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Active Transportation and Health Effects of Safe Routes to Schools (SR2S) Projects and Planning

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BACKGROUND

On July 29, 2005 Congress passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the federal government's transportation bill, in part, designating $612 million over five years to go to a relatively new funding program: Safe Routes to School (SR2S). The legislation mandated that state departments of transportation (DOTs) receive annual funding in an amount proportional to the number of primary and middle school-grade children enrolled in their states. State DOTs could then grant that money to state, local, and regional agencies, as well as non-profit organizations to fund SR2S programs.

Eligible recipients included both infrastructure and non-infrastructure programs, though it was required that overall, states would need to spend between 70 and 90 percent of their total allocations on infrastructure projects, which in turn would improve safety for walking and bicycling to school; located within a two-mile radius of a school. Since then, Congress has renewed funding for SR2S programs with each new transportation funding bill (i.e., MAP-21 in 2012 and the FAST Act in 2015).[1]

The purposes of the SR2S program legislation and its funding have been to:

1. Increase walking and bicycling to school;
2. Make bicycling and walking to school a safer and more appealing, encouraging a *healthy and active lifestyle*; and
3. Facilitate projects and activities that improve non-motorist safety and reduce traffic, fuel consumption, and air pollution near schools.[2]

Improving public health (and increasing active transportation) is both an explicit and implicit factor motivating this piece of legislation. In the years since its passage into law, the effectiveness of SR2S projects at improving public health have been tested and researched. This paper documents our current state of understanding of the effects of SR2S projects on public health and active transportation in the U.S.

SR2S AND SAFETY

Traffic safety for pedestrians and bicyclists can have direct and indirect health benefits. Safety from traffic collisions improves the health of pedestrians and bicyclists—a direct effect and benefit. Additionally, if parents and students perceive that the streets leading to their schools are safe, they will be more likely to walk or bicycle on their way to school—an indirect benefit. Several studies in the literature provide insights into these potential effects.

Some early research has studied SR2S interventions (projects such as speed bumps, bike lanes, etc.) and their effects on child safety. For example, Tester et al. studied the effects of speed humps on child-motor vehicle collisions and found a 53 to 60 percent reduction in the odds of injury or death.[3] Jones et al. studied the effects that neighborhood/areawide traffic calming strategies have on childhood pedestrian injury rates. They found that child pedestrian injury rates fell in the most traffic-protected neighborhoods compared to those in poorly protected neighborhoods.[4]

Taking aim directly at SR2S projects, Boarnet et al. studied California's pioneering SR2S efforts beginning in the 1990s by looking at the safety impacts of ten traffic improvement projects in that state. Using before and after case studies, they studied the perceived and actual safety impacts of projects that included sidewalk improvements, traffic signal improvements, crosswalk and crossing signal improvements, and bicycle path improvements along existing and potential routes to nearby schools. Among the five sidewalk improvement projects studied, three were found to have measurable, statistically significant, near-term effects on safety, with the fraction of children observed in the study walking exclusively on the sidewalk increasing after construction. Both cases where traffic signals replaced stop signs on routes used by students traveling to school, found significantly higher shares of vehicles at these intersections yielding to pedestrians. While non-signal crossing improvements showed few measurable increases in vehicles yielding to pedestrians, the research team suggested that this may be the case since a large percentage of vehicles were already yielding before the projects were undertaken, and therfore, their safety benefits might not be detectable with the methods used in this study. The only bicycle improvement project studied—on-street bicycle lanes near an elementary school—did not yield any significant safety impacts.[5]

Like Boarnet et al., Orenstein et al. studied the safety impacts of the same five categories of California's SR2S projects: sidewalk improvements; traffic signal improvements; crosswalk and crossing signal improvements; and bicycle path improvements. Comparing the number of child pedestrian/bicyclist injuries within the influence areas of the SR2S projects to nearby control areas and the state as a whole, they found that while declines were found in the project areas, injuries also declined in the control areas and statewide. When compared directly to the control areas, the SR2S projects did not produce a measurable reduction in injuries. However, by controlling for the amount of children walking in these areas the authors also found that the rates of child pedestrian/bicyclist injuries in the project areas dropped compared to the control areas.[6]

Dimaggio et al. measured the child pedestrian injury rates in New York City census tracts before and after the completion of SR2S projects. They found that rates in these tracts decreased from 3.47 per 10,000 population before the projects were built to 0.74 per 10,000 after projects were completed. The researchers found no change in rates in control census tracts where there were no SR2S projects.[7]

Ragland et al. studied the long-term impacts of SR2S engineering improvements on the likelihood of pedestrian and bicycle collisions within 250 feet of an SR2S project compared to those living more than 250 feet and within one-quarter mile of the school. Their findings indicate that pedestrian and bicycle collisions within 250 feet of these SR2S measures decreased by 75 percent compared to the area beyond 250 feet.[8]

DiMaggio et al. (2016) studied the effects of SR2S projects on child pedestrian and bicyclist injuries in a nationwide sample. Their model found a 23 percent reduction in pedestrian/bicyclist injury rates overall (for all age groups), and a 20 percent reduction in pedestrian/bicyclist fatality risk in school-age children, compared to adults. From these findings, the research team concluded that SR2S projects and programs have helped to improve traffic safety for children in the U.S.[9]

As found by Orenstein et al., Rothman et al. identified the need to study walking rates and pedestrian collisions together, since only studying collisions ignores the relationship between the two factors. In other words, the more people walk, the more collisions occur. Unaccounted for, this correlation can make it appear as though SR2S projects increase pedestrian (and bicyclist) collisions when collisions rates are decreasing. By accounting for this relationship in their study of pedestrian-motor vehicle collisions (PMVCs) in Toronto, Canada, Rothman et al. found that speed humps provided a strong protective effect for child PMVCs. From these findings, Rothman et al. concluded that the association between high proportions of children walking to school and higher collision rates disappear in neighborhoods with a pedestrian-oriented built environment. In other words, child collision rates will fall when proper traffic calming (SR2S) interventions are made.[10]

SR2S AND ACTIVE TRANSPORTATION TO SCHOOLS

According to Orenstein et al. the rates of children walking to school in the U.S. have steadily dropped over recent decades. With close to 50 percent walking to school in 1969, by 2007 that figure had dropped to 12 percent. While results have varied widely depending on context and project specifics, Orenstein et al. further discovered that direct before and after observations of active transportation to school (ATS) have shown growth in the neighborhoods surrounding SR2S projects by between 20 and 200 percent. Students whose usual route to school passed an SR2S project were found to be three to four times more likely to begin walking/bicycling to school than were students whose route did not pass a project.[11]

In an evaluation of the first two years of SR2S programs in Marin County, California, Staunton et al. found a 64 percent increase in the number of children walking, a 114 percent increase in biking, a 91 percent increase in carpooling, and a 39 percent decrease in the number of children arriving by private car carrying only one student.[12]

Boarnet et al. studied California's pioneering SR2S efforts beginning in the 1990s by looking at the safety impacts of ten traffic improvement projects in that state. Using before and after cases, they studied both the perceived and actual safety impacts of projects that include sidewalk improvements, traffic signal improvements, crosswalk and crossing signal improvements, and bicycle path improvements. For all three sidewalk gap closure SR2S projects surveyed, researchers found statistically significant increases in walking after project completion, compared to before. Moreover, those children who routinely passed the project site before construction were more likely to walk to school after project completion compared to children who would not pass these projects. Increases in observed pedestrian counts were also seen at both traffic signal installations and one of the two crosswalk improvement projects.[13]

In a cross-sectional comparison of students who passed by an SR2S project on their way to school versus those who did not (but went to a school where an SR2S project had been constructed), Boarnet et al. found that those who passed completed SR2S projects were more likely to walk and bicycle than those who would not pass by projects (15% versus 4%).[14]

Pucher et al. performed a review of the literature on interventions and bicycling and found many studies confirming a positive influence of these interventions on bicycling levels. Fourteen of these sources were case studies, all of which showed that cities that adopted comprehensive, complementary packages of interventions—including bicycle infrastructure, bicycling programs, supportive land use planning, and car use restrictions—experienced substantial increases in bicycling trips and bike mode share afterwards.[15]

Stewart reviewed 42 available studies to identify factors influencing the propensity of children to walk or bicycle to school. Findings from the comparison of these 42 studies identified four factors that were most frequently reported as having an influence on active transportation to school (ATS) modes of travel: distance; income; traffic levels; and crime fears. A further review of these sources led to several conclusions, including, the fact that children are more likely to use ATS when: (1) they live in densely populated neighborhoods featuring mixed land uses, and a highly connected street network; (2) they live relatively short distances (i.e. walking distance) from their schools; (3) they live in economically and socially disadvantaged neighborhoods; and (4) they live in households with favorable attitudes towards ATS and fewer scheduling time constraints.[16]

Chriqui et al. studied the effects of state-level SR2S laws and regulations on ATS policies and practices at U.S. public elementary schools; this included minimum bussing distance requirements; hazardous route exemptions to the distance requirements; and requirements for sidewalks, crossing guards, traffic safety, and speed zones around schools. For example, when states mandated that elementary schools provide crossing guards at nearby intersections, these schools were also effective at reducing the barriers to walking/bicycling to school, increasing the odds of walking/bicycling to school, and the odds that zero percent of students walk/bicycle to school. Chriqui et al. also found that state laws for low speed zones around schools reduced the odds of zero students walking/bicycling to school by 51 percent. States with minimum distance requirements for bussing also seem to encourage a higher proportion of children to walk or bicycle to school compared to those without.[17]

McDonald et al. evaluated the city of Eugene, Oregon's SR2S efforts at 14 schools with and without Safe Routes to School programs. Education and encouragement programs were associated with a five percentage point increase in bicycling. When additional SR2S improvements such as sidewalks, crosswalks, covered bike parking, and "Boltage" were included with education programs, the researchers found that walking and bicycling increased by 5–20 percentage points.[18]

Henderson et al. administered a survey to parents of children in neighborhoods surrounding schools where SR2S projects had been completed in Atlanta, Georgia between 2008 and 2010. They found that the share of students walking to school in the morning increased from 18 percent in 2008 to 42 percent in 2010. However, there were no significant change in students walking home after school (18% in 2008 to 23% in 2010).[19]

Ragland et al. studied the long-term impacts of SR2S engineering improvements on the likelihood of children walking to school. They found that living within 250 feet of an SR2S project increased the probability that a child walked to school compared to those living more than 250 feet and within one-quarter mile of the school.[20]

Stewart et al. studied the ATS outcomes of 48 SR2S projects near 53 schools in four U.S. states. Using paired-samples t-tests to measure changes in ATS and bivariate analysis to identify SR2S project characteristics that led to increases in ATS, the authors found statistically significant increases in ATS across projects in all four states. Results indicated that post-construction ATS levels increased from 12.9 percent to 17.6 percent (all ATST modes together) compared to pre-construction levels; whereby walking increased from 9.8 percent to 14.2 percent; and bicycling from 2.5 percent to 3.0 percent.[21]

CONCLUSION

Since SR2S methods first gained prominence in the 1990s, researchers and practitioners have been working to determine best practices that can yield improvements in two areas: improved health and increased ATS participation. Many of these projects and programs have focused on the provision of physical infrastructure that can improve perceived and actual safety for children on walking and bicycling journeys to school. This literature review provides a summary of key research available on SR2S public health and ATS outcomes and additionally offers several insights into the state of the practice. Highlights among these are the findings that sidewalk and traffic signal upgrades measurably reduced the incidents of child pedestrian collisions[22] and child pedestrian injury rates.[23,24]

In terms of ATS outcomes, several sources have found encouraging results. Both in terms of perceived and actual safety impacts, sidewalk gap closure and traffic signal upgrade SR2S projects were found to yield increases in the likelihood of children walking to school,[25] and even greater increases when infrastructure interventions like these were combined with education programs.[26]

ENDNOTES

1 Safe Routes to School National Partnership. “Healthy Communities: Legislative History.” Safe Routes to School National Partnership, accessed 2/13/19. https://www.saferoutespartnership.org/healthy-communities/policy-change/legislative-history.

2 Safe Routes to School National Partnership. “Healthy Communities: Legislative History.” Safe Routes to School National Partnership, accessed 2/13/19. https://www.saferoutespartnership.org/healthy-communities/policy-change/legislative-history.

3 Tester, June M., George W. Rutherford, Zachary Wald, and Mary W. Rutherford. “A Matched Case–Control Study Evaluating the Effectiveness of Speed Humps in Reducing Child Pedestrian Injuries.” American Journal of Public Health 94, no. 4 (2004): 646–50. doi:10.2105/ajph.94.4.646.

4 Jones, S. J., R. Lyons, A. John, and S. Palmer. “Traffic Calming Policy Can Reduce Inequalities in Child Pedestrian Injuries: Database Study.” Injury Prevention 11, no. 3 (2005): 152–56. doi:10.1136/ip.2004.007252.

5 Boarnet, Marlon G., Kristen Day, Craig Anderson, Tracy Mcmillan, and Mariela Alfonzo. “California’s Safe Routes to School Program: Impacts on Walking, Bicycling, and Pedestrian Safety.” Journal of the American Planning Association 71, no. 3 (2005): 301–17. doi:10.1080/01944360508976700.

6 Orenstein, Marla R., Nicolas Gutierrez, Thomas M. Rice, Jill F. Cooper, and David R. Ragland. Safe Routes to School Safety and Mobility Analysis. Report. California Department of Transportation (Caltrans), UC Berkeley: Safe Transportation Research & Education Center. 2007. Retrieved from: https://escholarship.org/uc/item/5455454c

7 Dimaggio, Charles, Qixuan Chen, Peter A. Muennig, and Guohua Li. “Timing and Effect of a Safe Routes to School Program on Child Pedestrian Injury Risk during School Travel Hours: Bayesian Changepoint and Difference-in-differences Analysis.” Injury Epidemiology 1, no. 1 (2014). doi:10.1186/s40621-014-0017-0.

8 Ragland, David R., Swati Pande, John Bigham, and Jill F. Cooper. “Examining Long-Term Impact of California Safe Routes to School Program.” Transportation Research Record: Journal of the Transportation Research Board 2464, no. 1 (2014): 86-92. doi:10.3141/2464-11.

9 DiMaggio, Charles, Spiros Frangos, and Guohua Li. “National Safe Routes to School Program and Risk of School-age Pedestrian and Bicyclist Injury.” Annals of Epidemiology, April 13, 2016, 412-17.

10 Rothman, Linda, Howard Andrew, Buliung Ron, Macarthur Colin, Richmond, Sarah A., Macpherson, Alison. “School environments and social risk factors for child pedestrian-motor vehicle collisions: A case-control study” *Accident Analysis and Prevention* 98 (2017) 252–258.

11 Safe Routes to School National Partnership. “Healthy Communities: Legislative History.” Safe Routes to School National Partnership, accessed 2/13/19. https://www.saferoutespartnership.org/healthy-communities/policy-change/legislative-history.

12 Staunton, Catherine E., Deb Hubsmith, and Wendi Kallins. “Promoting Safe Walking and Biking to School: The Marin County Success Story.” American Journal of Public Health 93, no. 9 (2003): 1431–434. doi:10.2105/ajph.93.9.1431.

13 Boarnet, Marlon G., Kristen Day, Craig Anderson, Tracy Mcmillan, and Mariela Alfonzo. “California’s Safe Routes to School Program: Impacts on Walking, Bicycling, and Pedestrian Safety.” Journal of the American Planning Association 71, no. 3 (2005): 301–17. doi:10.1080/01944360508976700.

14 Boarnet, Marlon G., Kristen Day, Craig Anderson, Tracy Mcmillan, and Mariela Alfonzo. “California’s Safe Routes to School Program: Impacts on Walking, Bicycling, and Pedestrian Safety.” Journal of the American Planning Association 71, no. 3 (2005): 301–17. doi:10.1080/01944360508976700.

15 Pucher, John, Jennifer Dill, Susan Handy. “Infrastructure, programs, and policies to increase bicycling: An international review.” *Preventive Medicine* 50 (2010) S106–S125.

16 Orion Stewart. 2011. “Findings from Research on Active Transportation to School and Implications for Safe Routes to School Programs.” *Journal of Planning Literature* 26 (2) 127–150.

17 Chriqui, Jamie F., Daniel R.Taber, Sandy J.Slater, Lindsey Turner, Kerri McGowan Lowrey, Frank J. Chaloupka. 2012. “The impact of state safe routes to school-related laws on active travel to school policies and practices in U.S. elementary schools.” *Health & Place* 18 (2012) 8–15.

18 McDonald, Noreen C., Yizhao Yang, Steve M. Abbott, Allison N. Bullock. 2013. “Impact of the Safe Routes to School program on walking and biking: Eugene, Oregon study.” *Transport Policy* 29 (2013) 243–248.

19 Henderson, Susan, Robin Tanner, Norma Klanderman, Abby Mattera, Lindsey Martin Webb, and John Steward. 2013. “Safe Routes to School: A Public Health Practice Success Story—Atlanta, 2008–2010.” *Journal of Physical Activity and Health*, 2013, 10, 141–142.

20 Ragland, David R., Swati Pande, John Bigham, and Jill F. Cooper. “Examining Long-Term Impact of California Safe Routes to School Program.” Transportation Research Record: Journal of the Transportation Research Board 2464, no. 1 (2014): 86-92. doi:10.3141/2464-11.

21 Stewart, Orion, Anne Vernez Moudon, Charlotte Claybrooke. 2014. “Multistate Evaluation of Safe Routes to School Programs.” *American Journal of Health Promotion* January/February 2014, Vol. 28, No. 3 Supplement.

22 Boarnet, Marlon G., Kristen Day, Craig Anderson, Tracy Mcmillan, and Mariela Alfonzo. "California's Safe Routes to School Program: Impacts on Walking, Bicycling, and Pedestrian Safety." Journal of the American Planning Association 71, no. 3 (2005): 301–17. doi:10.1080/01944360508976700.

23 Orenstein, Marla R., Nicolas Gutierrez, Thomas M. Rice, Jill F. Cooper, and David R. Ragland. "Safe Routes to School Safety and Mobility Analysis. Report. California Department of Transportation (Caltrans), UC Berkeley: Safe Transportation Research & Education Center. 2007. Retrieved from: https://escholarship.org/uc/item/5455454c

24 Rothman, Linda, Howard Andrew, Buliung Ron, Macarthur Colin, Richmond, Sarah A., Macpherson, Alison. "School environments and social risk factors for child pedestrian-motor vehicle collisions: A case-control study" *Accident Analysis and Prevention* 98 (2017) 252–258.

25 Boarnet, Marlon G., Kristen Day, Craig Anderson, Tracy Mcmillan, and Mariela Alfonzo. "California's Safe Routes to School Program: Impacts on Walking, Bicycling, and Pedestrian Safety." Journal of the American Planning Association 71, no. 3 (2005): 301–17. doi:10.1080/01944360508976700.

26 McDonald, Noreen C., Yizhao Yang, Steve M. Abbott, Allison N. Bullock. 2013. "Impact of the Safe Routes to School program on walking and biking: Eugene, Oregon study." *Transport Policy* 29 (2013) 243–248.

About the Author

Dr. Ferrell began his planning career in 1995 working for the Metropolitan Transportation Commission (MTC) on intelligent transportation system (ITS) applications for traffic management. Since 2000, he has worked as a transportation consultant and most recently at MTI's Senior Research Scientist. In 2010 he co-founded CFA Consultants, a transportation planning and research firm. Dr. Ferrell completed his doctoral studies in city and regional planning at the University of California, Berkeley in 2005.

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