Journal of Transport & Health xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Evidence for associations between traffic calming and safety and active transport or obesity: A scoping review

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ARTICLE INFO

Keywords:
Traffic calming
Safety
Active transport
Physical activity
Obesity

ABSTRACT

Traffic calming interventions are policy relevant measures that aim to improve the safety of motorists, passengers, pedestrians and cyclists by reducing the frequency and severity of traffic accidents. Limited evidence exists on secondary effects of investment in traffic calming and safety, including effects on rates of transport-related physical activity (active transport) and more distal outcomes such as obesity.

This study aims to review evidence for association between traffic calming and safety and transport-related physical activity or obesity. A systematic search of the peer-reviewed literature was undertaken, with narrative review and quality assessment of evidence from 71 studies (12 reporting associations with obesity, 59 reporting associations with active transport). Our review demonstrates that whilst a feasible logic pathway exists between traffic calming and active transport and obesity, the current state of the evidence is inconclusive. The quality of evidence is also relatively low, particularly given the challenges involved in collecting rigorous evidence of environmental-type interventions.

Whilst the evidence for net positive health benefits of active transport is well established, the challenge now is to progress from health impact assessment to evaluation of specific interventions that increase active transport. Significant scope exists for a more thorough understanding of the impacts of traffic calming and safety on secondary health outcomes, taking advantage of natural experimental opportunities and using validated and rigorous measures of exposure and outcomes. A more complete understanding of the secondary effects of traffic calming and safety would allow for full economic evaluation of traffic calming interventions to be conducted, incorporating wider health benefits. This information would prove invaluable at the policy level, as incremental micro-scale interventions such as traffic calming are generally feasible and affordable. This information would also inform the more systemic change required to reverse the obesity and physical inactivity epidemics and to improve the health of populations.

1. Introduction

Traffic calming is a transport management approach designed to reduce the negative effects of motor vehicle use for motorists, cyclists and pedestrians, and is recognised as an important transport intervention for population health (Morrison et al., 2003; Pucher

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http://dx.doi.org/10.1016/j.jth.2017.02.011
Received 3 October 2016; Received in revised form 16 January 2017; Accepted 2 February 2017

et al., 2010). Traffic calming interventions have been widely implemented internationally, with road safety included in two of the United Nations' Sustainable Development Goals (United Nations Development Programme, 2015). Traffic calming includes physical measures (for example, speed bumps or chicanes), educational measures (for example, awareness campaigns) and enforcement measures (for example, legislated speed reduction). Reducing the speed of motorised travel decreases both the frequency and severity of accidents (Bunn et al., 2003; De Pauw et al., 2014; Grundy et al., 2009). Evidence suggests that the chances of surviving a crash between a car and a pedestrian decrease sharply above the 30km per hour impact speed (Fildes et al., 2005). Speed reduction through traffic calming measures may therefore lead to important population health gains, as the burden of injuries from accidents is lessened for motorists, passengers, pedestrians and cyclists.

Traffic calming could also lead to population health gains related to an increase in physical activity (PA) (Badland and Schofield, 2005). Whilst the primary objective of traffic calming is to decrease the frequency and severity of transport related accidents there may be secondary population health benefits arising from an uptake in active transport (AT) if the actual and/or perceived safety of walking and cycling for transport improves (de Nazelle et al., 2011). Evidence suggests that the perception of risk plays a significant role in the decision of whether to engage in AT for both adults (Washington et al., 2012; Pooley et al., 2013; Chataway et al., 2014; Mertens et al., 2016) and children (Lorenc et al., 2008; Timperio et al., 2004; Carver et al., 2005; Carver et al., 2010; Christie et al., 2011). The risk of death or injuries has been recognised as the strongest psychological barrier to cycling in particular in high-income, car dependent societies (Macmillan et al., 2014). Evidence also suggests a "safety in numbers" effect for AT (Elvik and Bjørnskau, 2015; Jacobsen, 2003; Elvik and Bjørnskau, 2016), whereby the risk of injury is non-linear with increasing numbers of pedestrians or cyclists engaging in AT. Therefore traffic calming may be an important intervention for improving rates of AT, particularly in countries with relatively low prevalence.

A feasible logic pathway exists between traffic calming, PA and obesity, albeit as secondary outcomes related to improvements in safety and perceptions of safety (Fig. 1). Yet to date, our understanding of these secondary outcomes of transport interventions in general, and more specifically of traffic calming interventions, remains unclear (Badland and Schofield, 2005). Walking and cycling for transport reduces all-cause mortality (Kelly et al., 2014). Evidence suggests that AT increases total PA and that substitution from other forms of PA (for instance, leisure time PA) is limited (Foley et al., 2015; Donaire-Gonzalez et al., 2015). PA reduces the risk of several chronic conditions, such as obesity, heart disease and type 2 diabetes (de Nazelle et al., 2011; Wanner et al., 2012; Saunders et al., 2013). Evidence of the effect of an increase in PA on energy intake is currently relatively mixed, with some studies reporting no or very little increase in energy intake given an increase in energy expenditure (Donnelly et al., 2014; Schubert et al., 2013; Douglas et al., 2015), some reporting increased energy consumption or compensation (Dhurandhar et al., 2015) and some reporting a highly variable response from individual to individual (Blundell et al., 2015). The health-related benefits of AT are however likely to outweigh any negative health impact of increased exposure to emissions or road traffic accidents due to modal shift from the relatively safer confines of a motor vehicle to pedestrian or bicycle travel (de Hartog et al., 2010; Doorley et al., 2015).

Gaining a better understanding of the potential for broader health impacts of traffic calming is methodologically challenging. Given that transport interventions are most commonly implemented to improve safety or congestion and not to improve population levels of PA (or to reduce the prevalence of health conditions related to physical inactivity), information on wider health impacts is often not comprehensively collected or routinely considered in the transport decision-making process (Brown et al., 2015). Traffic calming interventions form part of the broader environment and therefore their effects on rates of walking and cycling are difficult to separate from wider influences (such as urban design, street connectivity, public transport accessibility and so on). Other complex influences, such as cultural norms, may also mean that what works within one particular area may not necessarily have an identical effect on rates of AT in another geographical location. Traffic calming interventions are also often implemented simultaneously or with other types of interventions, meaning that separating the effects of individual traffic calming measures can be difficult. Lastly, evidence suggests that the correlates of walking and cycling for transport-related purposes may differ from correlates for leisure-

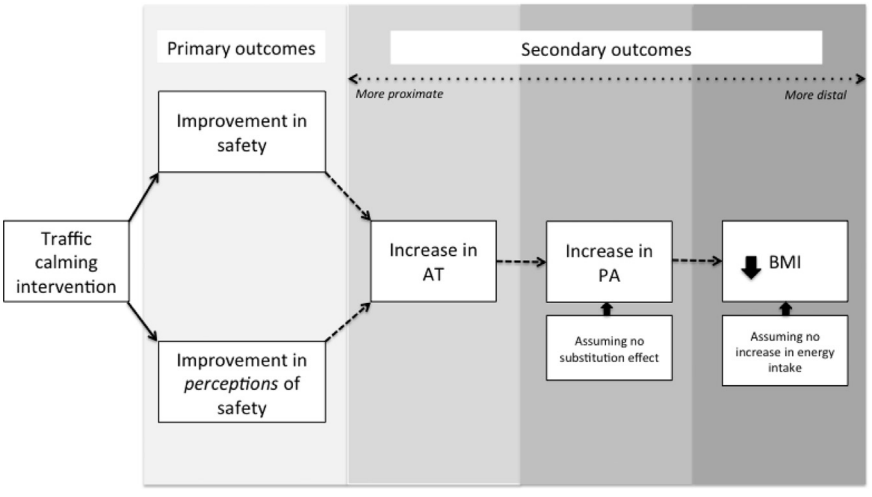

Fig. 1. The logic pathway between traffic calming, PA and obesity. AT = active transport. PA = physical activity. BMI = body mass index.