Built Environment and Physical Activity Promotion: Place-Based Obesity Prevention Strategies

Matthew J. Trowbridge and Thomas L. Schmid

Physical inactivity is one of the leading "actual" causes of preventable premature mortality[1] due in large part to its role in obesity and associated morbidities. Currently, less than half (47%) of U.S. adults meet recommendations for aerobic physical activity.[2] For children the numbers are also low, 29% of high school students reported meeting the goal of 60 minutes of daily physical activity over the last week.[3] There has also been a decline in the proportion of children walking or biking to school from 48% in 1969 to 13% in 2009.[4] As a result, promoting physical activity both as recreational exercise and as a part of day-to-day utilitarian travel by foot or bicycle has emerged as a central goal of national and international efforts, often as part of obesity prevention and control efforts.

Built Environment and Physical Activity Promotion

Research demonstrates that the design of our built environments, a broad term encompassing aspects of community and transportation system design such as sidewalk or park access and even interior building features such as stair design, plays an important role as a determinant of daily physical activity levels.[5] In its 2012 report *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*, the Institute of Medicine recommends "enhancing the physical and built environment" (Strategy 1-1) as a recommended strategy for the goal of making physical activity "an integral and routine part of life."[6] Encouraging physical activity through built environment-based strategies is also a core strategy recommended by the *National Prevention Strategy* to provide "Healthy & Safe Community Environments"[7] and an ongoing priority for high-profile childhood obesity prevention efforts such as the *Let's Move* Campaign.[8]

Consistent with these recommendations, diverse public, private, and non-profit groups are continuing their work in urban, suburban, and rural contexts to provide built environment resources like bike lanes and parks that make walking and biking for exercise and transportation an easy, safe, and enjoyable option in our day-to-day lives. The 2012 Centers for Disease Control and Prevention (CDC) *Weight of the Nation* (WON) conference (www.weightofthenation.org) included a thematic "track" focused on transportation and the built environment obesity prevention strategies. Sessions highlighted many successful examples across the U.S. and included walking tours of District of Colombia, pedestrian and bicycle-friendly redevelopment projects, as well as a hands-on demo of the city's bikeshare system and other infrastructure deployments (e.g., path and trail systems). However, for these types of programs to make a significant population-level impact on physical activity rates, implementation must be widespread and broadly accessible. This is a challenging endeavor given that built environment decision makers are highly multi-disciplinary and distributed across a wide array of public and private agencies and organizations, many of which do not have public health, including issues like physical activity promotion, as their primary mandate or motivation.[9]

Matthew J. Trowbridge, M.D., M.P.H., *is at the Department of Emergency Medicine at the University of Virginia School of Medicine.* **Thomas L. Schmid, Ph.D.,** *is in the Physical Activity and Health Branch, Division of Nutrition, Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion, at the Centers for Disease Control and Prevention.*

This paper seeks to encourage continued innovation in translating built environment and physical activity research into practice by highlighting successful built environment and transportation strategies, policies, and tools, featured at the CDC's WON conference and elsewhere, that demonstrate potential for wider-scale implementation. The importance of building practice and translational research alliances with groups and organizations outside traditional public health spheres with the capacity to impact real estate markets and land use decision-making is also discussed.

This paper seeks to encourage continued innovation in translating built environment and physical activity research into practice by highlighting successful built environment and transportation strategies, policies, and tools, featured at the CDC's WON conference and elsewhere, that demonstrate potential for wider-scale implementation. The importance of building practice and translational research alliances with groups and organizations outside traditional public health spheres with the capacity to impact real estate markets and land use decision-making is also discussed.

Successful Strategies for Using the Built Environment to Promote Physical Activity

There are myriad opportunities to make walking and biking as a form of transport and recreation easier for all ages and levels of mobility. In recognition of the influence that the built environment and transportation infrastructure have on physical activity and nutrition, organizers of the *Weight of the Nation* Conference devoted three concurrent sessions and four "Mobile Workshops" to these topics. This paper describes, and in some cases expands on, many of the evidence- and practice-based strategies offered by the presenters and participants in those sessions. Communities across the country and around the globe are using a broad range of environmental and policy-based interventions to re-focus the design of their neighborhoods, parks, and transportation systems on walking, biking, and public transit.

1. Support Alternative Transportation Systems to Reduce Automobile Reliance

Bikeshare Programs

Numerous cities around the U.S. are investing in large-scale bikeshare systems to jumpstart bicycling as a convenient, cost-effective, fun, and healthy alternative means of transportation. For example, in 2008, the District of Columbia, in partnership with the local governments of Alexandria and Arlington, VA launched the *Capital Bikeshare* system (www.capitalbikeshare.com) with funding from the Federal Highways Administration and the Virginia Department of Rail and Public Transportation. As of fall 2012, the system had over 24,000 annual members, 175+ bike stations, and over 1,650 distinctive red bicycles in operation. A recent survey estimates that members reduce their collective driving miles by 5 million miles each year due to their use of bikeshare.[10] More cities are rolling out bikeshare programs each year with major systems recently launched or planned in cities like Boston, New York, Chicago, and Chattanooga, TN. Federal funds and technical assistance from the Environmental Protection Agency (EPA) are also becoming available to support community bikeshare programs through EPA's Building Blocks for Sustainable Communities Program.[11]

Public Transportation

Providing multi-modal transportation options is a key component of making walking and biking convenient. In many communities, public transit is an important part of creating built environments that promote physical activity due to the fact that many trips by subway or bus begin and end with a walking or biking trip.[12] Early studies show that improvements in transit systems, such as light rail, are associated with increased physical activity.[13]

Pedestrian and Bicycle Infrastructure Improvements and Repurposing

Providing safe and convenient environments for people of all ages and mobility levels to walk or bike for transportation and recreation is one of many important steps needed to encourage more active lifestyles. Many improvements can be made without major capital investment. A prime example is the phenomenon of "ciclovias" or "open streets" in many cities and towns across the U.S., in which sections of road are temporarily shut down for motor vehicle use

to create public space for exercise and community gatherings.[14]

The New York City Department of Transportation has extended this idea further by experimenting with "road diets" for major urban streets, including large sections of roadway along Broadway and in Times Square, to provide street surface cafes, pedestrian areas, and fully protected bike lanes, improvements brought about primarily with careful planning, paint, semi-portable large planters, and street furniture. Multiple cities are also making investments in repurposing abandoned freight rails or elevated highways to create new pedestrian and bicycling facilities.[15] A prime example is the Atlanta Beltline project which will provide pedestrian-friendly rail transit along an existing 22-mile railroad line within the city to connect 45 neighborhoods and new housing to existing subway transit, trails, parks, and job sites.[16]

2. Use Schools as a Community-Based Focal Point for Physical Activity Promotion

Schools offer opportunities to focus physical activity promotion efforts. Community-based initiatives, such as Safe Routes to Schools (http://www.saferoutesinfo.org/), which promote environmental changes and policies to encourage walking and cycling, are shown to increase active transportation to school for children.[17] In fact, research shows that environmental walkability improvements focused on school travel for children have ancillary benefits for the community at-large.[18] At a broader scale such improvements can have community-wide benefits. A recent report to Congress by the Federal Highway Administration (FHWA) regarding its *Non-motorized Transportation Pilot* documents a 49% increase in cycling, and 22% increase in walking among their four demonstration communities from 2007 to 2011 (Colombia, MO; Marin County, CA; Minneapolis, MN; Sheboygan County, WI).[19]

School-based environmental improvements and policy supports such as joint use agreements can also focus on promoting and enabling recreational facilities as community-wide assets. Formal joint-use agreements[20] to allow playgrounds and school grounds to be used after hours as park facilities by the general public can help leverage the health impact of public investments. Considering schools from this perspective (i.e., as physical activity and other community-use resources) also has important public health, social, and sustainability implications for decisions such as school closures and new school site choice as highlighted in the Environmental Protection Agencies recently released *School Siting Guidelines*.[21]

3. Promote Use of Health-Focused Built Environment Policy, Decision-Support, and Information Tools

Creating walk- and bike-friendly communities requires consistent consideration and prioritization of physical activity promotion across multiple domains of city planning, including land use and transportation. Policy-development and information tools are increasingly available to help guide municipalities. These include broad-scale frameworks such as smart growth policies or certification frameworks such as LEED for Neighborhood Design developed by the U.S. Green Building Council, which emphasizes walkability as a central design goal (http://www.usgbc.org/neighborhoods).[22] Other publicly available tools include the *Sustainable Communities Index* (previously known as the *Healthy Development Measurement Tool)*,[23] developed by the San Francisco Department of Public Health, and street design manuals from cities like New York,[24] whose departments of transportation are prioritizing pedestrian and bicycle improvements. Policy options available to communities at the local and state level include adoption of "complete streets" legislation that mandates inclusion of pedestrian and bicycle facilities as part of any new road construction project.[25] The number of communities that adopt complete streets policies continues to grow; of the total 448 regional and local jurisdictions, 250 new jurisdictions committed to Complete Streets between 2011 and 2012.[26]

The CDC's 2012 *Weight of the Nation* conference also highlighted several communities, such as the San Diego Association of Governments (SANDAG) partnership which recently released model guidelines focused on planning and designing for pedestrians at a regional-scale.[27] Another example, the King County Health Department, is leveraging decision-support tools such as health impact assessment[28] for projects like the 520 SR bridge[29] outside of Seattle to ensure that walking and cycling are considered in transportation and community development. Similarly, the Nashville, TN Metropolitan Planning Organization has adopted an active transportation funding policy and project rating scale that dedicates and prioritizes funding to pedestrian and bicycling transportation projects (both infrastructure and education) where possible. Nashville has also spearheaded the *Middle Tennessee Transportation and Health Study* that includes health and physical activity questions as a core component of its household travel survey.[30]

Resources are also becoming available to help provide building-scale environments to promote physical activity. Evidence from projects to promote daily stair use and reduce sedentary time, such as an evaluation

of design improvements within the CDC headquarters in Atlanta,[31] have been judged to be effective by the Task Force on Community Preventive Services,[32] and similar "point of decision" prompts are being piloted in other venues such as in airports prompting the choice to walk between concourses rather than take the train.

Measuring and demonstrating the value of investments to improve walkability and bikeability of communities is critical to validate ongoing and expanded implementation. One example highlighted at the *Weight of the Nation* conference is the ongoing bicycle benchmarking project led by the Alliance for Biking and Walking.

Design tools such as the New York City *Active Design Guidelines*[33] provide specific guidance for architects and have been adapted as a Leadership in Energy and Environmental Design (LEED) "innovation credit"[34] by the U.S. Green Building Council allowing physical activity promotion strategies through building and site design to count toward overall green building certification.

4. Improve Pedestrian and Bicycle Data Systems and Metrics

Measuring and demonstrating the value of investments to improve walkability and bikeability of communities is critical to validate ongoing and expanded implementation. One example highlighted at the *Weight of the Nation* conference is the ongoing bicycle benchmarking project led by the Alliance for Biking and Walking.[35] This project provides easy access to nation-wide information on bicycling and walking use, safety, programs and policies in a standardized format. This format helps individual communities measure their own progress and evaluate results, draw from best practices in other locations, and benchmark program efforts and efficacy with regard to bicycle use promotion between cities and states.

Another example is the City of Boston's Department of Transportation, which is specifically developing data systems to reduce bicycle injuries. The first step in this project, also highlighted at the *Weight of the Nation*, involves improving information regarding cycling and pedestrian injuries, including location, time and conditions, by combining data from various data sources including EMS, police reports, and emergency department records.[36] These new resources allow identification of injury "hot spots" where remediation efforts can be focused.

How Do We Keep Progress "Moving"?

As outlined here, utilizing proven built-environment strategies to increase physical activity as a way to reduce obesity will require continued investment in evaluation of successful programs and broad-based collaboration with a diverse set of non-traditional public and private stakeholders. Engaging environmental design decision-makers in local government, private design firms, and private development firms will require data demonstrating the comprehensive "value" of prioritizing physical activity within the context of community design, city planning and real estate investment.[37]

Economic analyses of the benefits of investment for design goals such as walkability are beginning to become available. For instance, a recent study in Washington, D.C. neighborhoods found that residential, and retail rents and revenues increase as walkability increases,[38] and a recent research synthesis of a wide range of studies documents the economic benefits of open space, recreation facilities, and walkable community design.[39] Similarly, tools to forecast the economic impacts of infrastructure projects designed to increase rates or walking or cycling are also becoming available. For example, the Health Economic Assessment Tool (HEAT) bases these estimates on reductions in mortality associated with physical activity (http://www.heatwalkingcycling.org/). When the HEAT was applied to the San Francisco open streets program, benefits for cycling ranged from 3.7 to 4.2 million dollars per year.[40]

Conclusions

This paper presents a variety of successful built environment and transportation strategies, policies, and tools from across the U.S. and globally, many of which were highlighted at the 2012 CDC *Weight of the Nation* obesity prevention conference, that demonstrate potential for wider-scale implementation. However, continued investment in rigorous evaluation of communities that have implemented these strategies will be critical to give decision makers actionable and defensible evidence of health benefits from these investments.

For example, to date, the majority of studies investigating the association between built environment interventions and physical activity rates have been cross-sectional; limiting ability to control for poten-

tial sources of confounding such as "self-selection" (e.g., active people may choose to live in more "walkable" or "bikeable" communities).[41] Early examples of studies employing longitudinal methodologies report similar but potentially attenuated associations to previous cross-sectional analyses between the built environment and levels of physical activity.[42] Additionally, reviews of the literature also suggest that features of the built environment that influence transportation related walking and cycling likely differ from those associated with recreational activity.

Finally, while results of studies on the built environment and physical activity are generally consistent, studies on the associations between the built environment and obesity-related comorbidities are more mixed.[43] Continued innovation among researchers, such as increased application of quasi experimental and opportunistic studies of "natural experiments" (e.g., measure physical activity before and after significant environmental changes such as new trails, sidewalks, or transit stops) should be encouraged to further understand how changes in how we build our communities can lead to population level improvements in our health.

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References

1. A. H. Mokdad, J. S. Marks, D. F. Stroup, and J. L. Gerberding, "Actual Causes of Death in the United States," *JAMA* 291, no. 10 (2004): 1238-1245.
2. Data from National Health Interview Survey, Series 10, no. 256, "Summary Health Statistics for U.S. Adults: National Health Interview Survey," (2011): 2013-1584.
3. Centers for Disease Control and Prevention, "Youth Risk Behavior Surveillance – United States, 2011," *Morbidity and Mortality Weekly Report* 61, no. SS04 (2012): 1-162.
4. N. C. McDonald, A. L. Brown, L. M. Marchetti, and M. S. Pedroso, "U.S. School Travel, 2009: An Assessment of Trends," *American Journal of Preventive Medicine* 41, no. 2 (2011): 146-151.
5. J. F. Sallis, M. F. Floyd, D. A. Rodriguez, and B. E. Saelens, "Role of Built Environments in Physical Activity, Obesity, and Cardiovascular Disease," *Circulation* 125, no. 5 (2012): 729-737.
6. Institute of Medicine, *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation* (Washington, D.C.: The National Academies Press, 2012).
7. National Prevention Council, *National Prevention Strategy* (Washington, D.C.: U.S. Department of Health and Human Services, Office of the Surgeon General, 2011).
8. White House Task Force on Childhood Obesity, *Solving the Problem of Childhood Obesity within a Generation: White House Task Force on Childhood Obesity Report to the President*, July 21, 2010: 1-124.
9. R. McKinnon, H. Bowles, and M. Trowbridge, "Engaging Physical Activity Policymakers," *Journal of Physical Activity and Health* 8, Supp. 1 (2010): S145-S147.
10. Capital Bikeshare, *Capital Bikeshare 2011 Member Survey*, June 14, 2012, *available at* <http://www.capitalbikeshare.com> (last visited November 7, 2013).
11. U.S. Environmental Protection Agency, *Building Blocks for Sustainable Communities*, *available at* <http://www.epa.gov/smartgrowth/buildingblocks.htm> (last visited October 10, 2012).
12. L. D. Frank, M. J. Greenwald, S. Winkelman, J. Chapman, and S. Kavage, "Carbonless Footprints: Promoting Health and Climate Stabilization through Active Transportation," *Preventative Medicine* 50, Supp. 1 (2010): S99-S105; American Public Transit Association, Federal Transit Administration, "Transit Performance Monitoring System (TPMS) Results," *available at* <http://www.apta.com/gap/policyresearch/Documents/TPMS_summary_I_and_II.pdf> (last visited November 7, 2013).
13. J. M. MacDonald, R. J. Stokes, D. A. Cohen, A. Kofner, and G. K. Ridgeway, "The Effect of Light Rail Transit on Body Mass Index and Physical Activity," *American Journal of Preventive Medicine* 39, no. 2 (2010): 105-112.
14. J. Hipp, A. Eyler, and J. Kuhlberg, "Target Population Involvement in Urban Ciclovias: A Preliminary Evaluation of St. Louis Open Streets," *Journal of Urban Health: Bulletin of the New York Academy of Medicine* (2012), *available at* <http://download.springer.com/static/pdf/349/art%253A10.1007%252Fs11524-012-9759-6.pdf?auth66=1386367116_14f387f66bf7756258af39a6b30d6e73&ext=.pdf> (last visited November 7, 2013).
15. Railts to Trails Organization, *avaialable at* <http://www.railstotrials.org/index.htm> (last visited November 9, 2013).
16. Atlanta Beltline, *avaialable at* <http://www.beltline.org> (last visited November 9, 2013).
17. M. G. Boarnet, K. Day, C. Anderson, T. McMillan, and M. 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): 301-317.
18. M. Watson and A. L. Dannenberg, "Investment in Safe Routes to School Projects: Public Health Benefits for the Larger Community," *Preventing Chronic Disease* 5, no. 3 (2008): A90.
19. Federal Highway Administration, *Report to the U.S. Congress on the Outcomes of the Nonmotorized Transportation Pilot Program*, SAFETEA-LU Section 18072012.
20. M. Filardo, J. M. Vincent, M. Allen, and J. Franklin, *Joint Use of Public Schools: A Framework for a New Social Contract* (Washington, D.C.: 21st Century School Fund and Center for Cities & Schools, 2010).
21. Environmental Protection Agency, School Siting Guidelines, *available at* <http://www.epa.gov/schools/siting/> (last visited November 9, 2013); J. Vincent and M. Filardo, "School Construction Investments and Smart Growth in Two High Growth States: Implications for Social Equity," *School Siting and Healthy Communities: Why Where We Invest in School Facilities Matters* (East Lansing, MI: Michigan State University Press, 2011): at 41-64.
22. U.S. Green Building Council, *available at* <http://www.usgbc.org/neighborhoods> (last visited November 8, 2013).
23. San Francisco Department of Public Health, "Sustainable Communities Index: Healthy Cities, Healthy People, 2013," *available at* <http://www.sustainablesf.org> (last visited November 8, 2013); L. Farhang, R. Bhatia, C. C. Scully, J. Corburn, M. Gaydos, and S. Malekafzali, "Creating Tools for Healthy Development: Case Study of San Francisco's Eastern Neighborhoods Community Health Impact Assessment," *Journal of Public Health Management & Practice* 14, no. 3 (2008): 255.
24. New York City Department of Transportation, Street Design Manual, 2010, *available at* <http://www.nyc.gov/html/dot/html/about/streetdesignmanual.shtml> (last visited November 8, 2013).
25. J. LaPlante and B. McCann, "Complete Streets: We Can Get There from Here," *Institute of Transportation Engineers (ITE) Journal* 78, no. 5 (2008): 24.

26. Smart Growth America, *National Complete Streets Coalition: Policy Atlas, 2013*, *available at* <http://www.smartgrowthamerica.org/complete-streets/changing-policy/complete-streets-atlas> (last visited November 8, 2013).
27. San Diego Association of Governments, *available at* <http://www.sandag.org/index.asp?listbyclassid=12&fuseaction=publications.listbyclassid> (last visited November 9, 2013).
28. A. Wernham, "Health Impact Assessments Are Needed in Decision Making about Environmental and Land-Use Policy," *Health Affairs* 30, no. 5 (2011): 947-956.
29. Public Health – Seattle and King County, Puget Sound Clean Air Agency, *SR 520 Health Impact Assessment: A Bridge to a Healthier Community*, September 2008.
30. Center for Training Research and Translation, *available at* <http://www.centertrt.org/?p=intervention&id=1156> (last visited November 9, 2013).
31. N. Kerr, M. Yore, S. Ham, and W. Dietz, "Increasing Stair Use in a Worksite through Environmental Changes," *American Journal of Health Promotion* 18, no. 4 (2004): 312-315.
32. Task Force on Community Preventive Services, "Recommendation for Use of Point-of-Decision Prompts to Increase Stair Use in Communities," *American Journal of Preventive Medicine* 38, no. 2, Supp. 2 (2010): S290-291.
33. New York City Department of Design and Construction, "Active Design Guidelines," *available at* <http://www.nyc.gov/adg> (last visited November 9, 2013).
34. K. K. Lee, "Developing and Implementing the Active Design Guidelines in New York City," *Health and Place* 18, no. 1 (2012): 5-7.
35. Alliance for Biking and Walking, *available at* <http://www.peoplepoweredmovement.org/site/> (last visited December 19, 2013).
36. City of Boston, Bike Statistics, *available at* <http://www.cityofboston.gov/bikes/statistics.asp> (last visited November 9, 2013).
37. L. Frank, "Economic Determinants of Urban Form," *American Journal of Preventive Medicine* 27, no. 3 Supplement (2004): 146-153.
38. C. Leinberger and M. Alfonzo, *Walk This Way: The Economic Promise of Walkable Places in Metropolitan Washington, D.C.* (Washington, D.C.: Brookings Institution, 2012).
39. L. Shoup and R. Ewing, *The Economic Benefits of Open Space, Recreation Facilities and Walkable Community Design* (San Diego, CA: Active Living Research, 2010).
40. F. Montes, O. L. Sarmiento, and R. Zarama et al., "Do Health Benefits Outweigh the Costs of Mass Recreational Programs? An Economic Analysis of Four Ciclovía Programs," *Journal Of Urban Health-Bulletin of the New York Academy of Medicine* 89, no. 1 (2011): 153-170.
41. L. D. Frank, B. E. Saelens, K. E. Powell, and J. E. Chapman, "Stepping Towards Causation: Do Built Environments or Neighborhood and Travel Preferences Explain Phyiscal Activity, Driving, and Obesity?" *Social Science Medicine* 65, no. 9 (2007): 1898-1914.
42. G. R. McCormack and A. Shiell, "In Search of Causality: A Systematic Review of the Relationship between the Built Environment and Physical Activity Among Adults," *International Journal of Behavioral Nutrition and Physical Activity* 13, no. 8 (2011): 125.
43. J. F. Sallis, M. F. Floyd, D. A. Rodriguez, and B. E. Saelens, "Role of Built Environments in Phyiscal Activity, Obesity and Cardiovascular Disease," *Circulation* 125 (2012): 729-737.