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Changes in participation, demographics and hazard associated with mandatory bicycle helmets in New South Wales, Australia

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1. Introduction

New South Wales (NSW) Australia introduced mandatory helmets for bicyclists over 16 years of age in January 1991 and for bicyclists 16 and under in July 1991. Significant reductions in the number of fatalities and serious injuries to bicyclists were recorded. Differences of opinion about the causes of these reductions tend to focus on three areas. First, whether a reduction in participation coincided with the introduction of the law, thus reducing exposure (Austroads, 2000b; Rissel, 2012). Second, were demographic changes among bicycle riders (Robinson, 1996) reflected in fatality rates? Finally, to what extent road safety measures that were introduced at the same time (Road Safety Strategy Branch, 1999–2006) were responsible for the reductions in fatalities.

1.1. Studies of population and hospital treatment data

Given the effectiveness of bicycle helmets in reducing some head injuries, it is not surprising that hospital treatment studies usually find reductions in the severity of some head injuries that are attributed to helmets (Macpherson and Spinks, 2008). However, estimates of large reductions in deaths and serious injuries attributable to mandatory helmets (Thompson et al., 1999) have not occurred in the population. Additionally, the health benefits of cycling (de Hartog et al., 2010; Gotschi, 2011; Lindsay et al., 2011) are sometimes ignored although these may exceed the public health costs of the injuries and deaths suffered.

1.2. Method

In Section 2, the counts of bicyclists reported in four observational surveys (Smith and Milthorpe, 1993; Walker, 1990, 1991, 1992) taken before and after the legislation was enforced are examined in detail. Section 3 focuses on the changes in participation in the different age groups and the concurrent changes in fatality rates as recorded in relevant databases (Department of Infrastructure and Regional Development, 2017; Road Safety Strategy Branch, 1999–2006). Section 4 considers the fatality rates for motorcyclists and pedestrians in relation to changes in road safety, and the expansion and use of off-road cycleways. The R statistical and graphics language (R Core Team, 2017) was used for all statistical analyses and illustrations.

2. Participation over time in the RTA surveys

An observational survey of bicycle riders was commissioned by the Roads and Traffic Authority (RTA) to estimate the effects of the legislation. The four repeated sets of observations (Smith and Milthorpe, 1993; Walker, 1990, 1991, 1992) were conducted to study compliance with current laws applying to bicycling and estimate of bicycle helmet usage before and after the introduction of the law. The overall percentage of bicyclists observed wearing helmets rose from 27% in the 1990 survey to 83% in 1993.

In fact, the four surveys were conducted at almost the same locations and, save for the first, at the same time each year. Considerable effort was made to ensure geographic and demographic representativeness. Therefore the numbers of riders recorded

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are the best estimate of the effect of the mandatory helmet law on participation in bicycle riding in NSW at that time. Although, "…these numbers should not be used to estimate total exposure or ridership in New South Wales" (Smith and Milthorpe, 1993,p.ii), changes in participation can be estimated ("…this study captures helmet wearing rates and overall change in ridership." (Smith and Milthorpe, 1993, p 17). one of the objectives of the final study was to determine "…if decrease in cycling is continuing, has levelled out or reversed" (Smith and Milthorpe, 1993, p i).

2.1. The effect of weather on cyclist counts

Some have argued that the 1990 survey was comparable to the later surveys, and conclude that there was an increase in participation in cycling in 1991. The second report explains the low counts in 1990 as, "…the first survey was conducted in overcast conditions in Sydney and, in some areas, was interrupted by rain whereas the second survey was conducted in sunny conditions" (Walker, 1991, p2). The third (Walker, 1992, p.i) and fourth (Smith and Milthorpe, 1993, pp 11–12) surveys were also conducted in fine weather, Not only is rain a deterrent to cycling (Nankervis, 1999), the increased likelihood (Marmor and Marmor, 2006) and severity (Kim et al., 2007) of crashes is well known.

The weather was fine in rural NSW on the survey days in both 1990 and 1991, where counts decreased by 9% for adults and 14% for those under 16, overall a 10% reduction. Rainfall reports for the three survey days in 1990 (27, 28 and 30 September) for seven weather stations around the Sydney metropolitan area and the rural sites were retrieved (Australian Bureau of Meteorology, 2006). Out of the 39 days of rural observations, 31 had no rain recorded and only one substantial fall was recorded. That day in Albury was

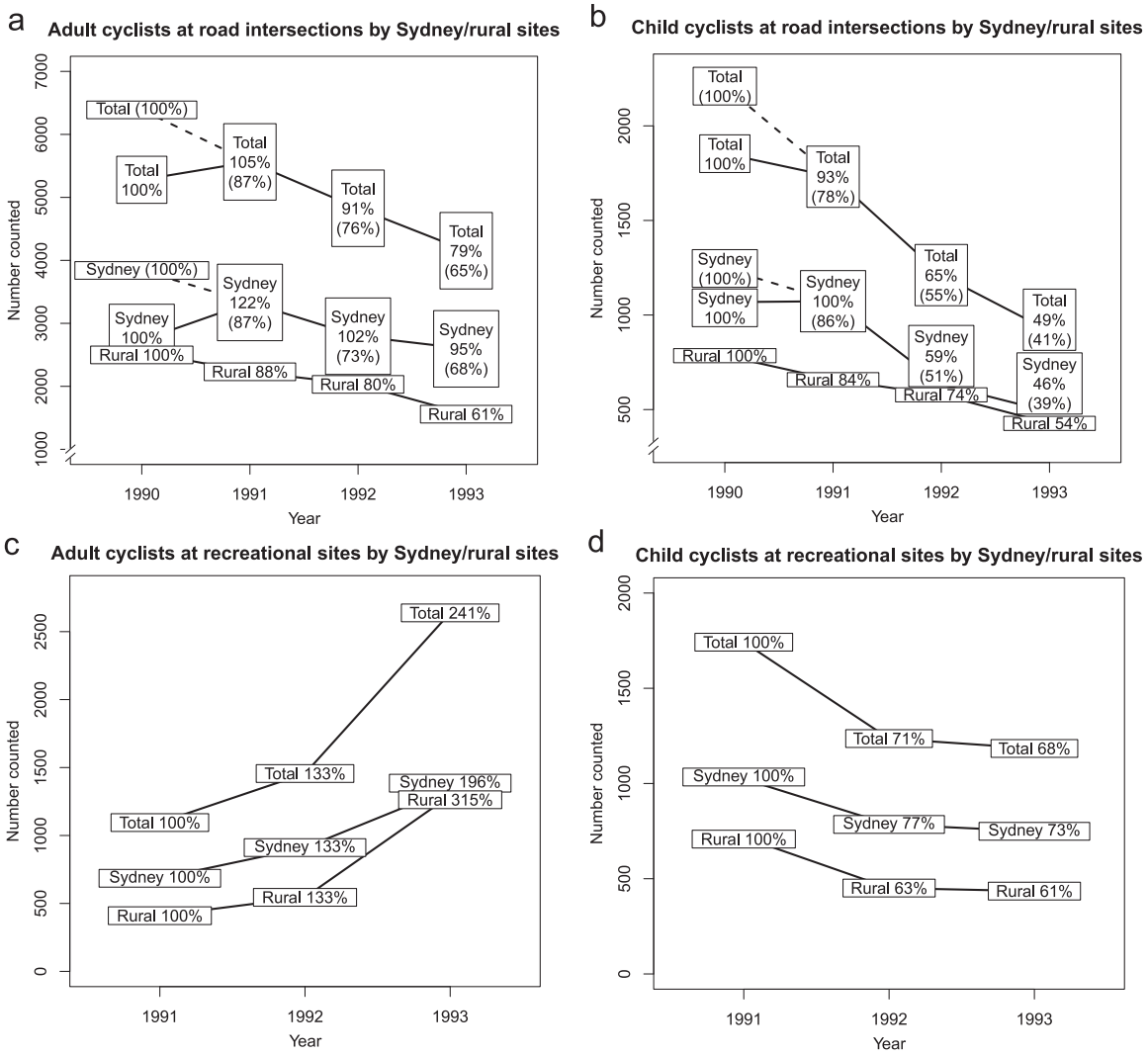

Fig. 1. a Counts of adult cyclists at "road intersections". Dashed lines show the city and total counts for 1990 adjusted for rain using the rural counts. b - Counts of cyclists under 16 at "road intersections". Dashed lines show the city and total counts for 1990 adjusted for rain using the rural counts. c - Counts of adult cyclists at "recreational areas". d - Counts of cyclists under 16 at "recreational areas".