To:	Transport & Health Policy Makers, & Practitioners
From:	Professor Adrian Davis
Date:	19th February 2021
Subject:	Essential Evidence 4 Scotland No.35 Safety in Number re-visited

Top Line: The Safety in Numbers effect exists both for pedestrians and cyclists. An increasing number of pedestrians or cyclists is therefore unlikely to be associated with a proportional increase in the number of crashes.

Sustainable transport is an increasingly important objective of transport policy. In Scotland, not least because of the Climate Change Act (2019), the Scottish Government has a range of commitments which now includes reducing car kilometres travelled by 20% by 2030. Non-motorised transport is, however, associated with a higher risk of injury per kilometre of travel than most forms of motorised transport. An increase in walking or cycling may, therefore, be associated with an increased number of injured road users. However, there has been a significant volume of evidence supporting the existence of a safety in numbers phenomenon. Behaviour change by motorists is considered the most likely mechanism which underlies the "safety in numbers" effect. By contrast, the risk profiles of cyclists and pedestrians is will worsen if fewer people walk and cycle and more use a car. [1]

A 2017 paper presented a systematic review and meta-analysis of studies (highly robust) that have estimated the relationship between the number of crashes involving motor vehicles and cyclists or pedestrians and the volume of motor vehicles, cyclists and pedestrians.[2] A key objective of most of these studies has been to determine if there is a safety-in-numbers effect. There is safety-in-numbers if the number of crashes increases less than proportionally to traffic volume (for motor vehicles, pedestrians and cyclists). On the other hand, a number of studies indicate that there is a so-called safety-in-numbers effect for pedestrians and cyclists. This means that when the number of pedestrians and cyclists increases, there is a less than proportional increase in the number of crashes involving them. However, the number of crashes involving pedestrians or cyclists and motor vehicles depends both on the volume of pedestrians or cyclists and on the volume of motor vehicles. To determine if there is a safety-in-numbers effect, one therefore needs data on all conflicting flows (motor vehicles, pedestrians, cyclists).

In terms of results, based on 26 studies meeting the inclusion criteria, it seems clear that a safety in numbers effect exists both for pedestrians and cyclists. An increasing number of pedestrians or cyclists is therefore unlikely to be associated with a proportional increase in the number of crashes. The increase in the number of crashes associated with an increase in the number of pedestrians and cyclists will be far less than proportional to the increase in the number of pedestrians and cyclists. The meta-analysis found no evidence of publication bias and indicated the existence of a clear safety-in-numbers effect. However, the authors noted a number of limiting factors. It is still not possible to determine whether the safety-in-numbers effect is a causal relationship or merely a statistical relationship not generated by any plausible causal mechanism. Nonetheless, the results of the individual studies were very consistent. All regression coefficients[3] for pedestrian volume and all regression coefficients for cycle volume indicate a safety in numbers effect. 31 of the 34 regression coefficients for motor vehicle volume indicate a safety in numbers effect. Such a high degree of consistency is rare in studies of road crashes.

[1] See Essential-Evidence-4-Scotland-No-30-Safety-in-numbers-danger-in-scarcity.pdf (napier.ac.uk)

[2] Elvik, R., Bjørnskau, T. 2017 Safety-in-numbers: A systematic review and meta-analysis of evidence, *Safety Science*, 92: 2874-282.

[3] Regression coefficient is a statistical measure of the average functional relationship between two or more variables. In regression analysis, one variable is considered as dependent and other(s) as independent. Thus, it measures the degree of dependence of one variable on the other(s).