

UTC Project Information	
Project Title	MPC 488 – Effects of Infill Development and Regional Growth on At-Risk Populations’ Exposure to Traffic Density
University	University of Colorado Denver
Principal Investigator	Carolyn McAndrews Wesley Marshall
PI Contact Information	<p>Carolyn McAndrews Assistant Professor, Department of Planning and Design University of Colorado Denver Phone: (303) 315-0028 Email: carolyn.mcandrews@ucdenver.edu</p> <p>Wesley Marshall Associate Professor University of Colorado Denver Department of Civil Engineering Phone: (303) 352-3741 Email: wesley.marshall@ucdenver.edu</p>
Funding Agencies	USDOT, Research and Innovation Technology Administration
Agency ID or Contract Number	DTRT13-G-UTC38
Project Cost	\$120,000
Start and End Dates	October 1, 2013 to July 31, 2018
Project Duration	October 1, 2013 to July 31, 2018
Brief Description of Research Project	<p>Existing research demonstrates that at-risk populations—groups with demographic, economic, social, or physical characteristics who are disproportionately vulnerable to adverse health outcomes—are more likely to be exposed to heavy traffic and air pollution [1-10]. This disparity is a problem because numerous adverse health outcomes—including lung cancer, premature mortality, cardiovascular disease, respiratory disease and asthma, poor birth outcomes, and injury—are associated with living close to high-traffic roads and being exposed to high traffic density [11-17].</p> <p>However, to fully understand how exposure affects at-risk populations, we need to consider two inter-related issues. First, estimates of traffic exposure depend on the spatial scale of investigation. Disparities in traffic exposure identified in studies at the national level are often heterogeneous at a regional scale. For example, Rowangould (2013) found that low-income and minority households are, on average, more likely to live near high volume roadways; yet, there are counties “where no disparities are present, or where disparities work in the opposite direction” [18]. Therefore, to learn what mechanisms underlie disparities in traffic exposure, we must investigate this question at the regional level.</p>

The second issue is that the distribution of traffic density across a region is a function of transportation and land use policies and plans. “Smart growth” strategies, such as urban infill and open space protection, may increase population densities in areas with highest traffic density. However, these strategies may actually decrease disparities in exposure to traffic density if new residents in high-traffic areas are from higher income groups. Thus, older patterns in health disparities may no longer be true today. Integrating public health concerns into transportation and land use planning requires additional knowledge about the effects of such policies.

Research Question

Our research addresses these two issues and asks whether infill development in the Denver metropolitan region has resulted in changes in the exposure of at-risk populations to high traffic density. We will also examine whether regional conservation efforts and other smart growth efforts have played a role in these changes.

To answer this question, we use time series data representing travel and population over 1997-2010—a period of “smart growth” in the region. [19] The study uses exposure to traffic density as the primary metric to represent public health risk because it is widely used in epidemiologic studies as an indicator of exposure to air pollution and because it is related to various adverse health outcomes. In addition, transportation planning literature has linked traffic density to poor residential livability in neighborhoods, including barriers to transit access and physical activity. [20-22]

Significance of the Research

We know that the interaction of transportation and land use systems concentrates high traffic density in specific neighborhoods, with resulting transportation and public health consequences. But what we do not yet know, and need to better understand, is how smart growth policies affect the distribution hazardous and protective environments in regions. Moreover, it is important to understand how transportation and land use planning and policy making can be used to *reduce* health disparities. To advance research in this area, we must develop multilevel and longitudinal models that represent changes in both the built environment and in population health and exposure [23].

The Denver metropolitan region is an important case for such an analysis because it has experienced significant population growth and infill development over the past two decades, much of which has been centered near regional public transport investments. As a result, the Denver’s Regional Council of Governments (DRCOG) and non-profit organizations such as Mile High Connects and the Piton Foundation are monitoring the equity outcomes of these regional dynamics [24].

In addition to their relevance for local policy and planning, lessons from the Denver metropolitan region have implications for other regions seeking to manage the equity, environmental, and economic outcomes of growth. In particular, this case offers lessons relevant to other growing cities and micropolitan regions emerging across the West. Thus, findings from this regional analysis can be interpreted and applied in a variety of other contexts.

The transportation profession increasingly recognizes the linkages between transportation and public health. In January 2015, the Transportation Research Board approved a new Task Force with the goal of increasing the use of public health research in corridor design, operations, and management strategies [25]. The authors of this proposal have been involved in proposing and developing this Task Force and anticipate that it will be a forum for sharing the findings of this study. In addition, the new Task Force builds on current efforts by the U.S. Department of Transportation to develop a Health and Transportation Corridor Planning Framework, which is a step-by-step tool for integrating information about public health into corridor planning being piloted by five communities [26]. Our proposed research responds directly to these efforts because corridor planning is a smart growth strategy that we can address through this research project.

Research Objectives

Although “smart growth” regions may have lower air pollution emissions overall, increasing population densities imply higher exposure to localized concentrations of air pollution [27-29]. The gaps in our knowledge are how transportation and land use policies “pattern” this exposure and whether functional elements of transportation and land use systems, such as infill areas and arterial corridors, contribute to higher exposure among at-risk populations.

To answer these questions, the research is organized to accomplish three primary objectives:

1. Explore and test the following hypotheses about *who* in the Denver region is exposed to the highest traffic density, *where* these exposures are highest, and *whether smart growth strategies in the region explain patterns in disparities or equality*.

Descriptive hypotheses:

- H₀: At-risk populations (poverty versus non-poverty, Hispanic versus non-Hispanic, children and older adults versus adults, African-American versus white, deprived not deprived) have the highest exposure to traffic density in the city/county of Denver and throughout the region in 1997 and 2010.
- H₀: At-risk populations’ share of exposure to traffic density in infill areas decreases between 1997 and 2010, and it stays the same in non-infill areas between 1997 and 2010.

Explanatory hypotheses to test with statistical modeling:

- H₀: The change in share of at-risk populations’ exposure to traffic density between 1997 and 2010 at the regional level, and for the city/county of Denver, is due to smart growth policies, including infill development and conservation actions (i.e. it is not due only to overall increases in traffic density in the region).

2. Identify the critical land use and transportation policies that contribute to the patterns of exposure observed in the study.

	<p>3. Propose future integrated land use / transportation policies to promote equity in dense (urban) and low-density (ex-urban/regional) geographies.</p>
<p>Describe Implementation of Research Outcomes (or why not implemented)</p> <p>Place Any Photos Here</p>	<p>All global model variables for the Denver metropolitan region were significant; this is consistent with the results of previous studies, and reinforces the premise that minority and lower socioeconomic status in the U.S. is linked systematically to higher exposure to traffic. The global model showed that for the Denver metropolitan region, racial and ethnic minority residents, lower income residents, and residents without college education are significantly more afflicted by the nuisance of traffic than their white, higher income, and college educated counterparts. We found that poverty was the most consistent predictor of traffic density in the region.</p>
<p>Impacts/Benefits of Implementation (actual, not anticipated)</p>	<p>Our findings indicate that, regardless of cause, it is necessary for transportation and land-use decision-making to ameliorate differential exposures to traffic. The challenge, based on this analysis, is finding the appropriate scale of policy action. Certain underlying processes, such as the protective effects of suburban form, appear to be regional in scale and market-oriented. Other processes, such as redevelopment and transit-oriented development, are within the scope of local land use control. This represents an important step to better understand the spatial aspects of differential traffic exposure.</p>
<p>Web Links</p> <ul style="list-style-type: none"> • Reports • Project Website 	<p>http://www.ugpti.org/resources/reports/details.php?id=877</p>