Child cyclist traffic casualties: The situation in South Australia

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Abstract

Data are presented on characteristics of child pedal cycle casualties (as recorded by the police) in South Australia for the period 2001-2004, and how they have changed over the longer period 1981-2008. The factors considered in this paper include site and events, characteristics of the cyclist, and characteristics of the motor vehicle and its driver.

Keywords

Cyclist safety, Child cyclist injury, Severity of injury, Accident statistics, Bicycle accidents, Pedal cycle accidents

Introduction

The purpose of this paper is to describe certain characteristics of child pedal cycle crashes in South Australia. The paper is fairly broad in scope, but there is some emphasis on variables that are not often tabulated as a matter of routine rather than on those that are often found in statistical yearbooks. The presentation of the detailed results will be split into (a) the pedal cyclist and the circumstances of the crash, and (b) the motor vehicle and its driver. First, though, Table 1 places child cyclist casualties in the context of cycle casualties as a whole, and shows how the distribution of ages has changed between 1981-1984 and 2005-2008.

Over recent decades, policy changes relevant to helmet use and vehicle speeds have affected cycling patterns and safety. Wearing of helmets by pedal cyclists was promoted from November 1985, and has been compulsory since mid-1991. According to Marshall and White [1], this probably led to both reduced cycling and reduced injuries among the majority who continued to cycle. More recently, there has been a trend towards lower speed limits. Person trips per day in Adelaide were 3.4 million in 1986 and also 3.4 million in 1999, of which the numbers by bicycle were 0.089 and 0.040 million, respectively [2]. The South Australian government is trying to encourage safe cycling, and aims to double cycling trips by 2015 [3]. These trip numbers are in the context of a population of about 1.1 million in the Adelaide Metropolitan Area, and about 1.5 million in the state of South Australia.

In this paper, a description of the methods and tables is followed by two sections of results and a discussion. Most of the tables of data refer to the period 2001-2004, though Table 1 and the comments in the 'Discussion' section concerning trends over time have been updated to 2005-2008. Data for 2001-2004 is included in Table 1 for consistency with the other tables. For further tables (of adult cyclist casualties as well as child), see Hutchinson, Kloeden and Long [4-8]. An earlier version of this paper was presented at a conference held in 2007 [8].

Methods

This is a retrospective review of police reports of road crashes involving pedal cyclists aged 5 to 15 years for the period 2001-2004 recorded in the Traffic Accident Reporting System (TARS). Police reports of pedal cycle crashes substantially

Table 1. Pedal cycle casualties in South Australia: Comparison of the distribution of rider age (percentages, of those of known age) in 1981-1984, 2001-2004 and 2005-2008

Cyclist age group (years)	Percentage in each age group (any severity of injury)			Percentage in each age group (those killed or admitted to hospital)		
	1981-1984	2001-2004	2005-2008	1981-1984	2001-2004	2005-2008
0-15	44.8	15.6	11.6	51.8	21.7	16.5
16-19	13.7	8.2	6.9	10.2	6.8	7.2
20-29	19.7	22.8	22.1	16.7	19.6	19.7
30-39	9.2	20.4	22.1	7.6	15.3	19.7
40-49	4.2	17.8	19.6	3.9	18.3	16.1
50-59	3.5	9.8	11.3	2.8	11.9	11.2
60-99	4.9	5.3	6.6	7.0	6.4	9.6
Total number[a]	2440	1605	1750	684	235	249
Total number[b]	2678	1819	1938	742	253	266

[a]Excluding those of unknown age [b]Including those of unknown age

understate the totality of pedal cyclist trauma: many cyclists are hurt without a motor vehicle being involved, and for these, hospital records are a better source of information. Nevertheless, for crashes that do involve a motor vehicle, and especially for information about the crash circumstances and the motor vehicle, police reports are the best source of routinely collected data.

Postcodes are used to describe the location of the crash. These are grouped as 5000-5099 (this is centred on the city of Adelaide and has a boundary between 8 and 16km from the centre of Adelaide), 5100-5199 (outer Metropolitan Adelaide), 5200-5999 (the rest of South Australia). The intention is not chiefly to compare the postcode groups, but rather to classify by site variables, vehicle variables and so on, within the different postcode groups, as questions may arise as to relative frequencies of different categories in downtown Adelaide, the outer suburbs of Adelaide and country South Australia.

Most tables refer to all casualties, and also the subset who were killed or admitted to hospital (termed 'serious'). Note that any finding about differences in the proportion of seriously injured casualties potentially has at least two interpretations: either one group does tend to be less seriously injured, or the minor crashes in that group are more likely to be reported to the police than in the other group. Casualties of unknown age were excluded from the tables. In 2001-2004, these accounted for some 11.8 per cent of the total (and for casualties who were killed or admitted to hospital, the proportion was 7.1 per cent).

Results: The cyclist and the crash circumstances

Among child cyclist casualties, males outnumber females about 6 to 1 (Table 2). The distribution of ages is skewed towards the older children (Table 3).

Tables 4 to 7 tabulate the following variables, respectively: whether or not the accident took place at a junction, speed limit, the nature of the site and crash type. Casualties occur in approximately equal numbers at and away from junctions (Table 4), and very largely on roads where the speed limit is 60km/h or lower (Table 5). Several traffic engineering features at a site may be of interest, singly or in combination – speed limit, whether there is a junction, whether the road is divided, complexity of the junction and nature of traffic control. In Table 6, these factors have been combined in a way intended to give a useful summary of the site – not too little detail, and not so much that it is overwhelming. As to crash type, those termed 'right angle' were the most common (Table 7). Types of crashes are devised with motor vehicles chiefly in mind. Further, an appreciable number of crashes are complicated or do not fall easily into one category or another.

From Table 5, the proportion of child casualties killed or admitted to hospital was 20 per cent when the speed limit was 60km/h or less, and 35 per cent when the speed limit was 70km/h or higher.

There are about the same number of casualties per day on weekends as on weekdays. The times of day when casualties are

Table 2. Numbers of pedal cycle casualties aged 5-15 in South Australia 2001 to 2004, by postcode group of crash and rider sex

Cyclist sex	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
Male	106	60	48	214	19	8	14	41
Female	17	8	10	35	3	0	7	10
Total	123	68	58	249	22	8	21	51

Table 3. Numbers of pedal cycle casualties aged 5-15 in South Australia 2001 to 2004, by postcode group of crash and age group of casualty

Cyclist age group (years)	All severities				Of whom, these numbers were serious			
	Postcode group			Total[a]	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
5000-50995100-5199	5200-5999			5000-5099	5100-5199	5200-5999		
5-7	5	6	7	18	1	2	5	8
8-12	57	28	34	119	13	4	11	28
13-15	61	34	17	112	8	2	5	15
Total	123	68	58	249	22	8	21	51

[a]Classifying the casualties by years of age (5, 6, ... 15), the 249 casualties were split as follows: 8, 6, 4 (totalling 18), 12, 17, 29, 23, 38 (totalling 119), 35, 41, 36 (totalling 112)

Table 4. Numbers of pedal cycle casualties aged 5-15 in South Australia 2001 to 2004, by postcode group of crash and road geometry

Road geometry	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
Junction	62	30	29	121	13	3	9	25
Not at junction	57	35	24	116	9	5	11	25
Unknown	4	3	5	12			1	1
Total	123	68	58	249	22	8	21	51

Table 5. Numbers of pedal cycle casualties aged 5-15 in South Australia 2001 to 2004, by postcode group of crash and speed limit

Speed limit (km/h)	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
40-60	114	55	48	217	20	7	17	44
70+	3	9	5	17	1	1	4	6
Unknown	6	4	5	15	1			1
Total	123	68	58	249	22	8	21	51

Table 6. Numbers of pedal cycle casualties aged 5-15 in South Australia 2001 to 2004, by postcode group of crash and the nature of the site

Speed limit (km/h), whether at junction, and details	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000 5099	5100 - 5199	5200- 5999		5000- 5099	5100- 5199	5200- 5999	
0-60, no junction, divided road	19	8		27	4	1		5
0-60, no junction, not divided road	36	22	19	77	5	3	7	15
0-60, junction, traffic signals, T- or Y-junction	3	1		4	1			1
0-60, junction, traffic signals, crossroads	10	3	1	14	2			2
0-60, junction, priority, T- or Y-junction	30	19	11	60	6	3	4	13
0-60, junction, priority, crossroads	15		13	28	2		4	6
0-60, junction, roundabout	2	2	3	7	1			1
70+, no junction	1	4	4	9		1	3	4
70+, junction	2	5	1	8	1		1	2
Other and unknown	5	4	6	15			2	2
Total	123	68	58	249	22	8	21	51

Table 7. Numbers of pedal cycle casualties aged 5-15 in South Australia 2001 to 2004, by postcode group of crash and crash type

Crash type	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
Rear end	6	5	1	12	1		1	2
Hit fixed object	2	2		4				
Side swipe	14	8	7	29	3	2	1	6
Right angle	83	46	45	174	12	3	17	32
Head on	5	3	3	11	1	1	2	4
Roll over	1	1		2		1		1
Right turn	7	1	1	9	2	1		3
Hit parked vehicle	2	1	1	4	1			1
Hit object on road	1			1				
Other	2	1		3	2			2
Total	123	68	58	249	22	8	21	51

most frequent are those when most children are travelling to or from school: the hours beginning 08, 15, 16 and 17. See Hutchinson, Kloeden and Long [4] for details. The hourly pattern is different at weekends and in school holidays, as might be expected.

Results: The motor vehicle and its driver

For the data discussed in this section, the crashes have been restricted to those in which there was a single motor vehicle and a single pedal cycle. The numbers of casualties are consequently slightly fewer in Tables 8 to 10 (concerning the type of vehicle, the sex of its driver and the age of its driver, respectively) than in other tables.

Cars and car derivatives make up at least 82 per cent of the total (Table 8). Of motor vehicle drivers whose sex was known, males made up 56 per cent (Table 9). The age of the motor vehicle driver is quite evenly distributed, except for ages over 60 (Table 10).

Considering the severity of injury, cars (including car derivatives) and other vehicle types were involved in the relative proportions 100:19 for serious casualties, but 100:8 for total casualties. Vehicle age has little effect on the proportion of child casualties killed or admitted to hospital; the proportion was 19 per cent when the motor vehicle dated from the 1980s, 22 per cent when it dated from the 1990s and 20 per cent when it dated from the 2000s.

From Table 9, the proportions of child casualties killed or admitted to hospital were 27 per cent for male drivers and 9 per cent for female drivers of the motor vehicle.

Following up that rather surprising difference, Table 11 gives data for 1985 to 2004 (the period 1981 to 1984 was excluded because the percentage of seriously injured casualties was higher then). What is shown in each of the eight cells is the percentage of pedal cycle casualties aged 5-15 who were killed or admitted to hospital.

It might be asked whether the apparent differences in Table 11 are statistically significant. A straightforward approach to statistical testing would lead to the conclusion that the effects of sex, age and speed limit are all significant. However, a straightforward approach is not necessarily correct. For one thing, the three factors might interact: it appears in Table 11 that the combination of the vehicle driver being male and the speed limit being high leads to particularly high probabilities of serious injury. For another, there is often a greater degree of variability in crash data than is implied by the usual assumptions [9].

Discussion

We should first repeat our earlier reservation that while police reports are the best source of routinely collected data concerning cyclist collisions with motor vehicles, casualties do occur without being reported to the police, particularly when no motor vehicle is involved.

Those aged 0-15, as a proportion of total pedal cyclist casualties, have fallen from 45 per cent in 1981 to 1984, to 12 per cent in 2005 to 2008 (Table 1). Child pedal cyclist casualties reached a maximum in about the period 1982 to 1987 and have fallen sharply since. In 2005 to 2008, the average annual number of pedal cyclist casualties aged 5-15 had fallen to 19 per cent of the number in 1981; and in the case of the seriously injured, to 11 per cent. Those seriously injured, as a proportion of total pedal cyclist casualties aged 5-15, fell from 34 per cent in 1981 to 21 per cent in 2005 to 2008. Similarly, those killed, as a proportion of total pedal cyclist casualties aged

Table 8. Pedal cycle casualties aged 5-15 in South Australia 2001 to 2004: Number in single motor vehicle vs. single bicycle crashes, by postcode group of crash and type of motor vehicle

Type of motor vehicle	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
Car[a]	99	52	42	193	16	6	15	37
Other	6	3	7	16	1	1	5	7
Unknown	12	9	6	27	4	0	0	4
Total	117	64	55	236	21	7	20	48

[a]Cars and car derivatives

Table 9. Pedal cycle casualties aged 5-15 in South Australia 2001 to 2004: Number in single motor vehicle vs. single bicycle crashes, by postcode group of crash and sex of motor vehicle driver

Sex of motor vehicle driver	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
Male	54	30	40	124	13	4	17	34
Female	54	29	14	97	3	3	3	9
Unknown	9	5	1	15	5	0	5	
Total	117	64	55	236	21	7	20	48

Table 10. Pedal cycle casualties aged 5-15 in South Australia 2001 to 2004: Number in single motor vehicle vs. single bicycle crashes, by postcode group of crash and age of motor vehicle driver

Age group of motor vehicle driver	All severities				Of whom, these numbers were serious			
	Postcode group			Total	Postcode group			Total
	5000-5099	5100-5199	5200-5999		5000-5099	5100-5199	5200-5999	
16-19	5	5	3	13	1	1	1	3
20-29	22	7	11	40	4	0	3	7
30-39	18	15	12	45	3	2	5	10
40-49	16	12	8	36	2	2	5	9
50-59	20	6	6	32	1	1	2	4
60-69	6	4	6	16	1	1	4	6
70-99	3	1	1	5	0	0	0	0
Unknown	27	14	8	49	9	0	0	9
Total	117	64	55	236	21	7	20	48

Table 11. Single motor vehicle vs. single bicycle crashes in South Australia 1985-2004: Percentages of pedal cycle casualties aged 5-15 who were killed or admitted to hospital, within each combination of categories of sex of motor vehicle driver, age of motor vehicle driver, and speed limit

Speed limit	Sex and age of motor vehicle driver[a]			
	Male		Female	
	16-29	30+	16-29	30+
0-60	28	24	27	19
70+	52	48	17	31

[a]Cases for which driver age (most commonly) or the other variables were unknown were omitted in constructing this table. As unknown information occurs disproportionately for minor injuries, the percentages here are higher than they would otherwise be.

5-15, have fallen from 2.1 per cent in 1981 to 1984, to 0.0 per cent in 2005 to 2008. A multi-hospital study in the U.K. [10] found a very substantial reduction in the probability of death of injured young people admitted to hospital over the period 1989 to 1995.

In 2001 to 2004, the percentages seriously injured were 18, 12 and 36 for postcode groups 5000-5099, 5100-5199 and 5200-5999, respectively; and 44, 24, and 13 for age groups 5-7, 8-12 and 13-15, respectively [4, 8]. The differences between age groups are very considerable; however, it is questionable whether this measure of severity of injury (largely referring to admission to hospital) is one that can really be compared across age groups, as being admitted to hospital may have different implications for younger children than for older children.

Concerning sex differences (Table 2), it is easy to speculate that boys cycle more and cycle more dangerously, but it is difficult to find supporting evidence for this. However, there is evidence from Toronto that boys both cycle more than girls and have more accidents per hour cycling [11]. Reviewing all forms of unintentional injury of children, Schwebel and Gaines [12] concluded that sex differences had a number of causes – the personality traits of boys as compared with girls, the expression of these traits in behaviours, the circumstances in which the behaviours took place – and both innate and learned factors played a part.

It seems likely that speed is the reason that the motor vehicle driver being male, the motor vehicle driver being young and the speed limit being high, all tend to increase the cyclist's severity of injury (Table 11). If this is true, it should also be reflected in a higher severity of injury in crashes occurring in similar circumstances to cyclist crashes – pedestrian crashes might be included among these.

The trends over time that have been noted demonstrate much progress in reducing trauma to child cyclists. However, part of this reduction is surely due to less use of the bicycle for travel and less use of the bicycle for play. Some people are uneasy that so many children are driven everywhere rather than walking or cycling independently, and that so much of children's time is screen time rather than active time. The policy of the South Australian government to encourage cycling is for reasons of health as well as sustainability [3]. It will be necessary to be on guard against a consequent future rise in cyclist deaths and injuries.

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