

Master Plans for Pedestrian and Bicycle Transportation: Community Characteristics

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Background: Recent research demonstrates the importance of targeting the built environment to support individual physical activity, particularly for people experiencing health disparities. Master plans to promote biking and/or pedestrians (BPMPs) are a potential method for environmental change. This descriptive study aims to provide a snapshot of plan attributes and better understand demographic, social and transportation characteristics of communities with BPMPs. **Methods:** We collected a census sample of BPMPs from 4 states. Population and commuting data were obtained from national statistics. **Results:** 294 master plans were included, with most plans representing municipalities. 62% of plans targeted biking only, one-fifth targeted biking and walking, and 15% targeted walking only. The sampled locations have a similar demographic profile as the overall U.S. for median age and household income, people of color, high school education, and income inequality. The degree of racial diversity of sampled communities is slightly less than the U.S. average and the percentage of people who walk to work were slightly higher. **Conclusions:** Given that communities with master plans have a similar profile as the overall U.S., BPMPs could feasibly be spread to communities throughout the country. Further research is planned to describe BPMPs in detail toward informing future plan development.

Keywords: physical activity, policy, public health

The importance of physical activity has been acknowledged in recent years by researchers and policy makers in debates about health and well-being. Sedentary lifestyle and poor nutrition are now second only to tobacco in causing illness, disability and premature death.¹ Nearly all persons can benefit from increased physical activity as regular activity contributes to the

primary and secondary prevention of several chronic diseases (eg, cardiovascular disease, type 2 diabetes),^{2,3} reduces the risk of many adverse health outcomes (eg, obesity, hypertension, ischemic stroke, depression),^{4,5} and is associated with improved psychological well-being and reduced risk of premature death.⁶ The urgency to increase activity levels across all segments of society has been acknowledged in Healthy People 2010, which includes several objectives aimed at increasing physical activity among children, adolescents and adults.⁷

If these ambitious objectives are to be achieved, a large-scale transformation in our social and physical environment must occur. To accomplish this, effective policies to promote physical activity must be implemented. In other words, the lack of physical activity is not solely due to inadequate personal motivation; inactivity is a complex public health issue involving pervasive social and physical obstacles. Advances in technology (eg, televisions and computers) have diminished the need to engage in regular physical activity at home and in the workplace.^{8,9} Many schools have cut back on traditional PE programs because of budgetary concerns and competing academic demands, such as federally mandated standardized tests under the No Child Left Behind Act.¹⁰ Urban planning and related regulatory mechanisms such as master planning, when they have occurred at all, have generally favored motor vehicles over walking and bicycling. The end result is that

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we have created environments in many communities in which physical activity is thwarted rather than facilitated. To counteract this situation, efforts to reengineer the “built environment” (the physical layout and psycho-social milieu of a community) to increase daily activity have been gaining traction over the past decade.

Physical Activity, the Built Environment and Planning

The examples cited above demonstrate that physical activity depends not only on individual characteristics but also on the environments where people live. These environments can be shaped by economic and social policies. The built environment influences physical activity, particularly active transport, and physical activity influences health. Built environmental characteristics that enhance walkability and are associated with greater walking and lower body mass index (BMI) include mixed land use, close proximity to destinations, increased density, street connectivity, and esthetics; whereas, low density, presence of cul de sacs and low street connectivity are associated with less walking and considered less walkable neighborhoods.¹¹⁻¹⁶ The association between greater physical activity in walkable neighborhoods has been found to hold up regardless of neighborhood income¹⁶ and may trump personal barriers, such as lack of time.¹⁷ However, neighborhood walkability may not be sufficient to promote walking. For example, neighborhood safety and traffic volume and speed have been identified as determinants to walking in a neighborhood.^{11,18} Urban planners can address issues related to safety by placing sidewalks and lighting to clearly guide pedestrians to entrances, creating visibility by landscaping with canopy trees and ground cover, and creating inviting spaces to encourage pedestrians and activity.¹⁹ Planners can address traffic volume and speed with traffic calming strategies, such as sidewalk bulbs, roundabouts; buffers between sidewalks and streets, such as landscaping; protected pedestrian crossings; bike lanes and bike and walking paths that are separated from traffic.^{11,18,19} These characteristics and strategies to create walkable and safe neighborhoods can be incorporated into bike and pedestrian master plans. Thus, urban planning policies influencing physical activity levels are, in fact, health policies.²⁰ We also know that environmental interventions are also clearly indicated in ethnic minority and lower-income communities, given their relatively greater substantial barriers to physical activity participation.^{21,22} A recent review of the scientific literature found that increasing places to exercise and improving neighborhood safety may also be promising strategies to reduce obesity-related health disparities.²³

Bike and/or Pedestrian Master Plans (BPMPs)

Master plans are local planning documents that influence the development of and use of landscapes and communities.²⁴ Bicycle and/or pedestrian master plans (BPMPs)

are intentional efforts to identify and prioritize comprehensive changes to improve conditions for walking and bicycling. BPMP’s typically include information on plan goals and objectives, current conditions and trends, the process for developing the plan (possibly including public engagement), proposed policies and proposals, and sometimes plans for implementation, evaluation and funding. While hundreds of BPMP’s in the U.S. currently exist, the exact number has not been tabulated.

BPMPs can be conducted at the local or state level. At the local level, a BPMP is often viewed as a multiyear (5 to 20 year) plan for improving conditions for bicycling and/or walking within the jurisdiction. When completed at the state level, BPMPs often help state institutions understand how to support local efforts and ensure that state projects (highway projects, for example) can incorporate bicycle or pedestrian improvements as standard practice. Both local and state BPMPs are opportunities to initiate policy change and serve as preparation for new funding measures. Policy change can be observed at several levels. BPMPs may establish specifications or standard processes for design or construction (eg, “Director’s Rules,” binding rules concerning land use, construction, housing, and other codes administered by Seattle’s Department of Planning and Development), catalyze new funding sources to increase investment, enact local ordinances or policies, realize or support goals from other plans, fulfill a specific requirement identified in a regional or state policy, or codify and institutionalize at the local level the agreed-upon best practices as articulated in Federal agencies or national professional associations (eg, the AASHTO Pedestrian Facilities Guidebook).

Often, BPMPs respond to public demand for active transportation and focus on environmental changes such as bicycle lanes, the sidewalk network, and multiuse trails that support physical activity. Therefore, typically BPMPs are considered the territory of transportation planning. Research in the field of Active Living increasingly points to the need to consider physical and psycho-social changes that move beyond the walls of the transportation department. Changes in land-use policy, public safety, planners, parks and schools can all influence walking and bicycling. BPMPs, therefore, also provide an opportunity to examine and support increased participation and relevance of public health policy-making across functional departments, including parks, schools, police, transportation, and public health. In addition, BPMPs may fall short of their potential for policy change, functioning as project work lists (or “wish” lists), and perhaps lacking guidance for prioritization for funding. To the extent that BPMPs create a public process for considering public investment and community improvements, however, they are also ideal opportunities for identifying and pursuing supportive policy change. Because little is known about the places that have BPMPs in place, our research team embarked upon a study of the characteristics of these communities in several U.S. states.

Study Aims

This descriptive study aimed to provide a snapshot of BPMP characteristics and to better understand the demographic, social and transportation characteristics of communities with bike and/or pedestrian master plans. This study is part of a larger study to describe attributes of master plans and the process used to develop and implement these plans. The larger goal of this multisite study is to better understand master plans as a potential policy tool for promoting physical activity.

Methods

This study was conducted by the Physical Activity Policy Research Network (PAPRN), a consortium of 12 community-based, academic research centers from across the country. The PAPRN was established in October 2004 as a thematic research network of the national Prevention Research Centers program funded by Centers of Disease Control and Prevention. The goal of this network is to study policies that contribute to increasing physical activity in communities.^{25,26}

Conceptual Framework

Our study was guided by the socioecological model (SES) developed by McLeroy and colleagues.²⁷ In contrast to individually focused explanations of health behavior, this model explicitly incorporates social, physical and other environmental influences on health-related behaviors.²⁸ The model can be used to posit that economic and social policies to modify environmental factors may be a more effective means of increasing physical activity than just encouraging individual behavior change without consideration of the larger environment. Importantly, it also indicates clearly that policy-level change can influence all other levels of the model. In this model, the term policy itself entails formal and informal rules and standards that may be explicit or implicit and may include 3 levels: 1) formal written regulations, codes or decisions bearing legal authority; 2) written standards, statements, explanations, decisions, or unwritten professional standards that guide choices; and 3) unwritten social norms that influence behavior.²⁸ BPMPs, the focus of our study, predominately reflect the first type of policy listed above.

Sampling and Data Collection

To identify and select plans, researchers conducted an internet search of bicycle, pedestrian and transportation-related plans for participating states. State and regional transportation agency and planning web sites were also reviewed, along with referenced sites with lists of bicycle and pedestrian plans (eg, www.bicyclinginfo.org). Researchers supplemented internet searches by contacting state bicycle and pedestrian coordinators in each state to request information on other available plans or related types of planning documents.

From this universe of plans, 4 of the participating PAPRN sites aimed to sample all bike and pedestrians master plans in their state: California, Missouri, North Carolina, and Washington. These master plans focused on pedestrians, on bicycles, and on both bicycles and pedestrians. Several multimodal master plans were also included which address bicycle and pedestrian concerns. By sampling all plans in the state, each site attempted to capture plans that represented a range of urban/rural areas (including a mix of geographic regions throughout the state and population density), level of coverage (eg, state, county, municipality), demographics (income, education, and racial/ethnic minorities), travel characteristics (eg, bike, walk, car), and plan authorship (with or without a consultant). Plans were obtained from government or consultant's websites; in a few cases, hardcopies of the plans were mailed to the respective research center and scanned electronically.

Demographic and transportation data were also gathered about the geographical area of focus for each BPMP. Data sources included the U.S. Census Bureau²⁹⁻³¹ and the U.S. Department of Transportation.³² Census data were linked to each plan using the unique FIPS code for each state, county or place ("municipality"). Regional master plans were excluded from the analysis given the mismatch between regional boundaries and census data boundaries.

Analysis

Analysis was conducted using Stata 10.1. Descriptive statistics included frequencies and odds ratios. For the master plans, key variables of interest included attributes such as plan focus (eg, bike, pedestrian, bike/pedestrian or multimodal transportation), the year the plan was adopted, if the plan was new or revised, and whether consultants were involved in producing the plan. For the communities that master plans encompassed, variables included individual/household demographic factors (eg, median age), community demographic factors (eg, Gini coefficient, a measure of statistical dispersion that is most frequently used as a measure of income inequality); and transportation factors (eg, travel mode to work).

Results

A total of 294 BPMPs were examined. State-level plans were available for North Carolina and Washington; County-level plans were retrieved from 3 of the 4 sampled states (California, North Carolina and Washington); and place-level plans were included from all 4 participating states. (Table 1). Of the 294 plans, 237 (80%) were at the municipal ("place," representing a city or town) level (Table 2). Most plans focused on bicycling only; 183 (62%) fell into this category. Mixed bicycle and pedestrian plans were the second most common category; 55 (19%) had both bicycle and pedestrian components, while 45 (15%) were pedestrian only plans. Only 8 (3%)

Table 1 Total Number of State, County, and City Plans, by Participating States

State	Total number of plans	Number of state plans	Number of county plans	Number of place plans
California	191	0	44	147
Missouri	4	0	0	4
North Carolina	71	1	4	66
Washington	28	2	6	20
Total	294	3	54	237

Table 2 Attributes of Master Plans, by Master Plan Level (n = 294)

Plan level	State (N = 3)	County (N = 54)	Place (N = 237)
Focus of master plan, count (%) ^a			
Bicycle-only plan	0 (0%)	41 (75%)	142 (61%)
Pedestrian-only plan	0 (0%)	3 (5%)	42 (18%)
Bicycle and pedestrian plan	3 (100%)	9 (16%)	43 (18%)
Multimodal transportation plan	0 (0%)	2 (4%)	6 (3%)
Other plan characteristics			
Years plans adopted, range	1996–2008	1977–2008	1974–2008
Master plan			
New master plan, count (%)	0 (0%)	1 (2%)	15 (6%)
Had previous plan, count (%)	1 (33%)	4 (7%)	4 (2%)
Unknown or No previous plan	2 (66%)	49 (91%)	218 (92%)
Involving consultants, ^b count (%)	1/3 (33%)	1/54 (2%)	53/237 (22%)

^a Some geographic areas have multiple master plans (eg, Alameda County, CA has both a bicycle-only plan and a pedestrian-only plan).

^b Involving consultants, denominator = eligible and not missing consultant variable, so N may be less than total.

plans were part of larger multimodal transportation plans. Municipalities and counties began implementing BPMPs earlier than states. Most of the BPMPs were de novo documents rather than replacements for existing plans (Table 2), though many plans did not provide information on whether the plan was new or revised.

The demographic profile of the sampled locations with BPMPs is comparable to the overall U.S. population (Table 3). For example, the median age of 36.7 years in the U.S. is similar to the median ages of 35.3 to 35.5 for states, counties and places with BPMPs. One-third of the populations in the U.S. overall and in the counties and places with BPMPs consist of persons of color, while the 2 states with BPMPs reported lower rates of one-quarter. States, counties and places with BPMPs also reported a similar median income (roughly \$46,000), percentage of residents living below the federal poverty line (12.5%), and proportion of adults age 25 and older with a high school degree or equivalent (80%). (U.S. Census Bureau, 2000a) The degree of income inequality or dispersion for the states and counties examined, as measured by the Gini coefficient, is close to the US average of 0.46.³¹ However,

the degree of racial diversity in sampled states (0.41) and counties (0.34) is less than the US average of 0.49.³⁰ A slightly higher percentage of the population at the study sites walks to work than the US average of 2.5% and the percentage without a vehicle at the study locations was similar to the U.S. average of 8%.³²

The length of master plans ranged from 8 to more than 200 pages, with most plans falling between 50 and 150 pages. Master plans were typically prepared by government agencies, advocacy groups, and/or special commissions or boards convened to prepare the plans. The use of consultants to help prepare plans has become increasingly common, as can be seen in the fact that 33% of state plans and 22% of place-level plans involved consultants.

When comparing bike and pedestrian master plans, several differences were striking. Places with pedestrian master plans had a lower median income (\$37,974 vs \$49,870), less diversity (.33 vs .49), lower percentage of people of color (.32 vs .42), and fewer bike and public transit commuters than those with bicycle master plans. Places were similar however for the percentage of adults

Table 3 Attributes of Demographic and Commuting Factors, by Geographic Level (N = 268 Unique Locations), Compared With the Overall U.S.

	State (N = 2)	County (N = 49)	Place (N = 217)	U.S. (approximate)
Individual/household census data				
Median age, mean (range)	35.3 (35.3–35.3)	35.5 (29–44.6)	35.4 (21.4–67.6)	36.1
People of Color, % (range) ^a	25.4 (21.1–29.8)	34.7 (0.9–80.0)	36.9 (0.1–99.2)	33
Adults with HS diploma, % (range)	82.6 (78.1–87.1)	79.9 (59–91.2)	81 (37.1–98.8)	80
Median HH income, mean (range)	\$42,480 (\$39,184–\$45,776)	\$44,724 (\$29,627–\$74,335)	\$48,225 (\$19,681–\$126,740)	\$46,000
Individuals living in poverty, % (range)	10.6 (8.2–12.9)	11.9 (4.2–24.5)	12.2 (1.5–35.6)	12.5
Community demographics				
Population Density, mean (range) ^b	.10 (.02–.29)	.21 (.04–.68)	1.3 (.02–7.98)	Not available
Gini coefficient, mean (range) ^c	.45 (.44–.46)	.44 (.39–.50)	Not available	.46
Diversity Index, mean (range) ^d	.41 (.37–.46)	.34 (.17–.54)	Not available	.49
Transportation				
Travel mode to work				
Walk, % (range)	2.6 (1.9–3.2)	3.0 (0.8–7.2)	3.5 (0.0–50.9)	2.5
Bike, % (range)	0.3 (0.2–0.6)	0.9 (0.0–7.5)	1.0 (0.0–21.2)	0.4
Car, truck, or van, % (range)	89.8 (86.1–93.4)	88.5 (76.2–96.4)	87.3 (29.2–98.1)	87.7
Public transportation, % (range)	2.9 (0.9–4.9)	2.4 (0.0–10.6)	3.3 (0.0–3.1)	4.7
Households without a vehicle	7.5 (7.4–7.5)	7.3 (4.6–11.1)	8.7 (0.7–32)	8

^a The People of Color is defined as the percent of individuals who identified as 1) any race except White or 2) Hispanic/Latino.

^b The Population Density is calculated by the number of persons divided by the land area per square mile. Does not include CA county-level data.

^c The Gini coefficient is a measure of inequality of income or wealth distribution. It is expressed as a ratio of 0–1, with higher numbers suggesting more inequality.

^d The Diversity Index is the percent of times 2 randomly selected people would differ by race/ethnicity. It is expressed as a percentage from 0–1, with higher numbers signifying more diversity. The U.S average is 0.5.

with high school diplomas and proportion of people that walked to work, when comparing municipalities with master plans to promote biking with those to promote walking.

Conclusions

Our review of a sample of bike and/or pedestrian master plans and demographic data suggests several trends. First, master planning in this realm appears to have started as a local phenomenon, with plans for cities or towns (as opposed to counties or states) arising sooner than at the county or state level. In addition, we were surprised to observe that this sample of communities with plans had a similar profile to the national averages on demographic and commuting data; our original assumption had been that plans would have been overrepresented in more affluent areas. The fact that this planning process is occurring locally in communities with modest socioeconomic profiles lends support to the notion that BPMPs could be spread to communities throughout the country.

In addition, there were far more bike plans than pedestrian master plans. One possibility for why this

occurred may be that BPMPs evolved from motorized transportation plans and biking is less of a leap for planners than walking, as bicycle planning involves many elements such as roadways and traffic signals that are similar to planning for motorized vehicles (whereas pedestrian planning involves evaluation of walkability issues, such as neighborhood density, and the presence of shopping or other destinations in addition to street layout). The large number of bike master plans may also reflect additional funding available for developing and implementing these plans. There may also be more bicycle advocacy groups, or those that are more vocal and proactive. Additional research would be needed to identify the reason for this discrepancy between bike and pedestrian master plans. The relative infrequency of pedestrian plans is an important issue for public health given that daily walking is probably the more important determinant of societal health because it is accessible to nearly everyone and can be done as part of a wide variety of activities.^{33,34}

While limited information is available on the impact of BPMP's, we have anecdotal information from 12 key informant interviews that collected information in

2008 from stakeholders involved in developing and/or implementing master plans in Washington State. Respondents believed that BPMPs were important for helping communities make the best use of their resources and provided a systematic guide for doing so. Stakeholders indicated that while master plans, per se, will not make direct impacts, several planning components provide necessary elements that can serve as a foundation for community action (eg, engagement of effective citizen groups, implementation of new laws and regulations, and involvement of engineers and public works departments). Participants also suggested training people at all levels of plan implementation, beginning with the easiest projects first to demonstrate BPMP capabilities and successes. That said, there are communities across the U.S. with master plans gathering dust on shelves, and, conversely, places that promote biking and/or walking effectively without having plans in place.

This study addresses several high feasibility/high significance areas identified by the PAPRN concept mapping exercise to determine a physical activity policy research agenda³⁵ (eg, to assess how city planning impacts the built environment and the promotion of physical activity, to assess the types of policies [zoning] that are most influential in affecting the built environment, and to understand the barriers to implementing policies that promote walkable communities). Yet this preliminary, descriptive research has several limitations, including the lack of a random sample and the lack of control communities without BPMPs. By merging state data together we may also have been masking differences within states. Given our modest budget to conduct this research, we chose to include those states where we aimed to capture all plans so as not to introduce bias into the analysis. In addition, our work cannot address the question of whether master plans actually succeed as policy tools to promote physical activity. For example, while local governments use master plans to guide the development of the built environment, these documents are rarely legally enforceable²⁴ and so may not strongly influence actual levels of physical activity. Further research would be needed to explore the correlation between BPMPs and physical activity. Lastly, planning to promote biking and walking can also be done through other planning documents, such as greenway plans, comprehensive transportation plans; our analysis does not account for these plans.

While this study gave us a snapshot of what the BPMP's and the communities with master plans look like, we are currently conducting a content analysis of plans to identify general plan information, plan components and presentation style, the planning process and public engagement for developing the plan, goals and objectives, current conditions and trends, policies and proposals, implementation plan, and information on funding and evaluation of the plan. This larger study will provide important information on what these plans include, and provide model language for communities interested in creating BPMPs. We know that in the United States the frequency and intensity of walking and biking falls short of the levels needed to meet recommendations around daily moderate or vigorous physical activity.⁷ Recent

legislative reports from 2006 indicate that 11 states introduced legislation to address access to safe walking and biking, of which master planning is one avenue.³⁶ This descriptive study is encouraging in that it shows that BPMPs can be adopted by US communities, counties and states with varying economic, geographic and climatic profiles. However, the question of how BPMPs across various settings can be optimally structured to promote physical activity still needs to be answered.

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