environment International 37 (2011) 766-777*

Improving health through policies that promote active travel: A review of evidence to support integrated health impact assessment

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TAPAS quantitative models: health impacts for travellers themselves

Walking and Cycling Policies/Scenarios

Air Pollution
Traffic Incidents
Physical Activity

Mortality / morbidity

Rabl and de Nazelle Transport Policy 2012
Impacts of mode shifts to active travel

Deaths/year - (DALY/5)/year - (€/20)/year

Include shifts to transit

Deaths avoided

Morbidity + mortality

Deaths avoided

Cost savings /mode shift

Europe

BICING

Barcelona car reduction scenarios
deaths/year - (DALY/5)/year - (€/20)/year

air pollution gen pop
Traffic mortality
Air pollution traveller
physical activity
Health impact assessments

- TAPAS model across 6 European cities: See David Rojas’ presentation 3:45pm today
- Main message so far (from all of 20 studies): Benefits of active travel in terms of physical activity outweigh adverse effects associated with air pollution and/or traffic injuries
- Review of HIAs: See Natalie Mueller’s presentation 10:30 tomorrow
BUT, lots of uncertainty still exists

- Knowledge gaps
- Lack of data
- Choice of metrics/outcomes
Effectiveness of policies

Photo: Gil Garcetti
Effectiveness of policies

Some methodological issues

- Residential choice / mode choice
- Behavioural theories
  - Environmental or social context, personal norms, etc
- Seasonal effects
- Physical activity substitution

Photo: Gil Garcetti
Effectiveness of policies

- Intervention study design
- Natural Experiments
- Longitudinal analysis

Centre for Diet and Activity Research (CEDAR, Cambridge)


Note. Whiskers indicate 95% confidence intervals. The findings were very similar when we repeated the analysis for the 1-year sample and for Connect2 use at 1-year follow-up.

FIGURE 1—Association between proximity to Connect2 and (1) past-week walking and cycling at baseline and (2) Connect2 use at 2-year follow-up: Cardiff, Kenilworth, and Southampton, United Kingdom; April 2010–April 2012.

Goodman et al. 2014 Am J Public Health
Air pollution and physical activity

- TAPAS epidemiologic analysis (Andersen et al. 2015 Environmental Health Perspectives):
  - Danish Diet Cancer and Health Cohort (52,061 members, NO2 concentration at home address)
  - Benefits of outdoor physical activity outweigh risks associated with air pollution exposure
  - Some benefits may be slightly attenuated when exposed to high levels of NO2 (respiratory mortality)
Air pollution and physical activity: Experimental studies

TAPAS experimental study (Kubesch et al. 2014 European Journal of Preventive Cardiology, & Occupational Environmental Medicine):

- Case crossover, 28 volunteers
- Benefits of cycling on respiratory and cardiovascular outcomes even at high air pollution levels, may protect against acute adverse effects
- Difficulty of disentangling effects

Exercise improves the same physiological mechanisms that air pollution deteriorates

Active travel and safety

Deterrent to active travel
Under-reporting of bike incidents: SHAPES longitudinal analysis
(Aertsens et al. 2010 Accident Analysis and Prevention)
Safe conditions?

Photo: Gil Garcetti
Population characteristics

Exposure to policies & risks
Uptake of active travel
Health effects

Photos: Gil Garcetti
Woodcock et al. (2014 BMJ) on the London cycle hire scheme: for young women benefits did not outweigh the harms

Photo: Gil Garcetti
Population characteristics: baseline levels of physical activity

Figure 8. Dose response functions (DRF) for physical activity and all cause mortality.

*METs/h/w: Metabolic Equivalent of Task per hour per week; DRF: Dose Response Function; Curvilinear DRF from a meta-analysis for physical activity and all-cause mortality (Woodcock J. 2010); Linear Walk DRF from a meta-analysis reported in HEAT for walking (WHO, 2010); Linear Cycling DRF from HEAT for cycling (Andersen L, 2000).
Range of conditions for environmental, population and personal risk tradeoffs
Effects of other exposures/behaviours
## Adjusted associations between natural outdoor environments within 300 m and health and mediators.

### Health indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>OR§ (95% CI)</th>
</tr>
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<tbody>
<tr>
<td>Less than good self-perceived general health</td>
<td>0.90 (0.83, 0.98)*</td>
</tr>
<tr>
<td>Perceived risk of poor mental health</td>
<td>0.79 (0.71, 0.88)*</td>
</tr>
<tr>
<td>Perceived depression and/or anxiety</td>
<td>0.81 (0.75, 0.88)*</td>
</tr>
<tr>
<td>Visits to mental health specialists</td>
<td>0.80 (0.69, 0.92)*</td>
</tr>
<tr>
<td>Intake of tranquilizers or sedatives</td>
<td>0.88 (0.79, 0.99)*</td>
</tr>
<tr>
<td>Intake of antidepressants</td>
<td>0.80 (0.71, 0.91)*</td>
</tr>
<tr>
<td>Intake of sleeping medication</td>
<td>0.89 (0.79, 0.99)*</td>
</tr>
</tbody>
</table>

### Mediators

<table>
<thead>
<tr>
<th>Mediator</th>
<th>OR§ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social support</td>
<td>0.98 (0.93, 1.04)</td>
</tr>
<tr>
<td>Physical activity</td>
<td>1.01 (0.93, 1.09)</td>
</tr>
</tbody>
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Triguero-Mas et al 2015 Environment International
Other health and wellbeing outcomes


Photos: Gil Garcetti
What will convince policy-makers? (And individuals?)

- Mortality, morbidity, burden of disease
- Metrics used by government agencies: congestion, air pollution compliance, medical expenditures, etc
- Climate change (ITHIM)
- Economic evaluations (HEAT)
- Fuel savings
- Stakeholder and public attitudes
- …
Benefits of car use?

GM add: “Stop pedaling, start driving”
Conclusion

Bridging the gap between transport and health:

• Current evidence shows benefits of active travel > risks
• Future work needed to further explore (Combining methods from various fields)
  • Effectiveness of policies (longitudinal analyses, behavioural theories)
  • PA and AP (real world, normal life conditions, subpopulations)
  • Traffic injuries (conditions and underreporting)
  • Variety of population and environmental characteristics
  • Other impacts
  • Exposome - novel technology
  • Stakeholder and decision makers

See Thomas Goetschi’s poster
THANK YOU

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Charlotte Braun-Fahrländer

...
Effectiveness of policies

Physical Activity substitution?

![Graph showing physical activity substitution](image)

Donaire et al. 2015 American Journal of Preventive Medicine
Active travel and safety

Deterrent to active travel

Under-reporting of bike incidents: SHAPES longitudinal analysis (Aertsens et al. 2010 Accident Analysis and Prevention)

Safe conditions?

Safety in numbers? (Jacobsen Inj Prev 2003)

Figure 1: Walking and bicycling in 68 California cities in 2000.
TAPAS quantitative models: health impacts for travellers themselves

Rabl and de Nazelle Transport Policy 2012

Trick: concentration contrast equivalent to inhaled dose contrast