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# Land Use and Transportation Planning to Promote Physical Activity in North Carolina

*Semra A. Aytur, Ph.D.*

*With national and state agencies as well as leading public health foundations providing impetus, efforts to improve the understanding of policy and environmental attributes that may support active lifestyles have become a promising area for collaboration between planning and public health professionals. This article highlights the results of work performed at the University of North Carolina at Chapel Hill examining the relationship between planning policies and physical activity and the prevalence of land use policies and implementation tools that might support the viability of non-motorized modes. With the hope of bridging research and practice, it discusses findings most relevant to planners interested in the broader health-related applications of their work.*

In response to escalating trends in obesity, diabetes, and related medical expenditures, the U.S. Surgeon General's Report on Physical Activity and Health recommends that Americans incorporate daily physical activity into their lives (U.S. Department of Health and Human Services 1996). Recognizing that health promotion requires both individually-oriented and community-based approaches, the Centers for Disease Control and Prevention (CDC) recently initiated the Active Community Environments (ACEs) program to promote policy and environmental interventions that create more accessible places for physical activity. With national and state agencies as well as leading public health foundations providing impetus, efforts to improve the understanding of policy and environmental attributes that may support active lifestyles have become a promising area for collaboration between urban planning and public health professionals.

## **Background: Relationships between the Built Environment and Physical Activity**

Prior research in the public health/urban planning fields has shown that activity-friendly environments depend upon appropriate integration of land uses and transportation infrastructure, including higher densities, a mix of residential and commercial land uses, safety measures such as traffic calming, and connected systems of sidewalks, bicycle paths, greenways, and transit. Residents of communities with higher density, greater connectivity, and more mixed land use report higher rates of walking and bicycling for utilitarian reasons compared to residents of low-density, poorly connected, and single land use areas (Frank, 1995; Handy, 2001; Ewing, 2001; Boarnet, 1998; Boarnet, 2001). Other researchers

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have reported a positive relationship between the number of places to exercise and the likelihood of meeting public health recommendations for physical activity (Parks, 2003). Prior research also suggests that transit users may be more likely to walk or bicycle compared to those who do not use public transportation (Cervero, 1996; Pucher, 2003).

Although the research to date has focused primarily on micro-level features of the built environment that may promote activity-friendly environments (Frank, 1995; Handy, 2001; Ewing, 2001; Boarnet, 1998; Boarnet, 2001; Atkinson, 2005), city and county land use and transportation plans may also play a role in facilitating supportive environments for physical activity. Because land use plans provide long-range guides for the location, design, density, rate and type of development within a community, planning scholars have suggested that land use plans should contain policy statements on both land development and transportation improvements related to such development (Kaiser, 1995).

Although limited empirical evidence exists regarding whether specific attributes of land use and transportation plans are associated with physical activity, several recent studies have reported associations between physical activity and features of urban form. Ewing (2003) and McCann (McCann & Ewing, 2003) made the connection between health outcomes and urban sprawl scores, derived from a series of factor analyses that identified measures of residential density, street connectivity, strength of centers, and land use mix. After controlling for demographic and behavioral covariates, results showed that minutes walked, body mass index (BMI), and hypertension were significantly associated with sprawl at the county level. Individuals living in sprawling areas were more likely to report weighing more, walking less, and having a higher prevalence of hypertension than those living in compact areas.

Other researchers have shown that more compact urban forms (Ewing, 2003; Saelens, 2003), mixed land uses (Frank, 2004), pedestrian infrastructure (Rodriguez, 2004), and open space (Giles-Corti, 2002; Zlot, 2005) are associated with increased physical activity; these attributes can be directly or indirectly influenced by planning. Thus, planners' decisions may play an important role in promoting community health.

### **Study Objectives**

The purpose of this study was to examine relationships between land use and transportation policies and physical activity in a representative sample of North Carolina counties from 2000 to 2003. As a rapidly growing state with considerable geographic variation in physical activity, North Carolina was particularly well-suited for a study of land use planning factors that might support activity-friendly environments. The proportion of North Carolina residents reporting no leisure-time physical activity varied substantially across different counties, ranging from 18.4 percent to 40.9 percent in 2002, compared to the national average of 25.3 percent (North Carolina Center for Health Statistics, 2002). The Southeastern U.S. also witnessed the greatest increases in obesity from 1991 to 2002 compared to the rest of the nation.

This research focused on coordination between non-motorized transportation improvements (NMTI), such as sidewalks, bicycle paths, greenways, and pedestrian ways, and land use policies that might support the viability of non-motorized modes. These policies included: designated growth areas, concurrency requirements, impact fees, transfer/purchase of development rights, land trusts, capital improvement programs, planned unit developments, and site design guidelines.

## **Methodology**

Analyses relating plan attributes to physical activity were performed at the county level, since this was the scale at which data from the planning survey could be linked to public health data with sufficient sample size. Information on physical activity was obtained from the Behavioral Risk Factor Surveillance System (BRFSS), a population-based, random-digit-dialed telephone survey of the civilian, non-institutionalized adult population maintained by the Centers for Disease Control and Prevention.<sup>1</sup> Several physical activity variables were derived from the BRFSS, including the proportion of the population in each county that reported no leisure-time physical activity in the past month, the proportion reporting walking or bicycling for leisure (recreational) purposes in the past month, and the proportion that reported walking or bicycling for transportation in the past week. Planning data from each county was linked with epidemiologic physical activity data on approximately 6,700 North Carolina adults.

### *Data Collection*

When this study first began, very little data existed regarding current land use and transportation practices in the state. The researcher utilized material from work performed by professors in the Department of City and Regional Planning (DCRP) at the University of North Carolina to examine the connection between land use and transportation in land use plans (Rodriguez, 2004). The DCRP project was designed to better understand how land use policies and implementation tools are being used by county and municipal governments in North Carolina and the degree to which such plans account for the effects of transportation projects. The premise was that local development plans should address the reciprocal relationship between future land uses and transportation infrastructure and services in the area. While separate transportation or thoroughfare plans may exist, such separation should not preclude land use plans from

accounting for the connections between planned transportation investments and land development.

As part of the DCRP project, a survey was mailed to directors in all 100 North Carolina counties and to 64 municipalities with greater than 10,000 residents. Responses were received from planners in 80 counties and 47 municipalities, a response rate of 77 percent. The impressive response rate suggests a high level of interest on the part of planners regarding this topic. Planners were asked to describe specific elements of land use and transportation plans in their communities, as well as the extent to which various implementation tools were currently being used to manage the location, character, and timing of land development. Planners were also asked to report if specific transportation improvements were included in the land use plan. In addition to the survey, a detailed content evaluation was conducted on a subset of 30 plans to examine goals and policies relating to the connection between land use and transportation in more detail.

## **Results**

The following section highlights key findings from two related projects: 1) the DCRP study of the connection between land use and transportation in North Carolina, and 2) the researcher's dissertation research relating specific plan attributes to the prevalence of physical activity at the county level. Specifically, the researcher examined whether residents of counties with land use plans that included more comprehensive sets of implementation tools to guide land development along with non-motorized transportation improvements reported more physical activity compared to residents of counties without these plan attributes. Appropriate statistical techniques were used to account for sampling and for socio-demographic factors.

### *The Connection between Transportation and Land Use in North Carolina*

The connection between land use and transportation was examined by asking planners to report the extent to which their land use plans accounted for the future land development impacts of transportation improvements, and reciprocally, to what extent the land use plan accounted for the transportation impacts of land development. Sixty-nine percent of respondents reported that their land use plans accounted for land development impacts created by transportation improvements to some extent.

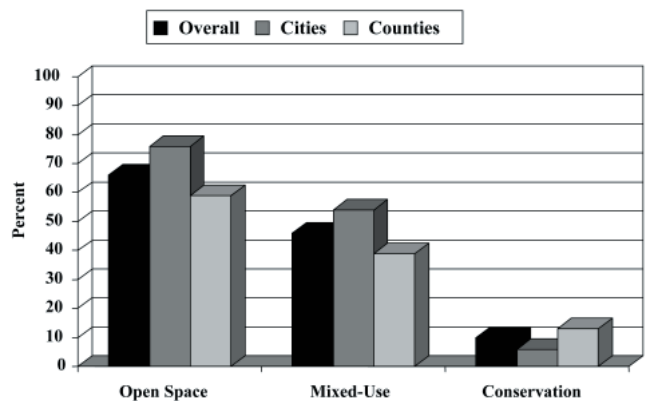
Planners were also asked about the extent to which the land use plan accounts for the transportation impacts of land development. Sixty percent of respondents reported that their plans account for the transportation impacts of land development projects to some extent. Respondents whose plans accounted for most or all transportation impacts of land development and, reciprocally, for most or all land development impacts of transportation improvements, were more likely to cite three or more implementation tools in their land use plans compared to those whose plans accounted for fewer impacts. Planners reporting stronger reciprocal accountability between land use and transportation projects were more likely to include non-motorized transportation improvements in their land use plans.

### *Prevalence of Plan Attributes that Support Physical Activity*

While the planning survey was not intended to provide detailed information on specific policies such as zoning and subdivision ordinances, it offers a broader view of the extent to which land use and transportation attributes supportive of physical activity are currently integrated within North Carolina land use plans.

Survey results suggest that 98 percent of municipalities and 77 percent of NC counties have land use plans to manage land development. The majority of these plans were developed over the last 10 years, but some plans were developed as early as 1974 and had not been updated since.<sup>2</sup> Of the jurisdictions having a plan, the vast majority (93 percent) had adopted it. Jurisdictions falling within a metropolitan statistical area (MSA), with faster growing populations, and with higher median income levels were more likely to have land use plans.

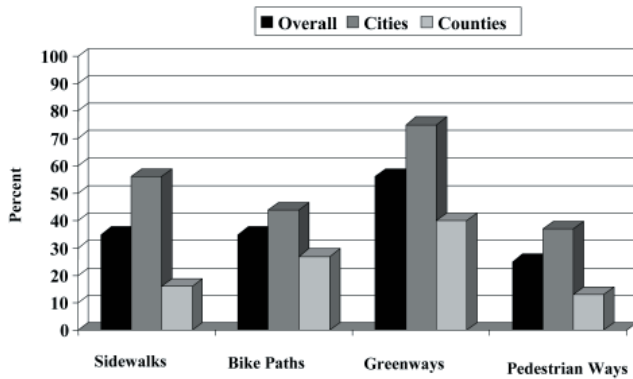
Figure 1 shows the percentage of North Carolina jurisdictions designating selected land use categories in their plans. Mixed land use, open space, and public parks have been associated with physical activity in the literature. Overall, approximately 66 percent of planners reported designating open space, 46 percent reported mixed land use classifications, and 10 percent reported conservation classifications.



**Figure 1: Selected Land Use Categories Designated in Land Use Plans**

Certain land use policies and implementation tools—such as designated growth areas, site design guidelines, capital improvement programs, and planned unit developments—were reported by approximately half of the planners. However, less than 20 percent of planners reported impact fees and land trusts; less than 10 percent reported concurrency requirements and transfer/purchase of development rights.

With respect to non-motorized transportation improvements, approximately one third of planners reported sidewalks and bicycle paths, while over 50 percent reported greenways (see Figure 2).



**Figure 2: Non-motorized Transportation Improvements in Land Use Plans, by Jurisdiction**

Planners were also asked to report whether any pedestrian or bicycle-oriented projects were currently funded in their communities. Fifty-nine percent of respondents reported having some type of non-motorized transportation projects funded in their communities. Sidewalks (41 percent), greenways (32 percent), and pedestrian crossings (31 percent) were the most frequently cited pedestrian/bicycle projects overall. Respondents from municipalities reported pedestrian/bicycle projects more frequently than respondents from counties, with the exception of Rails-to-Trails projects. However, 30 percent of municipal respondents and 48 percent of county respondents reported that there were no pedestrian/bicycle projects funded in their communities.

#### *Relationships to Physical Activity*

After linking land use and transportation plan attributes to physical activity prevalences, results suggest that residents of counties with land use plans that included non-motorized transportation improvements and more comprehensive sets of implementation tools to guide land development had significantly higher levels of physical

activity. These relationships remained statistically significant even after adjustment for socio-demographic factors such as education, income, age, gender, and employment status. Also, transportation-related physical activity and bicycling showed stronger relationships with coordinated land use and transportation planning compared to other types of leisure activities.

#### **Conclusion**

This study focused on coordinated land use and transportation planning as a means of facilitating activity-friendly environments. Over half of the residents of lower-income counties had no non-motorized transportation improvements and no supportive land use policies included in their land use plans. Yet, lower income populations may benefit the most from land use and transportation planning that supports walking and bicycling. Not only are these groups more likely to engage in physical activity for transportation purposes, they are also more likely to suffer from diabetes, cardiovascular disease, and other chronic health conditions associated with inactivity.

Even small increases in physical activity can substantially improve health and quality of life for most Americans. From a public health perspective, coordinated land use and transportation planning can play an important role in supporting public health goals. For example, Healthy People 2010 is a set of health objectives for the nation to achieve by 2010. One of the Healthy People 2010 goals is to reduce the percentage of people with no leisure-time physical activity to 20 percent or less (U.S. DHHS, 2000).

While we can not conclude from these cross-sectional analyses that land use and transportation planning can cause people to change their behavior, these findings suggest that counties that have adopted policies supportive of active lifestyles have a higher prevalence of both leisure-time and transportation-related physi-

cal activity. Better coordination between land use and transportation planning may play a role in promoting active community environments. The challenge will be for communities to utilize the planning process to encourage diverse public participation and to develop more comprehensive plans that may address the needs of different population subgroups. Continued collaboration between the fields of urban planning and public health may help to tailor interventions to meet the needs of particular communities, to reduce health disparities, and to make environments more amenable to healthy lifestyles.

### Acknowledgements

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## Endnotes

1. Information regarding the North Carolina BRFSS can be found at: <http://www.schs.state.nc.us/SCHS/brfss/questions.html>.
2. The results reported reflect planners' responses based on the plans existing in their communities in 2003. Several planners wrote that their plans were in the process of being updated, so different patterns might be observed if a similar survey were to be repeated in the future.