

A New Role for Public Health in Transportation
Creating and Supporting Community Models for Active Transportation

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An Emerging Movement

The inclusion of public health in city planning and transportation is not entirely new and most recently is consistent with traditional city planning applications such as the environmental health impacts of development ¹. In particular, recognizing the detrimental health impacts of poor air quality, the 1990 Clean Air Act (CAA) amendments require states to demonstrate that transportation activities would not cause, contribute, or increase the frequency or severity of exceedances of criteria air pollutant standards (CAA, section 176). The Transportation Equity Act for the 21st Century (TEA-21, 1998) reiterates the CAA air quality goals in transportation planning, and provides funding for that purpose through the Congestion Mitigation and Air Quality Improvement Program (CMAQ). The 1977 Clean Water Act and its amendments requires the regulation of non-point pollutant sources, including sources from land use and transportation projects, to protect surface and ground water quality in the US. More generally, the National Environmental Policy Act (NEPA) establishes the framework for Federal agencies such as the Federal Highway Administration to consider direct, indirect and cumulative impacts of their projects on the environment ².

Beginning in the 1980s however a shift in orientation occurred in public health. This change began to develop with the incorporation of a sociological and environmental analysis of health and disease; as research evolved it supported the hypothesis that socio-environmental conditions were important health determinants ³. In parallel, a new approach to the creation of communities began to emerge in architecture and urban planning that endorsed a development philosophy called new urbanism ⁴. The result of these changes in thinking emerged a belief that the built environment, particularly the infrastructure supporting transportation may have important implications for health promoting behaviors. The focus of this paper will be to articulate the role of public health in transportation and the potential health impacts offered through a transportation system that supports active living and provides more choices for people to be physically active (walking and bicycling).

Active living is a new way of framing an old concept of how we have historically obtained physical activity through daily routines. For example, walking is a natural act for most people, however, through new technologies, changes in community design, and skewed investments in transportation, we have essentially engineered this basic form of physical activity out of daily routines. These steady changes in our built environment and the introduction of devices that promote convenience have created subtle adjustments in behavior (less physical activity) that have grown into considerable consequences for society. The result of our advancements have contributed to the 70 percent of American adults who do not obtain the recommended 30 minutes of physical activity for five or more days a week ⁵. The risks of a sedentary lifestyle are much greater than generally recognized; being sedentary is a primary contributing factor in at least 200,000 deaths annually ^{6;7}, a number that is equivalent to approximately 25 percent of all

chronic disease deaths and 10 percent of all deaths in the United States annually. But the impact on morbidity and mortality doesn't end there.

The rising percentage of adults who are overweight (64%)⁸ and number who are obese (nearly 1 in 3)⁸ has created great debate to the cause of this fastest growing chronic disease epidemic. A debate that is shifting focus toward environmental conditions and social circumstances and how they impact behavioral choices and health outcomes. Additionally, many researchers support the belief that auto-dominant design of most communities has contributed to unsafe environments for walking and bicycling and has resulted in thousands of pedestrian injuries and fatalities annually^{3;9-11}. Nearly one in seven traffic-related deaths is a pedestrian or bicyclist.^{12; 13} Additionally, the auto-dominated metropolitan areas such as Atlanta, Houston, Seattle, and Los Angeles have increasing challenges to provide clean air and water, mitigate noise and land pollution, and minimize the impacts of urban heat islands. All of these issues not only disturb healthy human functioning, but also damage a sensitive eco-system that is struggling to cope with increasing encroachment on Mother Nature. The result is often avoidable disability, premature loss of life, and extraordinarily high economic consequences.

For people who are sedentary, even moderate activity such as walking and bicycling are likely to provide substantial improvements in quality of life and health status. The evidence from many studies on walking and bicycling demonstrate that regular participation in these activities provides a health benefit for people of all ages, genders, and races^{14; 15}. Therefore, walking and bicycling afford an excellent opportunity to incorporate regular activity into daily routines. Because walking and bicycling could potentially replace many short vehicle trips, a small shift in the number of trips from driving to walking could result in significant public health (environmental and individual) benefits.

Advancing Active Living Through Transportation

The primary challenge in advancing the concept of active living is effectively communicating its role within the context of other disciplines' missions. Few people have a clear understanding of the importance of the functions that public health agencies perform, or how these functions are related to city planning, transportation or design efforts. Public health agencies focus on promoting healthy people in healthy communities by preventing the spread of disease, protecting against environmental hazards, preventing injuries, promoting healthy behaviors, and assuring the quality and accessibility of health services. A unique approach to developing healthy and livable communities is to develop policies, programs and plans to support non-motorized transportation. Supporting walking and bicycling has been a challenging and often ignored issue for city planners and transportation engineers for the past 60 years. Walking and bicycling continue to be the least used transportation modes, even though they are often the quickest modes to accomplish short trips in urban areas. Additionally, even when non-motorized transportation could be regarded as a reasonable alternative for an individual, it may not even be considered as an option by that person, simply because of the lack of awareness about that possibility or out of mode choice habit. Getting beyond this dilemma requires efforts to reinforce and change public policy through a comprehensive and systematic research, education, and marketing approach that includes walking and bicycling as viable modes of transportation and behaviors for recreation. The result of this effort will be community models that identify how the disciplines of transportation, city planning, and urban design partner with public health to

foster active living approaches that translate into a robust transportation system supportive of physically active travel.

Why is Transportation Important to Public Health?

It is widely accepted that since the 1940s, planning, community design and transportation engineering practices in the United States have focused on segregating land uses and increasing the efficiency of automobile travel¹⁶⁻¹⁸. This trend in development paved the way for most cities to develop and grow beyond traditional city limits, and subsequently influenced consumer decisions to live further from the urban core while maintaining reasonable commute times. Over time, decisions to live further away from the urban core became more commonplace and Americans became increasingly more dependent on the automobile and less reliant on walking, bicycling and public transportation as the primary modes of mobility.

Why are these trends important to public health? Data from the 1995 Nationwide Personal Transportation Survey¹⁹ revealed that automobiles accounted for 89.3 percent of all trips, whereas walking and bicycle trips accounted for only 6.4 percent. These data are important because transportation and city planning researchers have suggested that a meaningful shift in auto trips to walking and bicycling could take place if community design adequately supported these behaviors²⁰. This assumption is reasonable because while nearly 25 percent of all trips are less than one mile, approximately 75 percent of these trips are made by automobile²¹. Changing trip-making behavior to include more non-motorized trips would translate into a favorable public health outcome. Therefore, a viable strategy in the U.S. to promote active transportation, where 70 percent of adults are irregularly active and more than 64 percent are overweight, would be to guide people to become moderately active through non-motorized travel. These strategies could potentially shift a portion of the 73 minutes the average person spends in an automobile each day to active transportation behaviors²¹. Support for this strategy becomes even more apparent when considering that less than 30 percent of trips to school which are one mile or less, that are made by children ages 5-15, are done by walking or bicycling. Only 10 percent of all trips to school are attributed to walking and bicycling²¹.

Furthermore, integrating additional walking and bicycling into a daily routine may be a better public health strategy than traditional structured and organized programs. Several studies evaluating physical activity promotion programs have shown that programs that require the participant to alter daily routines to accommodate the program (e.g. joining and participating in a fitness facility) have been less effective in promoting regular physical activity than solutions that integrate physical activity more easily into a person's daily routine^{10; 22}.

There are a variety of reasons why walking and bicycling can be attractive transportation alternatives. For many people, they are relatively inexpensive and easily achieved behaviors that can be substituted for existing trips. Walking or bicycling to work, to do an errand or to visit a friend is an excellent way to integrate physical activity into a daily routine¹⁵. Since the publication of the Surgeon General's Report on Physical Activity and Health⁵ there is mounting evidence that moderate physical activity, walking and bicycling in particular, can reduce disease and improve health. There is evidence that health benefits can be observed for levels of activity at lower durations and intensity than the minimum public health goal-- i.e., adding a number of five minute walks to the bus, the store, or to the neighbors can add to your health account²³⁻²⁵.

In addition to the direct health benefits of substituting walking or cycling trips for auto trips, there are important economic payoffs that would contribute to the sustainability of the

community. A study by Pratt et al ²⁶ suggests that if effective strategies were employed to increase participation in regular moderate physical activity among Americans over the age of 15 years, annual national medical costs could be reduced by as much as \$76.6 billion dollars.

Walking and Cycling Environments

Researchers have increasingly studied the impact of the built environment on travel behavior, although primarily from the perspective of its impact on auto travel. In general, research has shown that well connected street networks and dense, mixed-use and transit-oriented development generate lower vehicle miles traveled, because of shorter trip distances and hence more travel mode options ²⁷⁻²⁹. The study of the specific design features that make a community “pedestrian-” or “bicycle- friendly” is challenging, because of the difficulty of describing and measuring objectively or subjectively all relevant features of the spatial-temporal environment, and accounting for the interaction between factors. Furthermore, transportation behavior studies lack a clear conceptual framework to establish causality ³⁰. The three types of approaches that are generally found in the literature to characterize the urban microscale environment in travel behavior studies are: 1) a general description of the type of neighborhood (for example “traditional” or “suburban”) ²⁹; 2) description of specific design features (such as sidewalk width or ease of street crossing) ³¹⁻³³; and 3) the trip makers’ attitudes about travel and perceptions of the neighborhood environment (level of walking comfort for instance) ^{34; 35}. Regardless of the approach, research shows that neighborhood factors are often significant in determining mode choice or trip frequency for different modes, especially for non-work trips, although less so than socio-demographic factors. However, in all the studies reviewed, most of the variation in mode choice remained unexplained, and the difficulties in precisely describing what can be considered a friendly environment for walking and bicycling remain. Nevertheless, it can be said that in general, when examining the community design and transportation investment, data suggest that residents of what is characterized as pedestrian and bicycle oriented neighborhoods made more walking, bicycling, and public transit trips compared to residents in auto-oriented neighborhoods.

Furthermore, community design (higher density, high land use mix, and high pedestrian environment factors such as grid pattern streets, sidewalks, and safe and convenient street crossings) that provide opportunities for non-motorized travel behavior should also provide the same opportunities for recreational walking and bicycling, and while the decisions to engage in walking and bicycling for transportation and recreation are very different, the infrastructure needed to do the activities remains the same.

It is unclear however, how factors such as sidewalks, bikeways, or trails will impact sedentary individuals’ decisions to be physically active through walking and bicycling. We do not know if those who are sedentary are the same people who are driving automobiles more and walking and bicycling less due to poor community design.

Finally, some community features may be highly correlated and predictive of bicycling and walking and become useful as indicators of those behaviors, but at this point in time cannot be connected in any cause-effect relationship. In addition, as mentioned before, many community design variables have confounding relationships, making it difficult, if not impossible, to disentangle their separate effects as independent variables, such as land use, density, and connectivity, on the dependent variables of walking, bicycling, and transit use.

Therefore, although studies have shown that there is potential for creating environments conducive to active transportation and physical activity, more research is still needed to fully appraise the relationship¹¹.

Where are the Community Models for Active Transportation?

There are many examples of communities that are creating and supporting models for active transportation. Many communities are addressing barriers to active living by examining transportation policy and practice within the broader contexts of community-building and health, integrating transportation with land use reform, encouraging transportation choice, enhancing transit, developing non-motorized infrastructure and enhancing streetscapes to help ensure increased choice for active living through transportation. Some major factors behind these community successes include: multidisciplinary collaboration, improved community participation, careful and informed community design, updated policies, targeted programs and creative funding arrangements.

Multidisciplinary Collaboration

Multidisciplinary collaboration involves the conscious decision to engage a diversity of professional viewpoints in order to ensure a more complete and accurate picture of the challenges and opportunities presented by a project and to employ a more comprehensive set of problem-solving skills. Disciplines that are commonly included in successful collaborations include: city planning, transportation engineering, public health, urban and architectural design, parks and recreation, real estate development, crime prevention and law enforcement, affordable housing and community development, elected officials, code enforcement and other regulatory officials, issue-oriented community activists, and organizations representing priority populations such as youth, elderly, low-income people or people with disabilities. Examples of community models include:

Cabarrus County, NC where the involvement of the Cardiovascular Health (CVH) Coordinator on a multi-jurisdictional parks and recreation land use planning team brought significant new resources and perspective to the planning effort and led to the inclusion of bicycle and pedestrian transportation facilities and routes in a broader “Livable Community Blueprint”. As a result, the bike plan portion of the blueprint was adopted in the Metropolitan Planning Organization’s (MPO) transportation plan, and design guidelines for bicycle facilities are now being designed.³⁶

Henderson County, NC where the involvement of the Cardiovascular Health Program Coordinator led to the creation of a walking and biking suitability assessment. The partnership, in combination with the assessment tool, led the public works department for the first time to seek community input prior to making pedestrian improvement and to implement ADA sidewalk guidelines. This further led the city manager to encourage improvements such as sidewalk connections, curb ramps and pedestrian signals.³⁶

Oakland, CA, where a community development corporation called the Spanish Speaking Unity Council partnered with Bay Area Rapid Transit (BART) and the City of Oakland to develop the Fruitvale Transit Village, a large mixed-use development adjacent to the BART station in Fruitvale, a low-income, minority community. The project includes a mixture of housing, shops, offices, a library, a childcare facility, a pedestrian plaza, and other community

services all immediately adjacent to the train station. After leading the community in its successful rejection of a parking structure for commuters at the station, the Spanish Speaking Unity Council built relationships with a wide range of key players, conducted extensive community outreach, community site planning workshops and a community design symposium, and transformed the original BART vision for the station into a community vision, centered around improved pedestrian access between the station and nearby local businesses, that revitalized the community and created more opportunities for active living. As a community development organization, the Spanish Speaking Unity Council brought community goals such as job creation, affordable housing, shopping opportunities, better air quality and improved public safety into the planning process and ultimately became the developer of the project. It also attracted grants, loans, land and equity capital for the partnership and the project from an unusual combination of public, private and philanthropic sources. Included were two grants totaling over \$3 million from the Federal Transit Administration for the construction of a pedestrian plaza linking the station to the main commercial street and for a child care center at the station. With its groundbreaking in September 1999, this very unusual project was made possible because of the leadership provided by a non-traditional discipline partnering with transportation and planning agencies, banks, local, regional and federal government, nonprofit health and advocacy organizations and a variety of other partners.³⁷

Improved Community Participation

Improved community participation involves a commitment to reexamine and alter traditional means of project planning to invite greater involvement by the diversity of stakeholders and end users for a project. Successful models for active transportation often work hard to build community ownership by: reaching out to underrepresented stakeholders, soliciting ideas and feedback, engaging in ongoing dialogue for the purposes of mutual education, establishing and pursuing consensus goals, providing stakeholders with a more direct and influential role in decisions, and establishing greater institutional accountability for decisions that are made.

Examples of community models include Seattle and Boulder. All three cities are success stories for the creation of active transportation environments. One common feature essential to the achievements in the three cities is their focus on citizen participation in the decision making process. This trait is highlighted in the following short descriptions of the projects. Another important characteristic is the clearly stated goal of supporting non-motorized transportation.

Seattle, Washington, is a community where careful solicitation of direct input from citizens and municipal accountability to their concerns are the keys to creating successful bicycle and pedestrian “Spot Improvement” programs, which make low-cost and small-scale improvements such as pothole filling, sign and sewer-grate replacement and parking rack installation. Citizens recommend improvements by filling out post-paid suggestion cards at bike shops and public buildings. City maintenance crews fix problems indicated on the “report cards” within a matter of days. Citizen requests have also led to the construction of more than 200 traffic circles for traffic calming in residential neighborhoods. These “mini circles” have reduced speeds and traffic accidents and created a more pedestrian and bike friendly environment. Public support for the program is sufficient to have yielded consistently high funding for the pedestrian and bicycle improvement programs and dozens of pedestrian-related regulations.³⁸

Boulder, Colorado combined the work of its transit, bicycle, and pedestrian coordinators into a single “Go Boulder” initiative, guided by a citizen’s transportation advisory committee. It also has clear goals for replacing single occupant car trips with non-motorized trips, and has made significant physical improvements to pedestrian and dedicated bicycle infrastructure (e.g. shelters, sidewalk links, benches). Boulder features a downtown pedestrian mall, a greenbelt to reduce sprawl development, and significant investment in education and enforcement activities, maps, brochures, media and events³⁸. The importance of community participation was recently underscored when a proposal to eliminate the very successful and popular EcoPass transit program met with significant grassroots opposition. Following considerable public input, the regional RTD board agreed to seek only modifications to the program and has directed staff to organize stakeholders groups to examine both the Business Eco Pass program and the Neighborhood Eco Pass program.

Careful and Informed Community Design

Careful and informed community design emerges from the interplay of traditional professional practice, multidisciplinary collaboration and community participation. Through these processes, a community can reconcile project-based decisions with larger community goals, reconcile community desires with engineering requirements and market data, identify and overcome design weaknesses, test market important micro-scale features of buildings and streetscapes with end users, and remain flexible throughout the process.

Some common features of successful community design for active transportation include: bus shelters, benches, bicycle racks on buses and at destinations, continuous and enhanced sidewalks and bike lanes, enhanced paving, dedicated greenways, shade, human-scale street lighting and signage, outdoor cafes, longer crossing signals, prominent and well-lit stairways, enhanced wheelchair access, bike-friendly street grates, landscaping, street art, plazas, roundabouts, pedestrian buffers, crosswalks, refuge islands, bulb outs, neck-downs, small corner radii, and a variety of other traffic calming techniques and building façade enhancements.

Some commonly used tools for informed community design include, charrettes, visioning exercises, visual preference surveys, town meetings, walkability and bikeability audits, pedestrian and bicycle road shows, photo enhancement and manipulation, three-dimensional rendering and modeling, geographic information systems, asset mapping and impact analysis.

The following examples of community models show how some cities have applied careful and informed community design as well as other strategies to create vibrant communities that are more oriented towards pedestrians and conducive to active living.

Bethesda, MD has transformed an average automobile-oriented suburban thoroughfare into Bethesda Row, a highly popular, mixed-use, main street alternative to a sprawling shopping strip. In order to create a successful retail district, the city relaxed some outmoded and inflexible zoning codes and worked hard on streetscape design. Agency staff reconciled competing visions about street and façade design elements, created streetside cafes and a public gathering place on a prominent corner across the street from the Capital Crescent Trail, a popular biking and hiking route that connects downtown Bethesda to downtown Washington, D.C. Located two blocks from the Bethesda Metro station, and taking advantage of surrounding concentrations of housing, offices and a wide variety of retail, entertainment and other commercial activity, this vibrant area provides residents, shoppers, employees and restaurant and theater patrons with a wide variety of choices for traveling to many routine destinations.³⁹

Addison, TX, an edge city outside of Dallas surrounded by sprawling suburbs, redefined itself by creating a walkable, compact center called Addison Circle. Addison Circle was planned consistent with a public input process called Vision 2020 and using reformed regulations and zoning that would have stood in the way of creating a compact, walkable mixed-use neighborhood. It is intensively developed as an infill site, close to bus and rail transit, yet is designed on a human scale, with four-story buildings and attractive community parks and public squares. It places shops and services within walking distance of residents and employs wide sidewalks, arcades and a pleasant streetscape to entice pedestrians.³⁹

Lake Worth, Florida transformed a declining downtown with speeding traffic into a vibrant, pedestrian-friendly center using transportation improvements as the catalyst for broader community revitalization goals. A design charrette reinforced the public's desire for more pedestrian space, reduced speeds, and more on-street parking, negotiations between local planners and Florida DOT led to narrower lanes, parallel parking, decorative light fixtures, planters, paver-block sidewalks and crosswalks, benches, trash containers, and other amenities. Sidewalks were widened and the two main streets received 65-foot corner "bumpouts" that shorten street crossings and serve as convenient transit stops. As a result, traffic rarely moves faster than 20 m.p.h. and traffic accidents have been cut in half. The Florida DOT recognizes the mobility tradeoff, but has increasingly come to recognize the appropriateness of slow traffic in a downtown.⁴⁰

Somerville, MA used transportation partnerships to revitalize Davis Square from a depressed, high-speed intersection into a lively center of entertainment and commerce. In 1982, a partnership between city, state, regional and community planning groups used the construction of a new subway stop in Davis Square as leverage to fix the traffic problems. The city constructed new paving for crosswalks and sidewalks, pedestrian islands, and central islands. These features calm the movement of cars within intersections and enhance pedestrian movement. The City of Somerville also created a linear park with a pedestrian and bicycle pathway on an old railroad right-of-way which links to the 13-mile Minuteman Trail. The Massachusetts Highway Department redeveloped a portion of its right-of-way as a bike path with new lighting for nighttime bike riding. Adjacent residents have added their own personal design element by establishing community gardens along the route.⁴⁰

Updated Policies

Updated policies for governments and community institutions are critical elements to successful community models. For federal and state governments and agencies, these may involve:

- increased and flexible use of funding for transit, street maintenance and provisions to support non-motorized transportation;
- site location policies for major public facilities (e.g. post offices, government office buildings, university campuses, hospitals, etc.) which encourage their placement in the center of communities accessible to neighborhoods and other major destinations;
- providing incentives for infill development and brownfield / greyfield redevelopment;
- providing incentives for affordable housing development in downtowns; or
- providing incentives for regional cooperation on issues such as jobs/housing balance, affordable housing, travel demand management and rail transit;

- allowing and encouraging flexible highway design standards in communities, downtown areas, and other sensitive districts;
- recognizing the connection between land use and transportation in transportation modeling and project planning policies.

For local governments, updated policies usually involve:

- changing or adding flexibility to zoning ordinances to encourage greater density and mixed use and more pedestrian-friendly orientation of buildings to the street;
- reviewing and altering street standards to encourage safer and more pleasant pedestrian environment and slower traffic;
- removing disincentives and revising building codes to encourage property owners to maintain, renovate and fully lease their buildings without sacrificing safety and health;
- changing parking policies to: reduce subsidies to automobile use such as free parking or excessive parking; remove and/or reduce parking requirements for developments; add on-street parking where possible to buffer pedestrians from traffic; and create shared parking where possible to make more efficient use of facilities and encourage foot traffic on the street; and
- establishing density bonuses and other incentives for infill affordable housing production.

For schools, updating policies refers to:

- changing school site location standards and facility requirements to encourage maintenance, renovation and construction of neighborhood schools and discourage school consolidation on the fringe of communities in locations inaccessible by non-motorized transportation;
- instituting policies that encourage walking and biking to school, supporting these modes through features like bike racks and connectivity to the street network, and discouraging individual drop-off by parents at schools.

For employers, updating policies may involve:

- parking cash-out programs for employees who are willing to commute by transit or non-motorized transportation,
- flex time to encourage exercise,
- on-site exercise and showering facilities to support employees who want to exercise at lunch as well as those who want to bike, run, or walk to work, and
- participation in regional commuter choice programs.

For lenders, updated policies could involve:

- creation of location-efficient mortgages,
- financing for mixed use development,
- improved community reinvestment policies or
- becoming more flexible on parking requirements in developments with excellent transit and non-motorized access.

All of these policies encourage transit and non-motorized transportation. An example of a community model is **Arlington County, Virginia** where they implemented transit-oriented development practice to create vibrant “urban villages” where people live, shop, work and play, using transit, pedestrian walkways, bicycles or cars.

Arlington adopted a general land use plan (GLUP) and used incentive zoning to encourage and concentrate dense, mixed-use infill development at five Metro stations and developed sector plans to taper it down to residential neighborhoods and ensure a distinct sense of community.

The sector plans focus growth within a walkable radius of the stations and preserve established neighborhoods and natural areas. A site plan review links goals in the GLUP with details of each proposed project. Arlington's urban villages emphasize pedestrian access and safety and incorporate public art, "pocket" parks, wide sidewalks with restaurant seating, bike lanes, street trees, traffic calming, and street-level retail. In response to the popularity of the urban villages and rising housing prices, the local government recently added a density bonus provision for affordable housing in order to ensure that households of a variety of incomes can have access to the urban village lifestyle. Largely as a result of the coordination of land use and transportation planning, Metro ridership doubled in the corridor in the last decade and nearly 50 percent of corridor residents use transit to commute. Arlington is also an excellent example of successful citizen participation. Surrounding residents support the density because they are involved in developing plans and enjoy convenient shops, services and transit near their neighborhoods as a result of the growth. Community partnerships such as the Ballston Partnership, Clarendon Alliance, and Rosslyn Renaissance ensure a very high level of participation by citizens and businesses in nearly all development and policy decisions. More than 40 Board-appointed commissions and nearly 60 neighborhood and civic associations advise the County, and Arlington's site plan review process also includes significant and diverse community input.⁴¹

Targeted Programs

Targeted programs are direct efforts to encourage individuals to engage in physical activity and active transportation. They include traditional, community-based health promotion programs that encourage exercise, physical education curricula and programs in schools, parks and recreation programs for all stages of life, walking and running clubs, mall walking programs for the elderly, safe routes to school programs, walk-to-school days, special community events such as walk-a-thons, rides, races, clinics and health fairs. They also include a wide variety of educational, incentive-based and community awareness campaigns about the availability of opportunities for active transportation and exercise and the benefits of physical activity.

Safe Routes to School programs are particularly good examples of programs targeted at increasing physical activity through active transportation. Such programs not only offer non-motorized travel choices for a population generally underserved by transportation systems (because children cannot drive), but they also forge healthy lifestyle habits for a new generation. The following case studies, taken from 2002 Summary of Safe Routes to School Programs in the U.S. by Transportation Alternatives⁴², exemplify successful collaboration between transportation engineers and other partners.

Marin County, CA Safe Routes to Schools has established a grassroots program that is getting more children walking and biking to school by combining education, community organizing, and engineering improvements. It organizes school-specific teams and community-wide task forces to comprehensively create a safer environment that encourages a new culture of walking and biking. Parents and neighbors map the routes, identify problems areas and, with the help of an engineering consultant, develop recommendations. Safe Routes task forces collaborate with public works and law enforcement staff to develop and implement an improvement plan, apply for funding and make easy improvements like crosswalks and signage. Law enforcement

helps with community events. Children are taught bicycle and pedestrian safety in the classroom as well as information on health and the environment. Drivers are educated through Share the Road campaigns launched by community task forces. The effort leverages public funding with private foundation funding, business support and money from the CA Dept. of Health Services.

Arlington County, VA, where the pedestrian initiative and Neighborhood Traffic Calming program for residential streets spawned a comprehensive Safe Routes to School program that combines engineering, planning and design with strong enforcement measures and strong public and school-based education to get kids walking to school. .

Chicago, Illinois where the Safe Walk to School program is strengthened by a Walking School Bus Program wherein police assist clusters of households that walk to school together for increased safety and education. 90 percent of the 422,000 public school students in Chicago walk to school.

Creative Funding Arrangements

Creative funding arrangements are often necessary to achieve success given the current bias of funding toward automobile oriented projects. These can include transportation and housing funding incentives that encourage the placement of housing near transit, efforts to combine project funding with funding for targeted programs and from other disciplines such as public health and environmental protection, requirements that new developments include sidewalks and capital budget set-asides for non-motorized infrastructure, tax supported bicycle and pedestrian programs, engaging pension funds as investors, taking advantage of little known and underused programs, creative application of user fees, and efforts to combine funding streams from different levels of government, different agencies within government, the private sector and private philanthropy.

Below are examples of communities that propose incentives that encourage dense and mixed-use developments concentrated in desirable locations for active transportation.

San Mateo CA's TOD Incentive Program spurs construction of needed housing near transit by allocating 10 percent of the funds they receive from the State Transportation Improvement Program to provide up to \$2,000 per bedroom for developments within 1/3-mile of a rail transit station and at least 40 units/acre density. The monies are used to support direct transportation improvements as well as landscaping, lighting, sidewalks, plazas, and recreational projects.⁴¹

Location efficient mortgages (LEMs) have increased the affordability of housing located near transit and encouraged active transportation in Seattle, Washington and Hayward, CA.

- **Seattle, WA** was the first city in the nation to offer the LEM, which increases home-buying power by allowing borrowers to put the money saved through use of public transit towards the amount of mortgage for which they can qualify. In Seattle, homebuyers using the LEM receive heavily discounted transit passes, subsidized membership in Flexcar, a public-private car-sharing program now used by 630 people in three neighborhoods. LEMs are offered through HomeStreet Bank.⁴³
- **Hayward, CA** the LEM supports homebuyers in the City Walk development one block from the Hayward BART station and close to retail and commercial services. Fannie Mae invested \$2.6 million in the project and will provide the LEMs through participating lenders. The LEM itself is a product of a multidisciplinary partnership between the Center for Neighborhood Technology, the Natural Resources Defense Council, the

Surface Transportation Policy Project and Fannie Mae, the nation's largest source of financing for home mortgages. Pilot LEM programs also exist in Chicago and Los Angeles.⁴⁴

The above factors combined with effective public and private sector leadership to create successful models of active transportation. It is clear that number of deliberate efforts to promote public health through active transportation and to employ these factors is increasing rapidly. A recent Call For Proposals by Active Living by Design, a national program of The Robert Wood Johnson Foundation, emphasized the need for multidisciplinary partnerships to develop community models supporting active transportation. More than 1000 proposals from urban, suburban and rural partnerships across the country were submitted. These efforts, if they continue, have the potential to yield major results for active transportation and the mainstreaming of active living into community norms across the United States.

Developing the Call to Action for Active Transportation

The primary call to action to advance active transportation is for increased interdisciplinary collaboration in research and practice, and for the transportation field to operate on an expanded vision of its mission. Specific to this call is integrating public health and quality of life concerns and moving beyond the traditional transportation system performance framework. This work will be helpful in engaging transportation professionals in taking a more active role in land use reform, transportation alternatives, community design and public health.

Research

Research in the transportation field has not been able to fully characterize the link between the built environment and non-motorized travel, and has not attempted yet to incorporate measures of physical activity in its forecasts. Much still needs to be done to fully appraise the link, and understand how different environments meet different user needs across the life span. The following section proposes research directions that can be taken to improve this understanding. A first step is to reconsider the theoretical framework used to study travel behavior, to more appropriately reflect behavioral mechanisms in transportation decisions. Researchers must then study the specific barriers to active transportation and the determinants of positive environments. Finally, by evaluating the premise for the constrained land use setting with which transportation experts work, and the disparities in the opportunities for transportation choices among the population, research can help transportation experts increase their understanding in land use decisions. This understanding would be helpful to motivate and empower transportation professionals to take a more active role in land use decisions that would encourage patterns that reinforce transportation choices.

Theoretical framework

The field has several theoretical and practical challenges it needs to address to improve the understanding of active travel behavior. The first challenge is that the conceptual framework used for travel behavior analysis is particularly ill adapted to study bike and walk travel. The framework, based on micro-economic theory of utility, and embedded in the theory of travel as derived demand^{45; 46}, is limited both because of the assumptions underlying random utility

theory, and because of its traditional application for mode choice modeling^{46; 47}. The current travel behavior analysis used in practice excludes the consideration that experiential and emotional factors may enter the decision making process, and that the individual may seek to fulfill other goals than monetary and time cost minimization⁴⁷. It also fails to take into account how individuals perceive their environment, how they process information, how they are affected by socio-cultural factors, and how habits are formed⁴⁷. Indeed, utility theory assumes that individuals behave rationally, but in reality this is not always fully the case. For instance:

- People use heuristics (simplifying rules), in particular their choices can result from habit or previous experience;
- They don't always fully appraise all options and all trade-offs but sometimes stop deliberating once they've found a satisfactory choice;
- Risk and uncertainty can influence choice, their choices are not always stable as they can be influenced by emotions.

The reason this framework is particularly ill-adapted to active transportation, is that:

- Often people in the U.S. drive out of habit, and thus don't fully consider the non-motorized choices.
- There can be much unknown and risk associated in the walking and biking modes if they haven't been experienced before (am I physically capable, what if I'm too tired on my way back? What if it starts raining? Is it safe for me to be walking or biking? What is it like out there?).
- Walking and biking can be an particularly emotional experience, influenced by such things as the aesthetics, the sense of "place", the perception of security and safety, of pride, etc.
- People's involvement in making mode choice decisions (degree to which they will fully appraise all choices) may change once they start thinking about consequences, so that awareness campaigns may change the decision making process.
- People's attitudes about transportation modes may change their decisions-making process (pride, values, social norms).

All of these psychologically and sociologically meaningful behavioral concepts that are missing in transportation modeling are familiar to experts from fields in public health and design. The transportation field would benefit greatly from partnering with those fields to add some perspectives in theory and practice that would help transportation planners advance on these issues.

For instance, urban designers and architects describe settlement form and explain the connection with human values. They have normative theories for building good cities or good neighborhoods. They relate the physical environment to psychological and emotional reactions such as feelings of anxiety, sense of security, stability and continuity, awe and pride, alienation, wonder and delight⁴⁸. To guide the discussion on the goodness of the city, for instance Lynch proposes performance dimensions that refer to general and measurable characteristics of the spatial form of the city, connected to goals and values of a culture.

The field of environmental psychology is within the design fields but explores scientifically the transactions between individuals and their physical setting. For instance theories conceptualize how the physical environment is a source of sensory information, how we react to the amount of control we feel we have in different environments, how some places trigger "programmed" behavior, and they build models on the dynamic interplay of social, societal and

individual factors. Furthermore, design experts study designs that respond to the different needs for the different stages of life (youth to elderly). The design fields offer very valuable theories, but they have not had a widespread positive impact in making our communities healthier. Rather, research findings from environmental psychology have mostly been applied on a case-by-case basis, where circumstances were favorable for such applications – the findings are intended to respond to specific client needs in specific places and time rather than to establish scientific principles⁴⁹. To complement this approach, health behavior analysts may offer theoretical frameworks and analytical methods for incorporating psychosocial factors in models of travel behavior⁵⁰. Transportation researchers would benefit from working with experts in the design and behavior science fields to describe how, within the city and urban form, the transportation system relates to human values and how it affects individual behavior. Furthermore, the health behavior field applies theories and techniques, such as social marketing, to trigger desired behavior outcomes. Those public health frameworks can be investigated in the context of desired transportation choices outcomes to explore new solutions for transportation systems.

In the long term, researchers need to work towards creating a comprehensive theoretical framework that combines the theoretical understanding of human behavior from different fields, for a full appraisal of the effect of the built environment on choices and lifestyles. The previous discussion has shown how the theory and models used in transportation have gaps, and how theoretical understanding from the design fields and behavioral sciences can complement them. Creating a conceptual framework that will help fit these different theories and perspectives together will help in future analyses to assess comprehensively the impact of the built environment on lifestyles.

Barriers to active transportation

Since the early 1990s, researchers in transportation planning and urban design have increasingly studied the impact of the built environment on travel behavior. These studies have begun the work towards gathering data for a rich and varied characterization of the built environment, and have shown that there is indeed potential for creating environments conducive to active transportation and physical activity¹¹. Measures of the built environment, and matching data on walking and biking behavior still must be refined and expanded however, and in future studies, must be based on a clear and comprehensive conceptual structure, making use in particular of theories of behavior borrowed from social and psychological fields as described above. Research in transportation must work towards characterizing the transportation environment and how it relates to people's perceptions and travel behavior to create barriers to and positive environments for active transportation. Results from this research may then be used in transportation planning to provide a clear framework for assessing transportation systems, thus facilitating the expert's work for creating active environments.

Examples of barriers related to the built environment include fear of crime and of crashes, lack of destinations within reasonable distances, lack of adequate cycling and walking amenities. Descriptions of positive environments involve for example expressions of what is pleasant and welcoming to the pedestrian and cyclist, human-scale, safe, and with opportunities for diverse destinations and activities.

Other types of barriers, not directly related to the built environment, are economic incentives and cultural, individual and social factors that make driving cheaper, seem more convenient or appealing, or simply a systematic and habitual behavior. Solutions to these barriers

include redressing economic incentives to make driving less desirable ^{51; 52}, and social marketing and health education campaigns to promote healthy active travel.

Addressing root causes and disparities

All transportation decisions are not in the hands of transportation officials. For example, transportation engineers are not the decision makers on building and zoning ordinances or on school location. However, the transportation field would benefit from collaborating with city planners and other experts to research the processes and forces that lead to the formation of the “sedentary communities” that many Americans live in today and to take an active role in creating built environments conducive to active transportation.

The field of city planning can offer theories to transportation researchers to understand the root causes of the shape of our cities and neighborhoods, and hence the shape of our transportation systems, the choices for active transportation and people’s health conditions. Understanding the underlying inequalities and historical underpinnings that lead to segregation and the deterioration of urban life is particularly relevant to fundamentally altering the context of racial and income disparities in health ⁵³. Understanding the past and current context of planning in the US can facilitate finding strategies to implement ideals of healthy community building. How has the type of development we live in today occurred, with so little interest in creating a healthy environment conducive to active lifestyles for different user groups? Information on how policy priorities and dominant cultural and ideological currents have influenced the decision making process in planning will facilitate the work of changing the current trends to create active living environments instead.

Researchers in transportation planning can also lay the groundwork for a policy debate on the role transportation agencies should take in providing health-promoting transportation environments: should the transportation sector be specifically mandated to create transportation systems within communities conducive to healthy lifestyles, as it is mandated to take into account other environmental and social issues such as air quality? Should planners be responsible for a comprehensive approach to planning rather than be responding to isolated mandates on specific issue? Transportation analysts can also help describe what economic factors drive mode choice and how to address some pricing biases (i.e. road and parking subsidies) that distort the market response in mode choice. In addition, with the help of behavior scientists, transportation researchers can investigate the difficulty people have in evaluating transportation choices in their long term self interest, in particular good decisions for their health.

In short, transportation researchers in collaboration with planners can ask questions and generate societal debates about their potential role in creating healthy communities, and help devise strategies that respond to the forces that guide development.

Practice

Visions and performance measures

To effectively promote active transportation, engineers and planners must be able to relate their work to a broader set of goals than the field has traditionally considered. As the case studies in the previous pages have shown, defining a clear goal in support of non-motorized transportation is a key component in ensuring a project’s success. To lead transportation experts

in that direction, a first step would be to develop a matrix with a full-scale evaluation of impacts on people and the environment from the transportation sector. A “human impact statement” tool could be created for this purpose. Some concerns such as air and water quality, wildlife habitat protection, safety, or even minimizing travel time, are already relevant in the transportation planning process. Some policies and programs, such as the Clean Air Act and the Congestion Mitigation Air quality Standards, and the Transportation Equity Act for the 21st Century, require some impacts of the transportation system to be considered in the planning process. Furthermore, the Community Impact Assessment process provides a framework for assessing “community, neighborhood, social, economic and ‘people’ impacts”⁵⁴. However, today the transportation planning process does not consider physical activity as an outcome of interest, nor does it provide incentives for communities and transportation systems to be built so they are conducive to non-motorized transportation. A human impact tool could lie out clear measurements that relate to different community goals, and could also be used to highlight possible conflicting values, and allow for the resolution of these conflicts to be made in the open. For instance, some pedestrian and bicycle amenities that slow down traffic and possibly occupy vehicle travel lanes could, at least in the short term, worsen congestion and increase vehicle travel time. If such friction occurs, the impact assessment tool would allow the decision makers to weigh the competing values openly, thus ensuring a more transparent planning process that responds to stated goals.

While broadening the concern over the total effects of the transportation sector among its practitioners, the field will find opportunities for new solutions to traditional transportation problems by collaborating with experts from other fields who have overlapping concerns (for example partnering with public health practitioners to promote physical activity, or for such purposes as economic vitality, livability or crime prevention). Indeed, the case for active transportation is not just one of the transportation sector becoming concerned with health outcome, but also one of increasing transportation choices and alleviating problems such as congestion and bad air quality. An effort towards more inclusive collaboration will lead transportation engineers and planners to consider the goal of providing mobility to people in a more comprehensive way. The transportation system assessment will then reflect not only concerns over some impacts and determinants of vehicular mobility but also suggest solutions to provide more travel mode options, including opportunities and incentives for active transportation, and will evaluate more broadly the impacts of mobility choices on individuals, communities, and society as a whole.

An essential way to invite transportation practitioners to incorporate a broader vision in their work is to implement a set of performance measures that relate to the newly defined or enhanced goals. Choices of performance measures for the transportation system reflects the field’s concept of its mission, and are used in agencies as a tool to select projects. The recent series of articles published in the *Institute of Transportation Engineers Journal* on transportation systems performance⁵⁵ seem to show a bias towards concerns of traffic flows. Crash management, congestion, use of travel information, agency fragmentation and technology deployment receive the most attention from transportation experts concerned about performance. In the selection of abstract presented in the journal, only John Mason’s article reflected an orientation towards broader social performance measures. Even Michael Meyer and Richard Schuman⁵⁶ who are concerned in their article with users’ evaluation of the system, suggest a list of performance measures that look at the system’s performance only within the context of the system itself and with an emphasis on traffic flows. Their proposed list does not allow for a

measure of people's satisfaction with travel options nor does it consider broader social goals, both which would truly reflect how well the people and the community are served.

Transportation engineers and planners would benefit from adding or enhancing sets of performance measures that would address:

- The transportation system's ability to offer choices for transportation, especially to those who do not drive (children, people with disabilities, the elderly, low-income people), who do not wish to drive, or who wish to walk or bike for physical activity.
- The quality of the different travel options, especially the quality of the pedestrian and bicycle environment, which are rarely evaluated.
- The system's ability to generate non-motorized transportation and encourage physical activity.
- The impact of the existing transportation system on people's mental and physical health, on social networks and on the environment.

The four areas of performance depicted above require an understanding and measurements of the transportation environment that go beyond what is traditionally considered in transportation operations. What is meant by transportation environment in this context is a description not only of transit and road networks, but also the microscale design features of the built environment that pertain to the human realm of perceptions. In particular, this framework calls for an evaluation of the land uses in conjunction with the transportation system, to measure opportunities for destinations within walking and biking distances such as shopping and employment areas as well as parks and trails. In addition, measuring the quality of travel options signifies gaining an understanding of the relationship between the features of the transportation environment and travel behavior. Finally, transportation experts will need to collaborate with health and environmental scientists to evaluate the impacts of travel choices on people and the environment. Consequently, the proposed framework to evaluate comprehensively the transportation system will engage transportation engineers and planners in taking an active interest in land use reform, urban design and public health.

Data collection

The areas of performance measures called for above involve data that has been rarely collected. Furthermore, relevant data on transportation behavior and the built environment is needed for researchers to test empirically their theoretical hypotheses, and to ground action more firmly on reality. Some measurements such as impact data would entail collaborating with other agencies. But the information more directly related to mode choices and the built environment require a newly defined set of data to be systematically collected in the transportation context.

The transportation field has typically not taken into account non-motorized travel, has even often ignored short trips all together. As a result, there are major needs and gaps in data collection pertaining to walking and biking⁵⁷. The type of information required ranges from descriptions of the travel or physical activity behavior itself, to neighborhood and regional forms and design, household and social structure, individual factors, and perceptions and attitudes. Specifically, beyond variables that are usually present, some examples of measures that need to be developed and collected in transportation planning and health surveys are:

- Measures of non-motorized travel, both for utilitarian purposes and for exercise and leisure, and measures of the physical activity associated with it (so that, for example, the walk to the store may be translated into an energy expenditure outcome).

- Measures of the opportunities for physical activity in the built environment: proximity and density of destinations such as of parks and trails, shopping and other businesses, schools, work places, and transit stops.
- Detailed descriptions of the micro-scale design to objectively measure the quality of the pedestrian and bicycle environment: measures of facility widths, buffers, shade, lighting, greenery, building setbacks, parking lots, variety in the scenery, traffic volumes and speed, topography, crosswalks, legibility, scale, corner radii, crossing distances, medians, sight distance, and signal hardware and timing that affects pedestrians and bicyclists.
- Subjective measures of the environment: individual's perception of comfort, safety, beauty, noise, peacefulness, interest.
- Socio-demographic measures: to study how environments fulfill the needs of people at different stages of their development (from children to the elderly), and from different socio-economic, ethnic and cultural backgrounds, including social network needs; and to measure environmental correlates of disparities in opportunities for healthy lifestyles and health outcomes amongst different groups of people.

At the exploratory stage where insights are needed to discover new factors and behavioral mechanisms that may explain behavior, focus groups may be an appropriate collection method. When a new design is being considered in a locality, studies that survey the use and satisfaction before and after implementation would greatly advance the understanding of causal relationships. As research progresses, and hypotheses are tested in local surveys, there also needs to be an evolution towards integrating these measures systematically in the regular data sources and national surveys such as the National Household Travel Survey (formerly the Nationwide Personal Transportation Survey). This will not only facilitate research, but also will also help in raising awareness and concern about other fields in the expert's work. Along with the data collection, new analytical methods will also be required to analyze this new set of rich and complex data.

Policies and practice

We have seen how different disciplines are involved in forging environments conducive to active travel behaviors. The case studies presented above also showed that multidisciplinary collaborative work, including citizen participation, is an essential ingredient for success. The major message to transportation experts is therefore to expand their areas of interest and work on collaborating with other fields at multiple levels, and even be leaders in multidisciplinary team projects to promote active transportation. Following are examples of government, community and project level policies that transportation experts can participate in creating.

At the government level one very broad policy transportation experts could help put into legislation would be to include in transportation agencies' mandate an obligation to consider physical activity-related health concerns, in a similar way that it is mandated to take into account air quality. This new legislation could for example take the form of a required human impact statement for transportation projects. More specific government level policy avenues that target the different barriers to active travel or address incentives for development patterns and mode choices include: crime prevention and perception of crime, pricing policies for road, parking and gas, funding for active transportation networks and community design, zoning and building ordinances.

At the community level, transportation experts can work collaboratively with other agencies and organizations to ensure that communities create plans for active living and build environments that offer opportunities for and encourage non-motorized travel. Whether for comprehensive plans to improve the community livability, or for specific projects that address active living concepts, transportation engineers and planners need to take a leadership role as responsible experts for providing a healthy mobility choice to citizens. Examples of projects that would induce integration of physical activity in daily life are safe routes to school programs, access to trails and parks, or access to shopping and employment areas, traffic calming measures, bike facility networks and more. In this effort, the transportation expert should seek not only broad partnerships, but also citizen involvement in the process. Users' input is essential for a project to respond to needs, offer viable solutions, and engage citizens into being part of the solution to finally ensure its success, as the case studies in a previous section show. As mentioned before, social marketing techniques borrowed from the health behavior field could also be developed in collaboration with health experts, to trigger individuals to seek healthy behavior choices through active travel.

Finally, for each individual transportation project, whether regional or local, transportation experts should always and systematically consider the pedestrian and biking perspectives, and integrate designs that accommodate active travel needs within the project. When assessing a transportation system, experts should apply performance measures that evaluate its ability to offer choices for and generate non-motorized travel, as described above.

Building active living environments

Research on active transportation will lead to a more complete understanding of how the built environment affects behavior, how specific treatments of the streetscape, the building design, the land use mix, and public spaces, work jointly to affect travel behavior. If the findings and measurement methods are integrated in the transportation planning process, this research will motivate transportation engineers to take an active interest in implementing non-motorized travel. In addition, with a more complete understanding of how politics, socio-cultural factors, and market forces affect local decision-making about community design, multidisciplinary teams will be able to propose implementation strategies to build health-promoting strategies.

However, solutions need to be implemented now, even as the research is still ongoing and our understanding on the issue is only at its beginning. Action is needed now not only because it is imperative to start tackling the inactivity problems, but also because experimenting and testing different treatments and interventions are required to provide the empirical grounding for the analysis. Furthermore, it doesn't take years of research to know that building safe and beautiful, pedestrian-oriented neighborhoods is a desirable goal to improve the quality of life, and there are many views on how to operate such concepts even if a precise definition of what it means may not be possible now. The case studies presented in a previous section show how some communities have created active living environments. Urban commentators and planners who have an interest in walkability and human-scale urban form have studied and created norms and theories on the design of great streets, towns and cities^{48; 58-60} Other architects, designers, planners, environmentalists, community activists and other citizen groups and professionals, have developed guidelines for "transit-oriented developments", pedestrian pockets, and traditional neighborhood design with such goals as social diversity, affordability, sustainability, transit and walkability⁶¹. The Congress of New Urbanism has embraced these notions and is

attempting to create a unified design theory for all scales of the region, and develop norms, standards, codes, and specific designs⁶¹. The communities they have built provide some further examples to use for future health promoting built environment projects.

Although transportation experts are not directly responsible for decisions affecting the built environment as a whole, and they operate within a constrained framework, they are certainly an important part of the solution. It is in the communities' interest for different agencies to work together for successful solutions. Following are examples of directions and actions that can be taken in communities today to make them more conducive to active transportation, and that require transportation experts partnering with other agencies at the policy, planning or engineering levels⁶²:

- **Encourage mixed-use developments.** Provide opportunities for walking and biking trips by concentrating services near home, jobs and transit. Local governments, experts and citizen advocates can review the zoning ordinances in their community that limit the possibility of mixing land use types, and work to develop new ordinances that allow more density and a higher mix of land uses.
- **Build safe and well-connected pedestrian and bicycle networks.** Connect prominent destinations and origins with an efficient network for non-motorized travel, including paths connecting cul-de-sacs, and walkways and bikeways through parking lots, housing developments and commercial areas. Use more natural features such as utility corridors and other open spaces where no street network exists. Ensure safe routes by providing lighting and safe, convenient and frequent places to cross vehicular traffic. Ensure access for the disabled. **Develop land use patterns and street networks that avoid the use of high-volume, high-speed, multilane arterial streets and highways.** Discourage cul-de-sac and strip center type of developments that often require large roads for access. These developments also separate land uses, resulting in longer travel distances, which encourage automobile transportation and discourage walking and biking. Create grid or other well-connected street networks that provide motorists multiple options, reducing the need for high-volume streets.
- **Redesign and retrofit existing high-volume arterial streets and highways to improve access for pedestrians and bicyclists.** Ensure that these roadways include sidewalks for pedestrians and appropriate facilities for bicyclists. Incorporate access management including raised medians to reduce turning conflicts for these users and provide a refuge for pedestrians crossing the street. Install appropriate signal timing at signalized intersections. Use innovative treatments to make it easier for pedestrians to cross the street. Install corner radii. Minimize the use of continuous right turn lanes and free flow ramps and slip lanes.
- **Install traffic calming measures to reduce stress due to high speeds and noise.** Reduced vehicle speeds make pedestrians feel more safe and welcomed, and reduce noise, which is stressful to pedestrians. Guidelines on traffic calming measures can be found in Traffic Calming: State of the Practice⁶³ and other resources. Traffic calming measures include mini traffic circles, chicanes, chokers and narrowed travel lanes, allowing on-street parking, raised crosswalks, speed humps, curb extensions, vegetation, and more.
- **Adopt standards for narrow and slow-speed streets for residential neighborhoods designed with good connectivity.** Narrower street widths than the typical suburban street standards are appropriate in neighborhoods with well-connected street systems. These

street networks might also feature built in traffic calming measures such as circles, medians, and chicanes. Street standards can also include reduced horizontal and vertical curve standards, and smaller corner radii. A good resource for information on residential street standards is the forthcoming Recommended Practice from ITE for Neighborhood Street Design Guidelines.

- **Create pleasant, attractive, legible, and human-scale settings for the pedestrian and cyclist.** Build or renovate sidewalks with sufficient width, typically with a vegetative or other buffer to shield pedestrians from traffic. Beautify the streetscape by reducing building setbacks and locating sidewalks near the building fronts, retrofitting streets, providing greenery and benches, creating public spaces with public art where people can gather and interact, preserving and enhancing historical sites, encouraging a mix of activity - restaurants, sidewalk cafes, and shops- with large windows to look into. Local governments have design guidelines and zoning tools that can direct communities into developing in these pedestrian-friendly fashions: transportation experts in collaboration with other professionals and citizen groups can help in appropriately developing these tools for healthy environments.
- **Address specific challenges of the low-income population.** In both the implementation of health-promoting strategies and while studying built environmental influences on physical activity, practitioners and researchers need to target neighborhoods with a diversity of socio-economic and ethnic backgrounds. Because low-income populations and people residing in poverty areas have been found to have lower rates of physical activity⁶⁵, and low-income areas are often associated with low employment opportunities and high transit dependence, a particular effort needs to be made in investigating solutions in low-income neighborhoods.
- **Address crime and fear of crime in neighborhoods.** Fear of crime has sometimes been reported as a deterring factor to outdoor physical activity⁶⁶. Changes in the built environment can reduce the fear of crime and possibly reduce crime itself by improving surveillance and lighting, and giving a sense of place to care about it neighborhoods, for example: increasing visibility in pedestrian and cycle areas and increasing opportunities for the presence and gathering of people through mixed-use and public spaces⁶⁷.
- **Find funding to create health-promoting built environments.** Local governments that want to retrofit existing communities to make them more pedestrian-oriented will often require funding. Planners and health professionals can help these communities by publicly stating the benefits of creating these communities, and asking state governments to redirect transportation funds towards such projects. Federal funding also exists through CMAQ and the TEA-21 Transportation Enhancement provision, through the innovative use of other funding opportunities in government programs (public health-related funds for example), and through foundation grants. Experts in different fields can help communities find these opportunities, develop projects and write grant proposals. Transportation engineers can also work to promote legislation to allocate a percentage of Federal transportation funds to meaningful walk and bicycle systems.
- **Shift the financial incentive balance from driving to walking and biking.** Americans are given a financial incentive to drive: drivers are often provided free parking at their destinations, they don't pay the full cost of road building and maintenance, and they don't pay the full cost of externalities associated with their driving habits (health care costs due to crashes, pollution-related diseases, stress-related diseases and inactive lifestyles;

environmental degradation due to air and water contamination, land consumption; and foreign and military policy due to ensuring cheap and abundant gas for car users). Unfortunately, this form of subsidy not only encourages individuals towards unhealthy behaviors, but as a result it is also a disincentive for developers to build new pedestrian-friendly communities, since they respond to distorted market forces⁶¹. Therefore, efforts should be made to redress this subsidy: directly by making drivers pay for the real costs of roads and parking, and indirectly by providing incentives for people to walk or bike to their destinations. For instance, employers in some places have successfully given cash-out options for employees who do not use their parking lot⁵¹. Another example is commuter choice programs that offer features such as guaranteed rides home, occasional parking discounts, reduced transit fares, and other incentives to employees who walk, bike, carpool, or take transit to work. Other such innovative solutions could be sought at the community level, providing for example financial incentives to individuals who walk or bike to their local shops. Professionals and community advocates can help communities in exploring innovative solutions, convincing employers to be pro-active on this issue, and lobby state and federal governments for less distorted pricing practices.

- **Make walking and biking socially desirable.** It's time to move away from what is sometimes seen as a negative image of pedestrian travel (looking up the word pedestrian in the dictionary is enough to know what we're running up against*) to make it instead a socially recognized desirable act. There is no reason why driving a car should be seen as conferring status, and not riding a bike or walking. Health experts have a wealth of knowledge in social marketing techniques, and they can work with transportation planners and local communities to enhance the social desirability of the healthy travel and lifestyle habits of walking and biking.

Conclusion

A new vision of health-promoting communities and active transportation is possible. Research has begun to show that built environments do have an impact on our travel and physical activity choices. Our own experience in many cases also tells us that we are more likely to go out and enjoy a walk in a neighborhood if our sense of beauty is fulfilled, if we feel safe, if we get to see and maybe interact with people, if we have places to go to, and if there are things along the way to capture our attention and sense of imagination. Such a community might not only encourage us to be physically active, but also increase our mental well-being and quality of life. This seems so obvious, so why do we need all this research to prove it? Why not just build it? There are reasons why the creation of such neighborhoods is simply not so commonplace in the United States. There are attempts being made to build what we believe to be active and healthy communities. Research on processes and outcomes will better inform us on the economic, social, legal and institutional barriers to building these communities, and on what built environments work to trigger healthy physical activity lifestyle behaviors.

We have seen that transportation, design, planning and public health experts bear responsibility for different aspects of promoting active transportation, and all share a stake in it as well. It is now time for researchers and practitioners to include experts from other fields in their project teams, to create new forums and make use of existing ones to engage in

* For example, the first meaning of "Pedestrian" in the Merriam-Webster's Collegiate Dictionary is "commonplace, unimaginative."

multidisciplinary discussion on health and the built environment. Working together on projects, creating opportunities for joint research and policy discussion will enable us to uncover the areas where the expertise and reach of other disciplines is essential, and to formulate common goals and a common vision to have a comprehensive approach to building communities for the welfare of people.

What should city planning, transportation and public health professionals do with this information? Unfortunately, at this time, there isn't a specific professional mandate in any discipline to address such large and complex social and environmental problems, but this may be changing. There is a growing consensus within these disciplines and others that alternative strategies are needed to improve the health of the citizens we serve.

Understandably, many questions remain about the relationships between the built environment, transportation choices, and peoples' decisions to walk and bike. Therefore, recognizing the deficiency of data available to guide evidence-based policy decisions and intervention strategies, professionals in city planning, transportation, urban design and public health should seek to collaborate to develop a new paradigm, one that will utilize a multi-disciplinary approach using a combination of theories, empirical research and policy strategies to build communities that increase physical activity, promote health, and advance the concept of active living.

In closing, while we know very little about how we can work most effectively within this emerging movement of active living, it certainly is within the charge of each discipline to seek out opportunities for collaboration. It is evident that this area is rich with opportunities for research, policy development and interventions to promote health. Partnering on these efforts will not only enhance our knowledge and develop a new paradigm for practice and research, but will be a vital strategy in our efforts to support active transportation as a key strategy to foster healthier communities and more physical active people.

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