

Air Pollution Exposure in Walking School Bus Routes: A New Zealand Case Study

Kim N. Dirks, University of Auckland
Jennifer A. Salmond, University of Auckland

Introduction

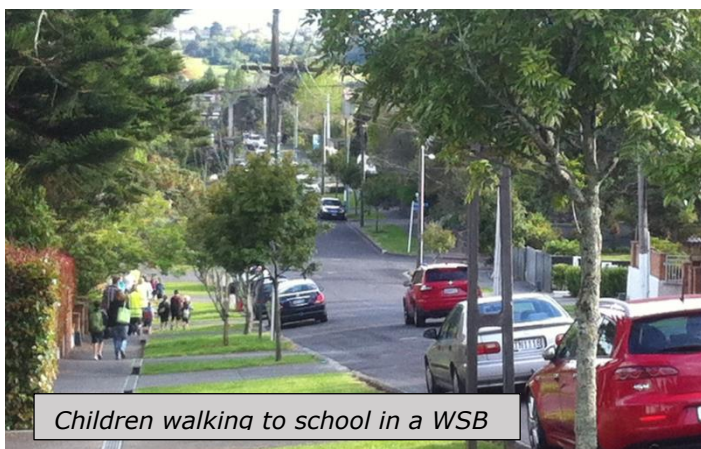
Walking School Buses (WSBs), organized groups for children to walk to school under the supervision of adults, help reduce traffic congestion and contribute towards exercise. Routes are based largely on need, traffic safety and travel time, with exposure to air pollution not generally considered, but this

research suggest that pedestrians travelling on the footpath next to the less congested side of the road in the morning avoid many short-term peaks in concentration and experience significantly lower mean exposures than those travelling on the footpath next to the more congested side.

Study

This research explored whether reductions in exposure can be achieved based on the side of the road travelled using data collected in Auckland, New Zealand. Exposure to air pollution was measured for a 25-minute commute consisting of a 10-minute segment along a quiet cul-de-sac and a 15-minute segment along a main arterial road with traffic congestion heavier in one direction. Two participants were each equipped with a portable ultrafine particle (UFP) monitor and a portable carbon monoxide (CO) monitor, and walked the route on opposite sides of the road simultaneously, for both morning and afternoon.

- Walking to school contributes towards Ministry of Health recommendations for children to stay active and can also be enjoyable, contribute to social cohesion, provide an opportunity to learn about traffic safety, encourage walking as a normal activity, and reduce traffic congestion around schools



Children walking to school in a WSB

Key Question:

Can exposure to air pollution for Walking School Buses be reduced based on the side of the road on which they travel?

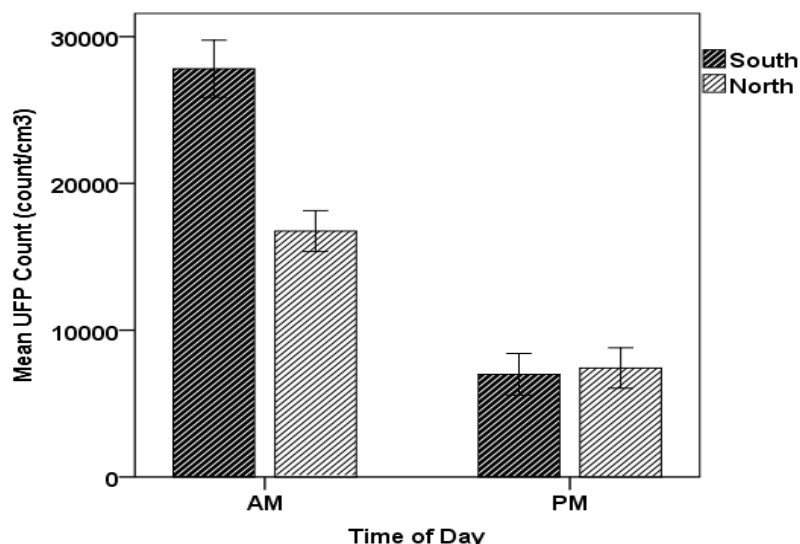
- Only 40% of primary-school aged children walk to school in Auckland, despite most living close to their local school. Barriers to walking include risk of traffic-related accidents and 'stranger danger', which has led to the development of walking school buses (WSBs), where children walk in groups to school, accompanied by adults, along a pre-specified route chosen based largely on catchment need, traffic safety considerations, parental participation and motivation to 'drive' the school buses
- Exposure to air pollution is generally not taken into account when planning WSB routes. Mounting evidence links exposure to traffic-related pollution to adverse health outcomes, including cancer and respiratory-related conditions. Children have been found to be more susceptible to adverse effects than adults.

Findings

- Mean UFP concentration was much higher when walking on the side of the road adjacent to the dominant traffic flow on the way to school (morning).
- Concentrations of UFP on the way home and concentrations of CO at both times were not found to be significantly different on each side of the road.
- Peak UFP concentrations were more likely to be experienced on the more congested side of the road.
- Highest spikes in concentration of pollution are more likely to occur at road junctions where vehicles are idling, so number of junctions might also be important factor for receiving UFP and CO spikes.

Significant increases in exposure when travelling on the more congested side of the road were found for UFP concentrations during the morning commute when 60% of the traffic and most of the buses were city-bound, but not for carbon monoxide. This could be a reflection of the dominance of buses travelling city-bound in the morning (the vehicles contributing to UFP counts), but not to petrol-engine vehicles that are responsible for most of the carbon monoxide.

Children walking to school are exposed to peak air pollution concentrations (by being proximate to exhaust pipes) which can trigger acute health effects, and cumulative air pollution over a long period of time



Average concentrations of UFP during the morning and after school in the afternoon. The South is the side of the road into the city in the morning

Recommendations

- Travel along congested roads should be avoided in favour of travel along quieter streets, and that attention should be paid to the side of the road on which children walk.
- Given that traffic-related air pollution exposure has been linked to both acute health effects triggered by short periods of elevated exposures, and chronic health effects resulting from cumulative effects over extended periods of time, an effort should be made to avoid both peaks in exposure as well minimising cumulative exposures.
- However, route planning decisions need to be weighed up against the extra time spent waiting at intersections and pedestrian crossings as pollution levels tend to be higher there than along the segment between intersections. The increased risk of accidents associated with crossing the road and the availability of suitable places to cross also need to be taken into account

To find out more about this research, please visit:
<https://www.mdpi.com/1660-4601/15/12/2802>

Contact: k.dirks@auckland.ac.nz

Adapted with assistance from Suzanne Woodward, PPI

