

## Understanding the multiple dimensions of transportation disadvantage: the case of rural North Carolina



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### ARTICLE INFO

#### Article history:

Received 11 May 2015

Received in revised form 11 February 2016

Accepted 22 February 2016

Available online 27 February 2016

#### Keywords:

Transportation disadvantage

Rural mobility

Qualitative research methods

### ABSTRACT

Transportation disadvantage, which may be described in simple terms as a mismatch between the need for mobility and accessibility and the travel options available, often is assumed to correlate with certain socio-demographic characteristics, such as age (young and old), physical mobility, income, English proficiency, and vehicle access. This paper reports on a study that combined quantitative Census data with qualitative field data collected in interviews and focus groups, to better understand which individuals may in fact be transportation-disadvantaged, and which personal and household factors or environmental conditions correlate with concentrations of transportation-disadvantaged populations. In five rural counties of North Carolina, maps showing areas of elevated risk of transportation disadvantage were used in key informant interviews with planners and other transportation-relevant professionals, as well as in focus groups that probed the travel experiences and patterns of residents. Content analysis of interview and focus group data yielded insights into who is transportation-disadvantaged; what personal, household and environmental factors are notable; and what strategies they use to manage their travel needs. Qualitative data revealed populations not identified by Census data, and yielded rich and nuanced insights into how rural residents perceive their travel needs and habits and how they respond to limits on their mobility and access to routine destinations.

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### 1. Introduction

Approximately one-fifth of the US population lives in rural areas, according to the 2010 US Census. Compared to their urban counterparts, rural residents tend to be more dependent on automobiles, endure longer commutes, and have limited options for travel via transit or non-motorized modes (Mattson, 2012). Changing economic bases and land use patterns have left many rural areas facing dwindling employment opportunities and spatially dispersed goods, services, and worksites, requiring rural residents to travel even farther to meet routine needs. These challenges put many rural residents at a tremendous social and economic disadvantage. Such residents—most often the poor, the elderly and, increasingly, racial and ethnic minorities—may

struggle to get to work, medical appointments, a grocery store, and other essential destinations, and often must rely on family, friends, neighbors, or associates for travel.

In this paper, we use the term *transportation disadvantage* (TD) to describe barriers or limits on access to participation in essential activities outside the home, including employment, education, shopping, recreation, socializing, and health care. Consequences of TD—and related mobility-based social exclusion—have been well documented (e.g., Currie et al., 2009; Lucas, 2012; Power, 2012; Stanley et al., 2011). Researchers across academic fields have also found connections between transportation disadvantage and intergenerational poverty (Chetty et al., 2015), obesity and chronic disease (Frank et al., 2006; Wright, 2008), and diminished quality of life (Kolodinsky et al., 2013). However, development of cost-effective solutions to address transportation disadvantage has been hampered by a lack of understanding of the complex travel needs of at-risk populations, particularly in rural areas.

This paper describes the results of exploratory research conducted in five rural counties in North Carolina. The objective of this research was to develop and apply a method of combining Census data with qualitative field data to (1) improve

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understanding of transportation disadvantage and unmet travel needs and (2) to identify strategies adopted by rural residents to cope with or overcome transportation barriers.<sup>1</sup>

Transportation disadvantage and the burden it may place on individuals are of interest for several reasons. First, federal laws, including Title VI of the 1964 Civil Rights Act (which bars discrimination based on race, color or national origin) and Executive Order 12898 of 1994 (which protects minority, low-income, and low English proficiency individuals), among others, dictate that all transportation projects must be reviewed for the potential for disproportionately high and adverse effects on certain populations.

In addition, public service and social inclusion are stated goals—as well as a professional point of pride—for most transportation planners and agencies. While the goal of serving the traveling public, particularly those with high unmet need, is nearly universal among transportation planners and other public servants, knowledge about the extent and location of those needs remain somewhat elusive (Karner and Niemeier, 2013).

Transportation planning and investment decisions generally rely on *a priori* determinations of need based largely on socio-demographic characteristics. However, while socio-demographics profoundly influence the risk of experiencing TD, transportation disadvantage actually arises from mismatches between individuals' travel demand—determined in part by socio-demographic characteristics—and the options available to meet that demand. Transportation options are, in turn, influenced by land use patterns, built environments, transportation infrastructure, and public transit services, as well as individuals' abilities to exercise those options. Thus, socio-demographic characteristics are one set of many interacting factors that enter into the transportation disadvantage puzzle. However, there has been limited empirical research on transportation disadvantage that attempts to take all of these factors into consideration, and little knowledge on how these factors interact in a rural setting. The present study begins to address these gaps by combining qualitative data from key informant interviews and focus groups with Census data and maps to explore the socio-demographic and environmental characteristics associated with transportation disadvantage in five rural North Carolina counties.

## 2. Literature review

Transportation disadvantage has been addressed in literature across a range of disciplines, including travel behavior and its correlates with built and physical environment; transportation infrastructure, operations and services; transportation investment and technical planning processes; health dimensions of travel behavior and transportation systems; and others.

Both the literature and prevailing practice identify certain socio-demographic characteristics that make people more likely to be transportation-disadvantaged. These include:

- People too young or too old to drive
- Low-income households
- LEP (low English proficiency) households
- Minority households
- Immigrants
- Households without reliable motor vehicles
- People with physical or cognitive mobility impairments

The impacts of environmental factors and transportation infrastructure and services on travelers may be moderated or compounded by the characteristics of those travelers. That is, people already at risk for disadvantage by virtue of socio-demographic characteristics such as age, poverty, language ability or physical condition may particularly struggle to gain access to key destinations when the environment includes distant and separated land uses, with few options to connect them to those destinations (Currie et al., 2009; Lucas, 2012). Public transportation is particularly limited in rural areas, where people are often older, less healthy, and less affluent than in urban areas, and where transportation agencies deal with managing the tension between goals of providing adequate coverage to meet need against providing only those services that will generate reasonable farebox receipts to partially cover costs (Walker, 2008).

The conceptual and practical distinction between mobility (the capacity and operations to move people and freight across space) and accessibility (to allow people to access the goods, services and activities they value) plays out in the interplay between the personal and household characteristics of travelers, and the environments they inhabit and move through. Several recent studies have attempted to bridge the gap in our knowledge about the supply-side factors leading to transportation disadvantage (for example, Apparicio et al., 2008; Apparicio and Seguin, 2006; Casas et al., 2009; Scott and Horner, 2008).

Most of the existing literature seeks to quantify transportation disadvantage using standard measures of land use patterns, transportation infrastructure, and transit services. However, no single standard exists for what level or quality of transportation options would be adequate or equitable across geographic regions or across various populations (Farrington and Farrington, 2005). Particularly in rural communities, it is not clear what aspects of transportation options are relevant to travel decisions, and for whom, thus raising questions about the validity of the quantitative measures used to assess transportation disadvantage. Furthermore, there is limited empirical research available on how relationships between socio-demographic and environmental characteristics may relate to *consequences* of transportation disadvantage, such as diminished ability to obtain and keep employment, reduced participation in social and recreational activities, or poorer overall health and well-being.

The goal of the present study was to examine, through interviews, focus groups, and mapping exercises, how socio-demographic characteristics, land use patterns, transportation infrastructure, and public transit services—as well as interactions among these factors—affect transportation disadvantage among rural residents. In the absence of empirically validated quantitative measures of transportation disadvantage, we rely on a qualitative research design that allows for nuanced exploration of the many factors thought to contribute to transportation disadvantage, from the perspective of local experts and individual travelers.

## 3. Methods

We conducted interviews with key informants and convened focus groups in each of five rural counties in North Carolina. Key informants provided insights into the particular kinds of transportation challenges in a community as informed by professional training and experience, while focus groups elicited personal attitudes and experiences typically faced by people in the communities in which they live or work. Key informants included local planners, elected officials, social service workers, and those in similar professions who, due to their knowledge and experience, can “speak for” a community. By contrast, focus groups allowed a small group of people from the community to speak for themselves. We conducted a total of 33 interviews with 47 key

<sup>1</sup> The development of the research method is described in detail in Shay et al. (under review); the current paper focuses largely on the results of the research effort.

informants and conducted eight focus groups with a total of 110 participants across our five study counties (Tables 1 and 2).

### 3.1. Site selection

The five sites were selected from across North Carolina out of a candidate pool of 14 counties (Fig. 1). The sites, selected in part because of interest among community partners to participate, vary in geography and climate, in rural character, and in socio-demographic profiles. For a full description of the site selection process, the reader is referred to the companion piece by Shay et al. (under review).

The sites vary in population, from 8,861 people in Graham County to over 81,000 in Wilson County, and in racial diversity, which ranges from 10% (Graham County) to over 62% nonwhite (Warren County). The five counties have a greater percentage of the population 65 years of age and older (ranging from 14% to 20%) than the state as a whole. Of the five counties, only one (Chatham) has a median household income greater than the state median and a poverty rate below that of the state.

### 3.2. Key informant interviews

The goal of the interviews with key informants was to solicit their expert knowledge of local transportation patterns, problems, and concerns. Using a snowball sampling technique whereby initial contacts provide names of additional contacts, we identified local stakeholders knowledgeable about the transportation supply and services in their communities and about instances of unmet transportation demand.

Key informants were drawn from a wide range of professions, and included representatives to Councils of Governments, economic development professionals, emergency managers, community planners, health and human service employees, social workers, elected officials, police officers, citizen advisory committee members, human relations officers, councils on aging members, adult education coordinators, and transit directors.

We interviewed key informants individually or in small groups, using a semi-structured interview instrument that was reviewed by the UNC-Chapel Hill Institutional Review Board. The interviews were conducted on-site and lasted about 45 min. Each interview was audio recorded, transcribed, and then loaded into Atlas.ti 7 for content analysis. Using a grounded theory approach, we conducted a mixed inductive-deductive content analysis. In the first stage, the lead researcher coded all interviews and generated 80 initial codes. The research team reviewed the initial list of codes and reduced them down to a parsimonious set of 30 codes. Each code represents a particular topic or theme that emerged from key informants' comments. Codes included, for example, words or phrases such as "transit supply," "isolation," "long distances," and "access to transit."

In the second stage, the remaining four team members worked independently to code the complete set of interviews using the reduced set of codes. Five of the interviews (approximately fifteen

percent) were randomly selected for double coding. Krippendorff's alpha = 0.84, indicating high intercoder reliability, so the remaining 29 interviews were single-coded. More detailed descriptions of the interview and analysis processes can be found in Shay et al. (under review).

### 3.3. Focus groups

The focus groups were intended to reach a diverse set of residents and to engage certain groups that key informants considered important, underserved or unique, rather than to represent a random cross-section of each county's population. Key informants were instrumental in identifying and assisting with recruitment of focus group participants. Participants were drawn from a wide range of communities, including:

- Citizens of the Eastern Band of the Cherokee Nation (Graham County)
- Senior citizens (Graham County)
- Residents of Soul City (a community created as part of HUD's Model City program in the 1970s; Warren County)
- Seasonal guest workers (Wilson County)
- Transit passengers commuting to a major employer (Chatham County)
- Participants attending a public rural planning workshop (Chatham County)

We conducted two additional focus groups in Wilson and Beaufort County that, inadvertently, were dominated by professionals working in the fields of transportation, emergency management, and/or social service.

Focus groups were conducted at a location familiar and convenient to the participants. They typically lasted about an hour, starting with an ice-breaking activity in which we asked participants to draw out their travel routines on a small map. This led into a facilitated group discussion about travel conditions and challenges, and ended with some parting written questions and comments.

Information derived from the focus groups was qualitatively different from key informant interviews in two aspects. First, focus group participants were generally not transportation or social service practitioners, with perspectives informed by professional training and experience, but rather lay individuals sharing personal experiences and opinions. Second, we did not record the focus groups, by choice, to keep the setting anonymous, informal, and non-threatening. The resulting data included easel sheets and handwritten notes about the discussion, along with the paper maps used as a warm-up exercise. Because of the smaller sample size and informal nature of the focus groups, we rely on information gleaned from these activities to add context and to corroborate the findings from the key informant interviews only. We summarize below the results from the interviews and focus groups.

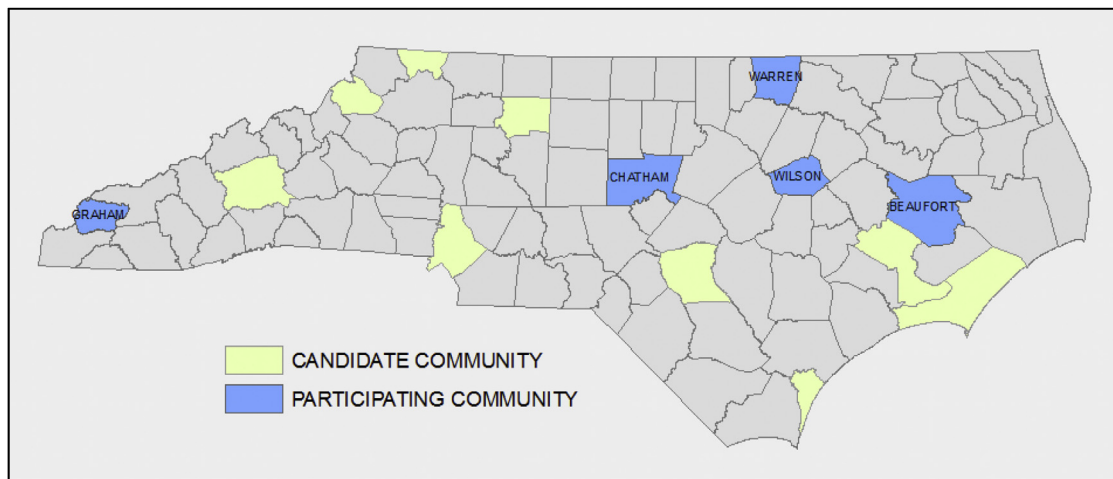
**Table 1**  
Number of participants by county.

County	Key informant interviews conducted	Key informants participating in interviews	Non-expert focus groups conducted	County residents in focus group
Beaufort	8	13	1	12
Chatham	9	10	2	4; 6
Graham	4	5	2	12; 30
Warren	6	7	1	13
Wilson	6	12	2	3; 30
<b>Total</b>	<b>33</b>	<b>47</b>	<b>8</b>	<b>110</b>

**Table 2**  
Socio-demographic characteristics of participating counties.

Socio-demographic measures	Beaufort	Chatham	Graham	Warren	Wilson	NC
<b>Population</b>						
Total population	47,759	63,505	8,861	20,972	81,234	9,535,483
Population density (persons/mi <sup>2</sup> )	58	93	30	49	221	196
Population change (2000–2010)	6.20%	28.70%	10.90%	5.00%	10.10%	18.5%
American Indian	0%	0%	6%	5%	0%	1%
Asian	0%	1%	0%	0%	1%	2%
Black	25%	13%	0%	52%	39%	21%
Hispanic	7%	13%	2%	3%	10%	8%
White	66%	71%	90%	38%	49%	65%
Under 18	22%	22%	22%	20%	25%	24%
65 or over	18%	18%	20%	19%	14%	13%
<b>Income and poverty</b>						
Median household income (2010)	\$38,194	\$53,958	\$31,863	\$32,574	\$36,645	\$43,417
Poverty rate (2010)	21%	14%	23%	27%	23%	17%
<b>Health</b>						
Physicians, per 10,000 population	15	6.6	3.4	1	15.1	21.7

Source: NC Rural Center, 2012. All figures are for 2010.



**Fig. 1.** Study sites.

## 4. Findings and discussion

Key informants provided insightful comments on their local populations and environments. Similarly, the focus groups provided rich information about local transportation needs and gaps, from the perspectives of residents themselves.

### 4.1. Key informant interviews

#### 4.1.1. Overview of the main themes

The themes that emerged from the key informant interviews are presented in Table 3, listed in order of the number of times they appeared in the interviews. This list should not be considered a ranking of the importance of themes discussed by key informants, as the interview instrument was designed to elicit responses on certain themes. For example, one interview question probed the topic of access to destinations; another question asked informants to comment on the relevancy of transportation disadvantage maps derived from Census data. Thus, given the inevitable bias in code frequencies, this list is meant to serve as a starting point for discussion, rather than a definitive ranking of factors that influence transportation disadvantage. Only codes occurring multiple times are listed in Table 3.

As we would expect given the interview prompts, the most common themes observed in our interviews included *pedestrian/bicycle*, *social vulnerability*, *planning & governance*, and *transit supply*. A majority of respondents also discussed ways people have learned to cope with deficiencies in the transportation options available to them; these comments we coded as *informal solutions*. *Long distances* was a dominant theme as well, which is not surprising given the sparsely developed nature of the counties studied.

One interview question was intended to elicit comments about deficiencies in access to destinations. The most common theme generated from this question involved *access to health care*, particularly among respondents employed in public health, senior services, and social services fields. Less commonly, respondents also discussed challenges in accessing employment, services and amenities, and school.

#### 4.1.2. Identifying potentially transportation-disadvantaged populations in rural areas

The literature identifies social vulnerability based on characteristics such as age, income, English proficiency, disability, minority status, and (lack of) car ownership. In addition to these groups, our research revealed pockets of transportation disadvantage among people or groups that otherwise might be missed by traditional

**Table 3**  
Frequency of codes.

Code	Freq	Includes discussion of . . .
Pedestrian/bicycle <sup>a</sup>	102	Issues related to travel by foot/bike (e.g. planning, safety, facilities)
Social vulnerability <sup>a</sup>	83	Populations <i>traditionally</i> considered at risk of TD (see list in Section 2)
Planning & governance	79	Processes/responsibilities of government entities with regards to transportation planning and/or allocation of resources
Transit supply <sup>a</sup>	73	Availability of transit (e.g., buses, paratransit, rural transit services)
Informal solutions	66	Informal/self-organized transportation (e.g., carpooling, unlicensed taxis, employer-provided, private transportation, private ferries)
Long distances <sup>a</sup>	48	Length of travel distance required to reach key destinations
Access to health care <sup>a</sup>	41	Ease/difficulty of access to health care or allied health services
Built environment	36	Sprawl, density, urban form, land uses, land use change
Challenges of paratransit	35	Specific challenges faced by paratransit users (e.g., fares, time cost, use restrictions); includes utility of service
Access to amenities	34	Ease/difficulty of access to discretionary activities (e.g., shopping, services)
Community resources	30	Community capital, local govt. budgets, public access to funding sources
Access to work <sup>a</sup>	29	Ease/difficulty of access to work or major employment places
Politics	28	Tensions among constituents (e.g., been-heres vs. come-heres, political differences)
Cost of travel	27	Household/individual travel expenses; includes monetary and time costs
Transit demand	27	The number of people using or desiring transit service and implications for service providers
Map	25	Utility and/or appropriateness of td map; includes critique
Decline	21	Economic contraction/depression and/or population decline
Map: agreement <sup>a</sup>	20	General agreement with accuracy of TD map
Geographic barriers	18	Geographic features impeding travel (e.g., rivers, mountain ranges)
Demographic changes <sup>a</sup>	18	Any changes in the sociodemographic makeup of the community
Isolation	17	Individuals' lack of ability to participate in community/social life
Wealth gap	17	Differences between rich and poor, esp. regarding public spending
Access to school <sup>a</sup>	16	Ease/difficulty of access to any kind of educational facility
Connections & corridors	16	Heavily used travel routes; popular ways of accessing destinations
Economic development	16	Positive growth or development of the local economy (either realized or intended); includes job creation
Map: mixed feelings <sup>a</sup>	13	Ambivalence or uncertainty with respect to accuracy of TD map
Hazards	13	Natural or manmade hazards/disasters and their effect on mobility
Transit challenges	13	Challenges faced by users of traditional transit (e.g., fares, time cost); includes use and utility of service; excluding paratransit
Nontraditional vulnerability	12	Populations not traditionally considered by DOT/federal government to be at risk of TD (e.g., community college students, migrant workers)
Rural self sufficiency	11	Pride in ability to 'make do' or not need public services
Trip chaining	11	Travel for multiple purposes, whether positive (reflecting opportunities for efficient travel) or negative
Road conditions	10	Unpaved, poorly maintained, and/or dangerous roadways or bridges
Rural vs urban	7	Urban or rural bias in TD maps
Community identity	6	The sense of place or character of the community
Map: disagreement <sup>a</sup>	6	General disagreement with accuracy of TD map
Marketing transit	6	Efforts to increase transit ridership through marketing or education
Carless households <sup>a</sup>	5	Individuals/households without access to a working automobile

<sup>a</sup> Denotes topics that were probed in scripted interview questions.

data sources because they are not spatially clustered or because they are identified by characteristics not typically measured or reported. This included community college students without access to a car, ferry-dependent workers at a large employer in a region split by a river with few bridges, and seasonal farm workers living in an employer-run camp. In the latter case, the farm workers typically did not have a car or a valid driver's license, limiting their access to nutritious foods, health care, and recreational activities. Traditional data sources (such as the Census) and traditional notions of transportation disadvantage fail to capture non-traditional groups such as the ones described here. Local knowledge is essential for filling in these gaps.

#### 4.1.3. Factors associated with transportation disadvantage

Our analysis of the key informant interviews and focus groups identified several factors that pose transportation challenges to people in rural areas. Some of these factors included long distances to destinations, high cost of travel, and limited options for public transit or paratransit.

In each of the five counties, there were some transportation options available in the form of paratransit. However, eligibility for paratransit services may be restricted, in many cases tied to income or health status. Learning about paratransit services may also be a daunting barrier for some potential travelers. Where paratransit is available and affordable, it may involve long

distances and time commitments, especially in sparsely populated areas. In one instance, service providers stretch resources by coordinating routes and adjusting schedules (as explained by a Graham County official):

"I'm positive that there are still a lot of unmet needs here, one of them being shopping. If you call me today and say 'hey I live over here in Snowbird and I want you to take me [to the] Murphy Wal-Mart so I can go shopping,' I'm probably not gonna do that. I'm gonna tell you 'hey, we've got a run going to dialysis in the morning and we can drop you off and then pick you back up four hours later after the dialysis patients are done. That gives you four hours to shop . . . do you want to do that?' I mean, that's how we're going to handle that."

Long wait and travel times are also onerous for people who are traveling to access medical care for conditions that involve weakness, pain, or fragility. Furthermore, as explained by a key informant from Beaufort County, many counties' paratransit services are also restricted to travel to medical appointments:

"As far as, we have people that need transportation [to] medical appointments that are not Medicaid eligible. And they do have to be on Medicare to receive services from us. There are other funding sources that are limited and if they don't fit in that bracket for that particular funding source . . . So there are a lot of people. And people will call and say they need to go to Piggly

Wiggly [grocery store] or something and we have to tell them we don't do that."

In some cases, there is a lack of understanding complicated service schedules, particularly among elderly users. For example, one key informant in Warren County explained:

"It can be a little confusing trying to remember, 'ok, they only make this drive on this day,' and remembering as you schedule appointments."

4.1.4. Coping strategies

Faced with substantial mobility barriers, socially vulnerable populations may rely on formal and informal solutions to get around. Formal solutions include public transportation, paratransit, and programs that offset the cost of ride services and taxis. These formal services were an important but incomplete solution in the rural counties we studied. They assist many, but not all people who need help getting around. There are still many challenges for riders, including monetary and time costs. Certain barriers, such as scheduling and trip purpose restrictions, make it difficult to link multiple trips, thus precluding opportunities for greater efficiency, convenience, and frugality. In this research we

identified several coping strategies individuals have adopted to overcome such challenges.

Active networks of informal transportation solutions were evident in all of the communities visited. As one key informant said, reflecting an independent, do-it-yourself attitude: "rural people just make it work." That is to say, people and groups use creative coping mechanisms when formal options prove inadequate. Many of the informal solutions involve obtaining rides from family and friends. This could be casual and infrequent, or a recurring arrangement. Informal solutions also included using church vans, non-profit and employer-sponsored transportation, or paying neighbors for a ride to common destinations. As one Wilson County key informant stated:

"Country folks are going to take care of themselves. And that's pretty much what happens here. They say 'hey neighbor, if you're going to the store, do you mind picking up this, that and the other one.' And most people do that."

Similarly, in Beaufort County, a key informant discussed how people without cars rely on social networks for transportation:

"Well, they can go to the Piggly Wiggly and the bank. And pretty much they rely on friends and relatives and they kind of ride share with each other. Like one of them will say "I'm going to

**Table 4**  
Matrix of code dominance by county and profession.

Code	Counties					Professions						
	Wilson (11)	Chatham (10)	Beaufort (8)	Warren (6)	Graham (5)	Planner (11)	Social services (8)	Elected/appointed (6)	Transit services (5)	County manager (3)	Public health (3)	Emergency mgmt (2)
pedestrian/bicycle	10	10	9	8	6	10	4	10	4	6	10	5
social vulnerability	6	6	9	10	5	4	10	4	9	3	5	6
planning & governance		6	6	8	10	9		7	4	10	3	5
transit supply	3	10	8	5	6	5	6	4	9	6	3	6
informal solutions	3	4	10	10	6	2	8	6	10	6	8	10
long distances		5	9	7	4	3	4	4	6	10	8	4
access to health care		2	6	5	8		5	5	6	7	10	2
built environment	2	4	4	5	2	3	2	2	4	1	3	
challenges of paratransit		3	5	5	4	1	9		7		3	
access to amenities		5	6	4	2	4	3	4	1	3		2
community resources	2	4	2	3	6	2	1	6	5	10	3	
access to work	2	3	5	2	2	3	1	4	3	6	3	3
politics			5	2	4	2		5		9		
cost of travel		1	6	2	3	1	2	4	4	4	3	2
map	1	5	3	4		3	2			4	3	
decline		2	5	3		1		2	2	6	3	
geographic barriers	2		7			1	1	2		3	3	
isolation		1	4	4	1		2	2	3	3	5	
economic development		4	3		1	2		2		4		
hazards	1		3					1		1		5
nontraditional vulnerability		2	1	1		1		2				4
rural self sufficiency		2	1		2			2	2	1	5	
road conditions			2		4			3		4		

town” and five or six of them will pile up in one vehicle just to go to Washington.”

Some social networks have earned a reputation for their transportation support to the community, like a group of Beaufort County women who play bridge together each week and arrange to transport those in need.

“There is a women’s club down here in Aurora. And I’ll be honest, they’re almost all widows. Because of the different churches, but they go there and they play bridge every Tuesday. And so when one church says ‘Hey Ms. So-and-so doesn’t have a way to get up to the Walmart; the Piggly Wiggly isn’t carrying some of the specialized food she needs.’ Those ladies plan it out to where they go pick these people up; race is not an issue. I mean, there’s a group like this, there’s another one in Belhaven, another one down here in the Bath area. They take it on themselves. If they need a few dollars for gas, they might ask them, but otherwise there is nothing. No charge.”

Finally, in Wilson County, the farm-worker employer provides transportation for workers:

“The seasonal workers that come in are largely in some labor camps, but they also have their transportation because they have buses. Go to Wal-Mart on Sunday afternoon and you can see the buses lined up in the parking lot.”

4.1.5. Contextual variations in findings

The relative importance of interview themes appeared to vary according to context, particularly with respect to geographic location and to the respondent’s profession. The matrix in Table 4 highlights these variations by county and profession type; the numbers in each cell represent the respective themes’ relative dominance within the county or profession. The numbers range from one to ten, with the themes discussed most frequently in each group receiving a score of ten and themes discussed least frequently receiving a score of one. Themes that were not discussed at all within a county or profession are not shown. Dominance is also indicated by shading, with darker shading representing increasing dominance. As with the list of code frequencies in Table 3, the numbers in Table 4 are intended to simply highlight important topics for discussion and should be considered illustrative rather than definitive.

4.1.5.1. Variations by county. There were some similarities among counties with respect to the dominance of a few themes, but quite a bit of variation with respect to the majority of our themes. *Pedestrian/bicycle* and *social vulnerability* are the most dominant themes—with moderate to high relative discussion frequencies—across all five counties. *Planning & governance* was also moderately or highly dominant in every county except Wilson.

Table 5  
Code co-occurrence matrix.

	pedestrian/bicycle	social vulnerability	planning & governance	transit supply	informal solutions	long distances	access to health care	built environment	challenges of paratransit	access to amenities	community resources	access to work	politics	cost of travel	access to school	hazards	nontraditional vulnerability	road conditions
pedestrian/bicycle	8	10	2				7	2							7			
social vulnerability	8		5	9	2	6		2	6	2			2			2	4	
planning & governance	10		2	2			2			6		4				3		4
transit supply		5	2				3	2	2	3	2							
informal solutions	2	9	2			2	2		3			2		3			3	
long distances		2			2		4	3	4	3		7		5				
access to health care		6	3	2	4				5	9				2				
built environment	7		2	2		3												
challenges of paratransit		2	2		4	5			2									
access to amenities	2	6	3	3	3	9		2										
community resources		2	6	2														
access to work					2	7												
politics		2	4															
cost of travel					3	5	2											
access to school	7																2	
hazards		2	3															
nontraditional vulnerability		4			3										2			
road conditions			4															

All co-occurrences have c-index coefficient < 0.1 except access to health care vs. access to amenities (c-index=0.12) and long distances vs. access to work (c-index=0.11)

Some themes stuck out as highly dominant in one or two counties, but of relatively low interest in the rest of the sample. These themes include: *transit supply*, *informal solutions*, *long distances*, *cost of travel*, and *geographic barriers* in Beaufort County, *long distances* in Warren County, and *community resources* and *access to health care* in Graham County.

There were also a handful of themes that, contrary to our expectations, seemed to be of universally low import across counties. These include *access to school*, *carless households*, and explicit comments about our Census-driven maps (*map: agreement*, *map: mixed feelings*, and *map: disagreement*). Interestingly, *carless households* was the least common theme across the entire study area. This is noteworthy given the importance researchers and policy-makers have historically often placed on car ownership rates as an indicator of transportation disadvantage (Johnson et al., 2008).

**4.1.5.2. Variations by profession.** We found fewer universally dominant themes across professions than across counties. *Informal solutions* appears to have been the most universally important theme: It dominated discussions with transit service providers and emergency management professionals and was of at least moderate interest among social services providers, public health professionals, county managers, and individuals holding elected or appointed office. *Pedestrian/bicycle* was a dominant theme among professional planners, elected and appointed representatives, and public health professionals, though was of relatively little interest to social service providers, transit service providers, and emergency management professionals. *Planning & governance* was one of four highly dominant themes among county managers, and was also prevalent in interviews with planners and individuals holding elected or appointed office.

Among the rest of the themes we found, most were dominant among one or two groups of professionals, and largely ignored or of little importance to the rest. The most dominant themes for each profession were largely as expected. Planners focused heavily on topics coded as *pedestrian/bicycle* and *planning & governance*. The most dominant theme among social services providers was *social vulnerability*, followed closely by *challenges of paratransit* and *informal solutions*. Among individuals holding elected or appointed office, dominant themes were *pedestrian/bicycle* and to a lesser extent, *planning & governance*. Transit services providers focused primarily on *informal solutions*, followed by *transit supply*, *social vulnerability*, and *challenges of paratransit*. Four themes dominated discussions with county managers: *planning & governance*, *long distances*, *community resources*, and *politics*. *Access to health care* and *pedestrian/bicycle* topped the list for public health professionals, while emergency management professionals focused overwhelmingly—and somewhat surprisingly—on *informal solutions*.

Contrary to our expectations, few of our key informants spent time discussing the potential influence of built environments on transportation disadvantage in their communities. However, that topic is incorporated into several other themes that were of more interest to our informants: *pedestrian/bicycle*, *long distances*, *cost of travel*, *geographic barriers*, and the four *access* themes.

There are at least two plausible explanations for the apparent lack of interest in the role of built environments among our study participants. First, we focused explicitly on rural areas. In the context of North Carolina, and certainly in our study, rural communities tend to be sparsely populated, economically depressed, and/or geographically isolated. The dimensions of built environments that are expected to influence travel in suburban and urban contexts (e.g., street network design, land use diversity) are less relevant in the context of our study, outweighed by gross travel barriers (e.g., extreme distances and high generalized travel costs). Second, tackling problems associated with transportation disadvantage with solutions focused on the built environment is a

lengthy process, and difficult to achieve in under-resourced communities with declining economic bases. Most of the informants with whom we spoke were concerned with directly addressing acute TD challenges through mobility services rather than grappling with the more theoretical question of the extent to which settlement patterns entrench or exacerbate transportation disadvantage.

#### 4.1.6. Co-occurring codes

Where themes overlapped, we applied multiple codes (co-occurring codes are shown in the matrix in Table 5; in this matrix, the numbers in the cells represent the number of times the respective codes occurred together). The code for *social vulnerability* often appeared together with codes for *pedestrian/bicycle*, *informal solutions*, *access to amenities*, and *access to health care*. *Pedestrian/bicycle* also frequently appeared alongside *planning & governance*, *built environment & land use*, and *access to school*. On balance, the main co-occurrences make sense. For example, members of populations traditionally considered to be ‘socially vulnerable’ are more likely to be dependent on pedestrian and bicycle travel modes, have difficulty accessing key destinations, and as we learned in our interviews and focus groups, have travel needs that do not align well with the formal transportation services available. The availability and quality of facilities for walking and bicycling are often the product of programs in the domain of planning and governance, and a function of built environments and land use patterns.

The following quotation from an interview in Graham County illustrates how themes overlap; in this instance, we applied the codes for *access to health care*, *long distance*, and *challenges of paratransit*:

“We had a dialysis appointment about 4 or 5 in the morning. The driver had to be here by a quarter to 3, in the winter. We had several clients out there. You may put 50 miles here and going and picking them up and then you’ve got a 30-mile commute. It’s so dangerous, if you knew you had to get up at 2 in the morning every morning, 3 days a week, would you sleep? I wouldn’t. You can’t hardly. And the road conditions in the morning—there’ve been many times when people were stuck. And each time you pick up a new rider somebody else needs dialysis and gets on that run you’ve got to come in and maybe they’re 30 minutes away from where you’ve got to pick them up. And we don’t deny that, we pick them up and take them [to dialysis], that’s life-sustaining treatment.”

Here is another example from Chatham County. In this case, *challenges of paratransit* intersects with the *cost of travel*:

“Chatham Transit will go out and pick you up and take you somewhere, but they’re going to charge you an arm and a leg to do it.”

Similarly, *long distance* is linked with many other codes, which is not surprising given the rural focus of our study. Additionally, long distance can exacerbate other challenges, by increasing travel costs and travel times (especially for paratransit users), and decreasing access to destinations.

Finally, *informal solutions* cuts across a wide variety of other themes, including *access to amenities*, *access to health care*, *access to work*, *long distances*, *cost of travel*, and *nontraditional vulnerability*. Such variation of co-occurrences indicates that informal solutions may be the result of a diverse set of mobility challenges.

#### 4.1.7. Relevance of maps

One of our research objectives was to evaluate the appropriateness of using Census-based indicators of social vulnerability to identify hotspots of transportation disadvantage (i.e., areas where



individuals likely to experience transportation disadvantage lived). Thus, near the end of each interview, we presented key informants with map of their county highlighting areas where there were concentrations of populations traditionally defined as ‘socially vulnerable.’ We asked the informants to comment on the extent to which the maps aligned with their own understanding of the distribution of transportation disadvantage in their community.

Nearly to a person, the informants were intrigued by and eager to discuss the maps. On balance, most of the informants agreed that the maps were partially correct, but they also had major shortcomings. For example, in Beaufort County, the map failed to capture the challenge posed by the Pamlico River, a wide water course with limited crossing points that separates many of the county’s residents from major employment opportunities. Census geographies in Graham County were too coarse—due to the county’s very low population density—to show any substantial variation in population characteristics; in effect, the entire county showed up as a TD hotspot. In Wilson County, a large Census tract that appeared as a TD hotspot was actually composed almost entirely of undeveloped land owned by the US Army Corps of Engineers. And in Chatham County, most informants agreed that the map failed to identify stark contrasts in accessibility between the county’s impoverished and economically declining western half and its affluent, rapidly urbanizing eastern edge.

#### 4.2. Focus groups

The input we gathered from focus groups was consistent with and added depth to the input from key informants. The focus groups provided an opportunity to hear from community members about their experiences with transportation, including issues, challenges, and effective transportation. Focus groups provided an opportunity to hear rich personal anecdotes from targeted populations, while key informants provided more comprehensive illustrations of transportation disadvantage with broader strokes, at a larger scale.

Focus group participants identified many of the same transportation challenges, including long distances to destinations, relatively high cost of travel, and limited transit service. For example, in Graham County, participants discussed lengthy travel times to reach the nearest dialysis clinic, four hours away.

In another instance, commuters from Chatham County to a major employment center in an adjacent county expressed concerns about upcoming increases in transit fees that they had to factor into their cost-benefit analysis for using transit. The focus group offered a transportation “user” perspective, whereas key informants in Chatham County provided a more comprehensive perspective, describing the user experience as one component of transit service considerations, which also had to take into account operating costs, funding sources, and usage rates, especially in a rural county.

Finally, Mexican and Central American farmworkers in Wilson County gave us insight into a set of transportation challenges unique to a carless, low-income, seasonal population, and alerted us to informal and employer-sponsored programs that support their transportation needs.

### 5. Summary and conclusions

Rural residents often face a variety of challenges in meeting their need to access key destinations, obtain and keep employment, attend school, receive health care, and engage in social and recreational activities. People that are unable to meet these needs safely, efficiently, and affordably can be considered transportation-disadvantaged. Identifying who these people are and developing solutions to improve their mobility is not a straightforward task. In

many states, including North Carolina, state DOTs rely on socio-demographic variables derived from Census data to predict what locations might contain socially vulnerable populations that are likely to be transportation-disadvantaged. However, our research shows that while these traditional variables were a helpful starting point in our efforts to identify instances of transportation disadvantage, they failed to capture many TD individuals that were either not identifiable via traditional Census markers, or not spatially clustered, or both. Examples include community college students in Beaufort County, non-driving elderly widows in Graham County, and seasonal farm workers in Wilson County. Local knowledge from professionals familiar with the TD landscape in their communities was essential for identifying these populations.

Our research uncovered a number of themes on transportation disadvantage that were consistent across our study area. For example, informal transit services based on social networks is a common strategy to cope with transportation disadvantage across our five-county sample. Also, many of the populations we investigated rely heavily on public transportation and paratransit systems, however limited, or on securing rides from friends and family. Paratransit use, however, can be hampered by a lack of understanding about how paratransit works, restrictive eligibility requirements or limitations on trip purposes eligible for paratransit dollars. Frequency, reliability, and cost may also affect the feasibility of paratransit use by some residents. With many key amenities and services located far from home for some people, public transportation, even when available, may simply involve too much of a time commitment for some.

At the same time, we uncovered striking differences in how transportation experts across counties and across professional roles view the travel challenges their service populations face and the options they have for responding to their needs. For example, *access to health care* was a particularly prominent issue in Graham County, which lacks both a hospital and a dialysis treatment center but has a disproportionately high number of residents with kidney disease. *Geographic barriers* were raised repeatedly by key informants in Beaufort County, where a wide river splits the county and separates many workers from several key employers. Furthermore, as illustrated by the variation in code dominance by professional groups, a range of perspectives is necessary to convey the complexity and nature of TD—a multidimensional phenomenon that reflects local conditions. Thus, the problem of TD takes on different meanings for different people and in different contexts. Likewise, the success of policies and programs intended to help reduce TD is likely to be highly dependent on local contextual factors.

Just as there exists no one-size-fits-all definitions of TD, there are no *universal* solutions to reducing transportation disadvantage and improving mobility across rural areas. However, our experience conducting this research suggests a few key recommendations for local officials seeking to identify and address *local* instances of TD:

- Look for informal transport networks, as they likely indicate the presence of TD hotspots
- For subsidized transit and paratransit services, look for ways to encourage “subsidy sharing” across agencies, thus enabling passengers to use the services for multi-purpose trips
- Census data are useful for first-cut spatial analyses of TD, but supplement those data with local knowledge to identify and account for geographic and sociodemographic anomalies (e.g., impassable waterways and wealthy retirement enclaves)
- Expect that many forms of TD will either not be captured in Census data, or will not have spatial components (e.g., undocumented workers and community college students)

In summary, detailed local knowledge from multiple perspectives is essential for identifying instances of transportation disadvantage, for understanding the causes and complexity of that disadvantage, and for crafting the most effective programs possible to address that disadvantage within the limits of budgets and authority. While use of traditional data sources—such as the Census—to identify transportation disadvantage may serve as a good starting point for discussion, practitioners and researchers alike may find it worthwhile to incorporate local knowledge derived through qualitative field work into their analyses.

As is generally true of qualitative research methods, the data are rich and revealing but limited in generalizability beyond the study sites and sample population. Moreover, qualitative data collection and analysis take time and resources, and may well be beyond the capacities of many of the agencies charged with addressing transportation disadvantage. Improved data about the availability, accessibility, and acceptability of transportation services in rural communities may offset some of the need for such detailed qualitative field data. Future research is needed to understand where and when such substitutions may be appropriate.

### Acknowledgments

This work was supported by a grant from the North Carolina Department of Transportation (Grant #2013-12). The work benefited from the efforts of an undergraduate environmental capstone class: Carl Kolosna, Aaron Kurland, Kendall Lancaster, Christine Lazina, Meredith Magjuka, Rachel Norman, and Niranjani Radhakrishnan. We appreciate critical and constructive comments from NCDOT steering committee members, and the time, expertise and provided by community partners in five counties. Staff at the Institute for Transportation Research and Education provided critical contributions and support: Leigh Lane, Kyle Hovey, Steven Bert, and Adrienne Heller.

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