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

Contents lists available at ScienceDirect

Journal of Transport & Health

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

Effects of cycle skills training on children's cycling-related knowledge, confidence and behaviours

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ARTICLE INFO

Keywords:
Children
Cycling
Cycle skills training
Knowledge
Confidence
Behavior

ABSTRACT

Background: Cycle skills training (CST) in a traffic free and light traffic environment is a promising approach to improve children's cycling-related skills and knowledge. This study examined the effects of short-term CST on children's cycling-related knowledge, confidence and behaviours.
Methods: Children (n = 429; 11.0 ± 0.9 years; 52.1% boys; 3 schools) participated in either playground-based CST (Traffic-Free CST; n = 164) or playground-based plus on-road CST (Traffic-Free + OnRoad CST; n = 265) in Dunedin, New Zealand in 2015–2016. Children completed pre-training and post-training surveys and practical skills assessment. Data were analysed using McNemar tests and paired t-tests.
Results: At baseline, 36.6% of children cycled ≥1/week, 7.7% cycled to school and 40.3% preferred cycling to school. Both types of CST significantly improved children's cycling-related knowledge (Traffic-Free: 80.8 ± 10.8% to 90.8 ± 10.3%; Traffic-Free + OnRoad: 84.2 ± 9.4% to 95.0 ± 5.9%; both $p < 0.001$) and self-perceived confidence to cycle in the parks/playgrounds (Traffic-Free: 61.3% to 74.8%, $p = 0.001$; Traffic-Free + OnRoad: 81.1% to 90.6%, $p < 0.001$) and on the road (Traffic-Free: 25.3% to 38.8%, $p = 0.010$; Traffic-Free + OnRoad: 51.7% to 67.4%, $p < 0.001$) but not to school (Traffic-Free: 46.9% to 50.5%, $p = 0.791$; Traffic-Free + OnRoad: 72.1% to 70.3%, $p = 0.029$). Cycling habits and preferences did not change significantly after CST with the exception of increased rate of cycling to school after Traffic-Free + OnRoad CST (10.6% to 12.5%).
Conclusion: CST with or without on-road training improved children's cycling-related knowledge, and self-perceived confidence to cycle on playgrounds and on the road but not to school. Traffic-Free + OnRoad CST had positive but small effects on increasing cycling to school. Additional interventions targeting parents, schools and built environment changes may be necessary for behavioural change.

1. Introduction

Cycling is a less common mode of transport to school compared to walking among children (Merom et al., 2006; Chillón et al.,

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https://doi.org/10.1016/j.jth.2017.12.010
Received 13 October 2017; Received in revised form 28 December 2017; Accepted 29 December 2017

2013; McDonald et al., 2011) and adolescents (McDonald, 2007; Larsen et al., 2009; Chillón et al., 2009; Nelson et al., 2008; Leslie et al., 2010; Mandic et al., 2015; Mandic et al., 2017b) in most developed countries. In addition, the rates of cycling to school have also been declining over the last two decades (McDonald, 2007; Ministry of Transport, 2015a). In New Zealand, rates of cycling to primary and secondary school have declined from 12% and 19% in 1989/1990 to 2% and 3% in 2010–2014, respectively (Ministry of Transport, 2015a).

One of the main concerns regarding cycling for transportation is traffic safety (Krizek et al., 2009; Sallis et al., 2013; Department for Transport, 2015). The concern about traffic safety is particularly relevant for children and adolescents. Children and adolescents in many developed countries have high rates of bicycle-related injuries (Candappa et al., 2012; National Highway Traffic Safety Administration, 2015; Boufous et al., 2011; Ministry of Transport, 2015b). Rates of cycling-related crashes and/or collisions were even higher among children with inadequate cycle skills compared to their peers with adequate cycling skills (Preston, 1980). Considering that parental confidence in the child's cycle skills is one of the determinants of the rates of cycling to school (Trapp et al., 2011; Ducheyne et al., 2012) and mediates the relationship between parental perceptions of safety and children's cycling behaviours (Trapp et al., 2011), development of children's and adolescents' cycling skills is also an important strategy to help minimize parental safety concerns and increase rates of cycling for transportation in young people.

Educational programmes for increasing safety of cycling for transport among children should include the development of motor and cognitive skills as well as education component related to the road rules, the appropriate protective gear and bicycle maintenance (Ellis, 2014). In addition to a large amount of practice required to master cycling as an efficient and automatic motor skill, cycling in traffic also requires cognitive skills and alertness to judge and respond to complex traffic situations (Ellis, 2014). To assist children to gain the skills and confidence to cycle safely in traffic, cycle skills training (CST) courses have been developed (Ducheyne et al., 2013; Ducheyne et al., 2014; New Zealand Transport Agency, 2012). Effective CST programmes reiterate safety-related messages and provide multiple practice opportunities (Macarthur et al., 1998). Despite differences in content, duration, and type of training, CST programmes often include the teaching and practicing of cycle skills in traffic-free and lightly trafficked environments (Ellis, 2014; Richmond et al., 2014).

CST programmes have a long history in many countries including New Zealand, the United States, Belgium, Canada and the United Kingdom (New Zealand Transport Agency, 2012; Ducheyne et al., 2014; Macarthur et al., 1998; Colwell and Culverwell, 2002). However, a recent review emphasized that the content of these programmes has remained relatively unchanged, with limited research to examine effectiveness of those programmes (Richmond et al., 2014). In young children (kindergarten and grades 1–3), classroom-based (Nagel et al., 2003) and internet-based (McLaughlin and Glang, 2010) education programmes were effective in teaching bicycle safety behaviours. In older children (8–10 years of age), evaluated CST programmes included a practical component with cycling in a traffic-free environment such as school playgrounds (Macarthur et al., 1998; Ducheyne et al., 2013, Ducheyne et al., 2014) or simulated traffic environment (van Schagen and Brookhuis, 1994). Most, but not all (Macarthur et al., 1998) previous studies reported that CST conducted in a traffic-free environment increased knowledge (McLaughlin and Glang, 2010; van Schagen and Brookhuis, 1994) and improved cycle skills (Ducheyne et al., 2013; van Schagen and Brookhuis, 1994; Ducheyne et al., 2014) in primary school children. In one study, improvement in children's cycling skills was maintained for 5 months after the training (Ducheyne et al., 2014). Gender, socioeconomic status and initial cycle skills had no significant influence on the effects of CST in children (Ducheyne et al., 2013). Recent studies also suggested positive attitudes towards CST among adolescents (Colwell and Culverwell, 2002; Mandic et al., 2016) and their parents (Mandic et al., 2017a).

This study extends the existing literature by comparing the effects of two formats of CST interventions in children (CST conducted in a traffic-free environment only (Traffic-Free) versus traffic-free plus on-road training (Traffic-Free + OnRoad)). In addition, the study provides a comprehensive assessment of children's cycling-related knowledge alongside relevant psychosocial and behavioural variables. The CST programme evaluated in this pre-test/post-test intervention study was based on national New Zealand guidelines (New Zealand Transport Agency, 2012), adapted to the local context and implemented by a local city council in three schools in Dunedin, New Zealand.

2. Methods

2.1. Context

In 2014, Dunedin City Council set up the South Dunedin Cycling Project to increase the rates of cycling in a highly deprived neighbourhood (South Dunedin) by giving community members the skills to use the recently built cycle routes. The project consisted of five components: cycle skills training, sports cycling activities, bike library, community trainers and evaluation. The project manager met with staff from each school in the neighbourhood to discuss their involvement in the CST programme.

2.2. Participants

Children (10–12 years of age; school years 5–7) were recruited from three South Dunedin schools (2 primary; 1 intermediate) in 2015–2016. The project manager sent packages containing standard CST material, study information and consent forms to participating schools. The schools delivered the CST packages to the children 1–2 weeks prior to the scheduled CST dates at their school. Children took the package home to discuss with their parents/caregivers. Children required parental consent to participate in the CST programme. All children were also invited to participate in the research component (i.e., to allow researchers to access their CST data). Only children with signed child and parental research consent were eligible for this study. In 2015–2016, 752 children