

## Article

# Transportation Justice in Vermont Communities of High Environmental Risk

Bindu Panikkar <sup>1,2</sup>, Qing Ren <sup>1,2,\*</sup> and Fosca Bechthold <sup>3</sup>

<sup>1</sup> Rubenstein School of Environment and Natural Resources, The University of Vermont Aiken Center, 81 Carrigan Drive, Burlington, VT 05405, USA

<sup>2</sup> Gund Institute for Environment, The University of Vermont, Farrell Hall, 215 Colchester Avenue, Burlington, VT 05405, USA

<sup>3</sup> Department of Geography and Geosciences, College of Arts and Sciences, The University of Vermont, Burlington, VT 05405, USA

\* Correspondence: [tsing0619@gmail.com](mailto:tsing0619@gmail.com)

**Abstract:** Transportation justice studies have largely focused on metropolitan areas, and the transportation disparities in rural areas and their most disadvantaged population are not well understood. Our study explored transportation injustices in high environmental risk communities in Vermont. We found that low-income communities and people of color disproportionately face inequitable access to transportation services: they are more likely to be concerned about lack of transportation, more likely to not own or lease a personal vehicle and rely more heavily on public transportation. Our study also found that those without a personal vehicle and those largely dependent on public transportation have less access to healthy food, are likely to go hungry, have greater reports of asthma, and have less access to primary care physicians and jobs. The transportation policies in the state are also procedurally unjust. These disadvantages, combined with higher exposures to environmental risks, also pose implications for public health and well-being. A combined transition toward sustainable mobility and transportation justice should prioritize greater equity in the distribution of transportation investment in infrastructure and services; recognition of historical patterns that inform current uneven and unequal mobilities; procedural and democratic engagement of the marginalized in transportation design, planning and policy-making; a capabilities approach to plan transportation systems that improve opportunities, wellness, and quality of life for the most disadvantaged population. Consideration should also be given to designing a sustainable transportation transition that prioritizes attention for all modes of transport accessibility and mobility, including non-motorized and public transit modes, in planning and policies so that streets are not dominated by a single mode of transportation, such as cars.

**Keywords:** transportation justice; environmental justice; transportation planning; sustainable transportation; just transition



check for updates

**Citation:** Panikkar, B.; Ren, Q.; Bechthold, F. Transportation Justice in Vermont Communities of High Environmental Risk. *Sustainability* **2023**, *15*, 2365. <https://doi.org/10.3390/su15032365>

Academic Editor: Luca Salvati

Received: 4 August 2022

Revised: 20 December 2022

Accepted: 30 December 2022

Published: 28 January 2023



**Copyright:** © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

### 1.1. Transportation Justice Research

Prior work on environmental justice (EJ) has advocated for and advanced the needs of people of color and low-income people to reduce disproportionate exposure to environmental and health risks and increase access to environmental benefits, including food, housing, clean energy, green space, health care as well as transportation [1,2]. Starting in the late 1990s, scholars and activists have been applying frameworks of environmental justice to transportation planning and development [3–5]. Transportation justice is an important ethical issue of our time and includes reforming and transforming systems, approaches, and processes that lead to inequitable distribution of transportation externalities while providing beneficial access to systems and services through procedural engagement in transportation planning across populations and space [6–8].

Transportation infrastructure and services can include a wide array of public infrastructure, including roads, railroads, airports, bicycle paths, gas stations, traffic lights, and parking spaces, as well as public transport services, including affordable fares, bus stops, and times to convenient destinations [7]. A connected, affordable, reliable transportation network is a public good that transforms public space, public life, and democratic participation. While modes of travel are socio-culturally shaped, they are politically governed by state and federal taxes and big infrastructural spending, which dictates “who and what can move (or stay put), when, where, how, and under what conditions” [9] (p. 19). Good transportation facilitates better access to many environmental, social, and economic benefits and opportunities including education, jobs, recreation, health care, social connection, and is also essential for thriving commerce and economy [10].

However, research has found that Black, Indigenous, and People of Color (BIPOC) populations, low-income people, and other vulnerable groups such as the disabled, elderly, and the youth, have inequitable access to transportation or automobility [8,9,11–14]. Traveling between two locations is much more difficult for the poor, who have limited resources, and hence, they rely heavily on public transportation to get around and access essential services [7,13]. Examining the commute patterns in US metropolitan areas, Taylor and Ong [14] found that Black workers rely heavily on slow public transit to get to work. Others have shown that public transit tends to be inaccessible, as it may be expensive for everyday use, unsafe, poorly maintained, crowded, infrequent, with inconvenient access, and untimely [7,15–17]. Lack of adequate transportation has also been shown to cause inequity in employment opportunities [12,13]. These disparities impact people’s mobility, social participation, and social well-being [18,19].

Early research on transportation justice also focused on the inequitable distribution of transportation pollution in minority and low-income areas [20–22] and adverse health burdens from poor air quality and high noise levels [23]. Several environmental health studies also show significantly elevated cardiovascular mortality risk, lung cancer, and childhood asthma for people living near heavily traveled freeways [24,25]. Sheller [9,25] argues that “environmental injustices and mobility injustices are two faces of the same problem, each contributing to the other, and they are intertwined with the uneven distribution of access and harms of logistical space, energy infrastructure, and the fundamental life requirements of clean air, water, food, and shelter”.

In addition, the interaction of multiple inequalities can further limit the ability of these underserved groups to cope and adapt [26–28]. For example, in metropolitan areas, lack of public investment in low-income and communities of color, as well as discrimination in employment, and housing, may trap African Americans in urban neighborhoods burdened by public infrastructure deterioration (including transit networks) and recession [29]. Gentrification of these urban neighborhoods, on the other hand, may also increase the cost of living and push people into suburbs with fewer transportation facilities [30]. In some cases, transit-related development (to alleviate traffic congestion, air pollution, and urban poverty) along with other infrastructural development has also been shown to cause gentrification and displacement of low-income and minority populations unless comparable effort in affordable housing is prioritized as part of the initiatives to prevent such gentrification [31,32]. Communities that face the worst environmental and social injustices often also lack the economic, political, and social resources to challenge and shape decisions that affect these conditions [3,8,22,33].

Addressing these inequities requires that we meet the distributional, procedural, and recognitional justice needs with an eye toward enhancing the functional capabilities of the most underserved populations. Pereira et al. [34] find that spatial equality and accessibility are important considerations for transportation justice. Distributive justice highlights the distribution of burdens and benefits of transportation infrastructure and services and the resulting disparities across social groups, neighborhoods, and communities. Procedural justice emphasizes the extent and robustness of procedural engagement with an eye towards advancing the political agency of the most disadvantaged communities in transportation

planning and decision-making. Recognition justice emphasizes a pluralistic approach to valuing diverse traditions and knowledge systems in decision-making. Furthermore, the capabilities approach identifies that injustices are found when there are limitations to the capabilities necessary to build a free and productive life and defines the range of needs, functions, and opportunities necessary for vulnerable populations in various locations to thrive and overcome vulnerabilities [6,34,35]. In this study, we focus on the unique transportation justice issues—access to transportation, limitations to essential services and functional capabilities, and procedural inequities in transportation policies that exacerbate injustices in Vermont. Understanding the transportation challenges of the marginalized population is critical to addressing the distributional, recognition, and procedural inequities in transportation in Vermont.

### *1.2. Transportation Issues in Vermont*

Vermont is a largely rural state, with 61.1% of the population living in rural areas, and also an overwhelmingly white state (94.2% identify as white, United States Census Bureau, 2019). Part of Vermont's diversity comes from the resettled refugee population, immigrant farmworkers, the Indigenous Abenaki population, and other people of color who have settled in Vermont for work. Vermont's resettled refugees, concentrated in semi-urban areas in Burlington, Winooski, and Rutland, combined with Latino migrant farmworkers working on remote farms and other people of international origin, make up 5.6% of non-English-speaking households in the state. These populations have been shown to experience difficulties from inadequate public transportation, even in more urbanized areas [36]. In addition, Vermont's low population density, aging population, and poorer rural population implicate unique transportation challenges that the state has not adequately dealt with.

Public transportation options are scarce in rural Vermont, making access to healthy food, health care, and employment difficult without a personal vehicle [37]. A recent report compiled by Yale School of Public Health and Vermont Law School [38] points out that the rural nature of Vermont means that the residents rely heavily on personal motor vehicles. This reliance poses two main issues. People who do not own, cannot afford, or cannot operate automobiles have limited access to transportation means and have limited freedom of choice to access other essential services and benefits. The heavy reliance on personal vehicles that are powered by fossil fuels also produces greenhouse gas emissions that account for 40% of the state's yearly greenhouse gas emissions.

Transportation justice studies have largely focused on metropolitan areas, and the transportation disparities in rural areas are not well understood [39]. Lack of safe, affordable, and reliable transportation is one of the most pressing issues in many rural areas. Still, less federal funding is allocated to rural transportation [40]. While many rely on personal automobiles for transportation in rural areas, approximately "40 percent of county roads are inadequate for current travel", according to the United States Department of Transportation [41]. The suppressed or unfulfilled needs of the less mobile groups due to the lack of services or socioeconomic pressures are often less examined [42].

In this study, we examine the practices and discourses surrounding transportation and mobility to examine how transportation benefits and burdens are distributed in vulnerable communities and explore the moral principles that guide and justify redistribution. We examine: what are the transportation accessibility issues or the distributive inequities that disproportionately impact low-income and communities of color in VT? How do these transportation-related inequities impact access to essential services, benefits, and opportunities? And, what transportation policies and just transition initiatives are non-inclusive and unjust? Combining interviews and survey results, we discuss approaches to address transportation issues and needs in these communities to strengthen their capability to address environmental risk and social inequalities. In the discussion, we integrate the key aspects of our data-based findings to contemplate the possible measures to improve transportation justice in these communities.

## 2. Methods

### 2.1. Study Areas

This study was conducted in collaboration with the Rural Environmental Justice Opportunities Informed by Community Expertise (REJOICE). REJOICE is a coalition initiated in 2017 to advise the Vermont Department of Environmental Conservation (VTDEC) on incorporating environmental justice into its policies and practices. The goals of REJOICE are to identify the key concerns among the most vulnerable groups in the state, engage communities in decision-making, and inform policy-making. The University of Vermont (UVM) is a member of the REJOICE research core. The research team used mixed methods, integrating door-to-door surveys, interviews, and focus groups with community organizations, state officials, and residents to explore access to transportation in Vermont's most environmentally vulnerable communities.

We identified areas that had the highest cumulative impact of environmental, social, and health risks using spatial analysis (See detailed spatial analysis approaches and results at Qing et al. 2022). Seven identified areas became study sites for the data collection of surveys and interviews. Figure 1 shows the approximate locations of the survey and interviews. See Table 1 for the variables included in the preliminary spatial analysis. For more information about the full spatial analysis, see <https://uvm.maps.arcgis.com/apps/webappviewer/index.html?id=68a9290bde0c42529460e1b8deee8368> (accessed on 20 December 2022).

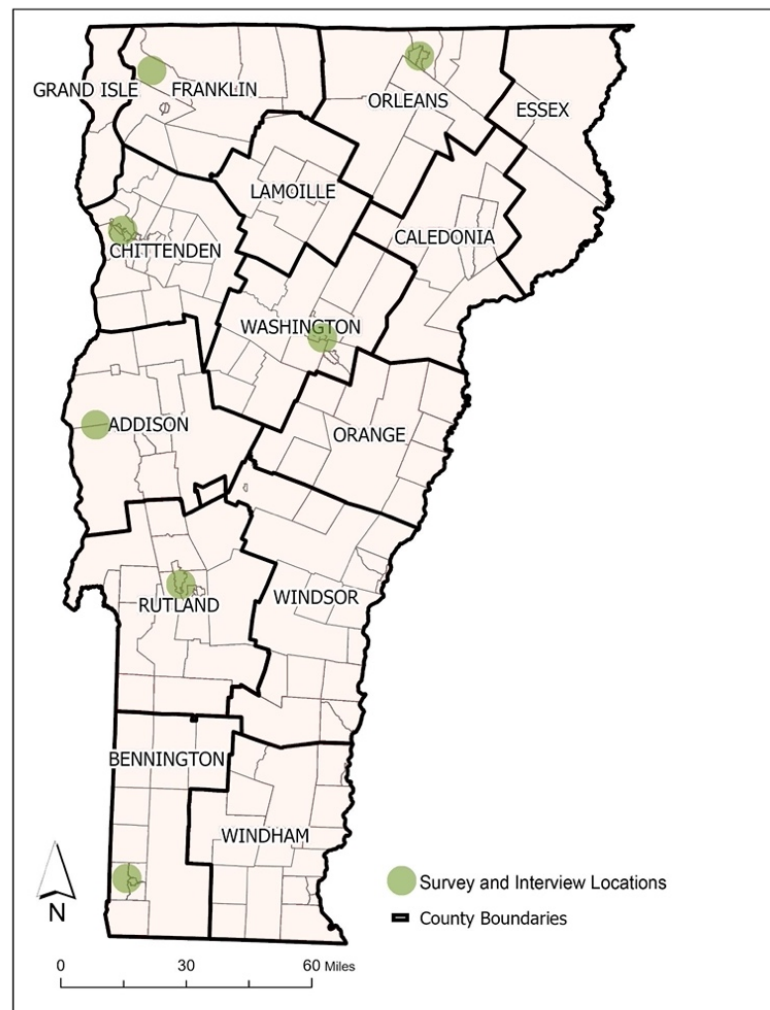


Figure 1. Study sites.

**Table 1.** Variables included in the preliminary spatial analysis.

Spatial Variable	Data Source
Percent of the population estimated to be BIPOC	2017 American Community Survey Estimates
Average per capita income	2017 American Community Survey Estimates
Respiratory Hazards Index Percentile	EPA 2014 National Air Toxics Assessment (NATA)
Percent of the State’s brownfield sites contained within town boundaries	Vermont Agency of Natural Resources’ brownfields data set, 2017
Percent of State’s High-Priority Hazardous Sites contained	Vermont Agency of Natural Resources’ Hazardous sites data set and reduced to include only high-priority sites 2017
Percent of State’s conventional (non-organic) farms contained (indicating exposure related to the use of pesticides)	US Department of Agriculture’s (USDA) database of organic producers, narrowed to agricultural operations
Average energy burden, reflecting the percent of each household’s average expenditure allocated to natural gas, liquid fuel, biomass, propane, and/or electricity	ESRI 2017 Consumer Expenditure Index
Whether a town contained or was part of a USDA-Designated Food Desert	2015 USDA Food Access Research Atlas
Whether a town contained or was part of a FEMA-designated Special Flood Hazard Area	FEMA’s publicly available geodata

## 2.2. Door-to-Door Surveys

The research team designed a survey questionnaire with 58 questions arranged under the following topics: local environmental risks and social concerns, water and climate change, housing (including indoor environmental risks), energy supply, food access, transportation, health, outdoor recreation, safety and the sense of place, agriculture concerns, and demographic questions. The demographic variables included race, gender, income, and ownership of the residence. Race and gender questions were left open-ended. Annual household income was categorized into different income brackets based on the US Department of Health and Human Services 2019 poverty guidelines, which set household income greater than \$25,750 per year for a four-person household as above poverty [43].

In each study area, we also consulted community experts for specific site selection to focus on socially and/or environmentally high-risk neighborhoods in the area. Between May and August 2019, seven trained surveyors from our research team knocked on as many doors as possible to administer the survey to all consenting participants. The respondents were voluntary participants. The response rate varied by location. We estimated that 25% of people answered their doors, and about a third of those who answered their doors agreed to take the survey.

The surveys were all anonymous. We also developed an online version of the survey using the Lime Survey statistical survey web application. Surveyors left flyers with a link to this form at unanswered doors. The survey link was also publicized on relevant local neighborhood notice boards and forums. The survey results were manually typed into a spreadsheet and analyzed in SPSS Statistics (IBM, New York, NY, USA, version 26). Sample sizes for some of the demographic categories were small. We combined the categories into binary format for further analysis (e.g., white/BIPOC, above the poverty line/under the poverty line, etc.). This study focused on the transportation-related variables of the dataset. We calculated descriptive statistics, including cross-tabulations and logistic regressions between two demographic variables of race and income and transportation access variables. We also conducted a descriptive analysis of the use of public transport and car ownership and access to food and health variables. Further analysis was completed using binomial logistic regression, as these were binary categorical variables, to determine the odds ratios (ORs) at 95% confidence intervals (CIs). Race and the poverty line were set as covariates in SPSS and served as control variables of each other and transportation access and affordability were dependent variables in the first regression analysis. The second

analysis examined the use of public transportation and car ownership as independent covariates and food and health variables as dependent variables. All regression results, including the statistically non-significant results, are reported in the results section in combination with the qualitative data.

In total, we collected 569 surveys. Surveys were conducted in all Vermont counties (n = 11) except for Orange, Windham, and Windsor counties, which we were unable to go to due to COVID restrictions. The survey sought to represent the experiences of more BIPOC and low-income residents in Vermont. As seen in Table 2 the percentages of BIPOC and under-poverty-line respondents were both higher than the census baseline. A total of 14.4% of our respondents were BIPOC, compared to 5.8% in the census. Over 40% of the respondents had a household income below \$25,750, compared to 11% in the census.

**Table 2.** Descriptive statistics of survey respondents.

Variable	Category	Frequency (n = 569)	Percent	Valid Percent	US Census (2019 Estimates)
Race	White	429	75.4%	84.0%	94.2%
	BIPOC, including two or more races	82	14.4%	16.0%	5.8%
	Missing or N/A	58	10.2%	-	
Poverty	>\$25,750	259	45.5%	59.1%	89.0%
	<\$25,750	179	31.5%	40.9%	11.0%
	Missing	131	23.0%	-	

### 2.3. Interviews with Community Organizations

We developed a semi-structured interview guide that had general questions on environmental justice and different aspects of climate, food, housing, energy, transportation, safety, and outdoor recreation. Using a combination of expert knowledge and an “organic” approach of snowball sampling, we contacted 127 potential key informants of community organizations, state agency staff members, and legislators that served the target. A total of 43 interviews were conducted by six researchers between June 2019 and February 2020. Not all questions were relevant for every key informant, and the conversations were shaped around their expertise. Each interview lasted about 1–1.5 h and was recorded with the interviewee’s consent. Out of the 43 interviews, 28 had transportation-related content.

The recordings were transcribed and imported into NVivo 12 for qualitative analysis. The data collection team first sorted the transcripts by general topics, such as climate, food, housing, energy, transportation, and so on. In the next round of coding, the leading author of this article worked through all transportation-related texts and coded them further. Another qualified coder was trained to conduct independent “double-coding” of 25% of the 28 transportation-related interviews (n = 7) using the established codebook. The second coder’s finished NVivo file was combined with the first coder’s file. A code comparison query was used to test the inter-coder reliability. The result showed that the two coders had an average Cohen’s kappa of 0.73 among all codes, suggesting a moderate to strong level of agreement between the coders [44].

In addition to surveys and interviews, we have utilized the focus group data held by our REJOICE community partners during the COVID-19 outbreak [45]. The focus group discussions were conducted via group Zoom calls that allowed individual participants to call in from a phone or access the conversation digitally. REJOICE engaged relevant community leaders or liaisons and compensated them to co-design and co-facilitate focus group conversations. If an interpreter was required, they were included in the design process and compensated as well. Eight focus groups were held across Vermont among the elderly, mobile home residents, chronically ill residents, farmworkers, Bhutanese Nepali immigrants, and Somali Bantu immigrants as well. Participants were asked to devote roughly an hour and a half of their time to these focus groups and were compensated \$50

each. We report on the transportation related responses from the interviews and focus groups that we conducted.

### 3. Results

Our study results can be broadly defined by three broad themes that define our findings: (1) distributive inequities disproportionately impact low-income and communities of color, (2) transportation injustices limit access to essential services and opportunities, freedom, and capabilities, and (3) transportation policies and just transition initiatives are non-inclusive and exacerbate injustice.

#### 3.1. Access to Transportation Services among Low-Income and Communities of Color

Many interviewees mentioned that access to transportation was a major challenge as “a big struggle”, one of the “biggest challenges”, and a “big problem” in VT’s most vulnerable communities. Our interviewees identified the important role of geographical factors in the transportation barrier. They mentioned that it was not cost-effective to run public transportation systems in rural Vermont. Rural low-income populations who were “far away from everything [services in urban areas]” experienced more difficulties in transportation because they were unable to afford a car. Several interviewees also noted that the backroads and harsh winter of Vermont’s rural areas further increased the cost of car maintenance and the fuel cost for residents in these areas.

Even in Vermont’s most urbanized Chittenden County, which has the most extensive public transportation in the state, the interviewees said it was still difficult to get around without a personal vehicle. For some city dwellers, even with good access to buses, the “last mile” or even the last few yards could become barriers, too. Public transportation takes longer, there are no direct routes, and they are not frequent enough, as well. Further, sidewalks were sparse and disconnected. Not all destinations were near a bus line. Narrow and steep stairs alongside an apartment building could be difficult for a single parent to navigate with multiple children.

The survey results also confirmed these observations of difficulties in accessing public transportation and maintaining car ownership among low-income communities and people of color. After controlling for race and income level, lack of transportation and car ownership were significant issues of concern among BIPOC and low-income communities, and they were also more likely to use public transportation. Table 3 summarizes the results of the logistic regression analysis on demographic variables and transportation variables. BIPOC respondents were more likely to consider lack of transportation a social issue in their community (OR: 1.812, CI: 1.007–3.257). BIPOC respondents were three times more likely to use public transportation (OR: 3.765, CI: 1.787–7.929) and over 2.5 times less likely to have access to a personal vehicle (OR: 0.374, CI: 0.180–0.777) than white respondents. Low-income respondents were four times more likely to use public transportation (OR: 4.563, CI: 2.316–8.992) and over six times less likely to own or lease a personal vehicle (OR: 0.145, CI: 0.076–0.278). Income furthered disparities in this study. It is important to note that approximately 46% of the BIPOC respondents were living under the poverty line, compared to 40% of the white respondents. However, this difference was not statistically significant to show a strong relationship between income and race. These results show that automobility is a personal issue for many BIPOC and low-income Vermonters.

One interviewee living in a mobile home park community in the Northeast Kingdom highlighted her significant challenges in maintaining vehicles in the state. She mentioned that her car was old and could not pass the new inspection standards, and it was easier for her to either use it illegally and get caught or scrap it. She commented that the harsh winter in Vermont, road salt, and bumpy rural roads speeded up the deterioration of vehicles and increased maintenance costs. Additionally, the fines from illegal use of the car and towing (from the car breakdowns) also added to the cost of keeping her car, and therefore, had to give it up and now was entirely dependent on public transportation, which had severely restricted her freedom in day-to-day life, and access to services. The key informants also

mentioned that for people with less economic means, the high towing cost could prohibit them from getting their cars back. The key informants also recognized the elderly as a group that had greater than average transportation barriers and was more likely to suffer from isolation and food security issues due to transportation restrictions.

**Table 3.** Transportation disparities by race and income.

		Race		Income	
		White	BIPOC	Above \$25,750	Below \$25,750
Considers lack of transportation a social issue	n(%)	100(24.0%)	25(32.1%)	5 (22.9%)	43(24.2%)
	OR(CI)	1.812(1.007–3.257)	0.047 *	0.988(0.619–1.577)	0.961
Use public transportation daily/weekly	n(%)	37(12.6%)	20(35.7%)	16(8.6%)	34(29.8%)
	OR(CI)	3.765(1.787–7.929)	< 0.001 *	4.563(2.316–8.992)	0.001 *
Own or lease a personal vehicle	n(%)	259(83.8%)	39(63.9%)	177(91.2%)	77(61.1%)
	OR(CI)	0.374(0.180–0.777)	0.008 *	0.145(0.076–0.278)	0.001 *
Live more than 10 miles from the nearest grocery store	n(%)	27(14.1%)	9(12.3%)	19(14.4%)	11(13.9%)
	OR(CI)	1.209(0.492–2.969)	0.678	0.920(0.404–2.098)	0.843
Live more than 10 miles from the nearest hospital	n(%)	59(31.2%)	12(16.2%)	36(27.5%)	17(21.3%)
	OR(CI)	0.291(0.121–0.697)	0.006 *	0.806(0.402–1.616)	0.543
Live more than 10 miles from the nearest pharmacy	n(%)	35(18.3%)	11(14.9%)	21(15.9%)	12(15.0%)
	OR(CI)	0.473(0.181–1.234)	0.126	1.103(0.501–2.430)	0.807

Note: \* indicates significant result at the 95% confidence level.

### 3.2. Limitations to Essential Services, Functional Capabilities, and from Transportation Inequities

Our results also suggest that lack of access to transportation impacts a wider array of day-to-day activities that limits functional capabilities as well as opportunities of individuals and communities. Below we highlight how transportation inequities impact functionality and quality of life due to limited access to essential services such as food, health care, and job opportunities.

*Food access:* Food access is, in general, a problem in rural Vermont [46]. (Note that “Food desert” is a controversial frame. In the cited article, the author uses the food desert concept defined by the USDA as low-income Census tracts at least 1 mile away from a grocery store in urban areas or 10 miles in rural ones.) Previous research has shown that 30% of residents of low-income towns in Vermont have to travel more than 15 min to a grocery store, and travel time is much longer for rural areas [47]. Some interviewees who worked at food shelves specifically stated that lack of transportation further concentrated the problem by making it more difficult to access sufficient, healthy food. The survey results did not show any significant differences between sociodemographic groups and distance to the nearest grocery store. This could be due to surveys being conducted largely in vulnerable communities. About 12% of the non-white and 14% of the low-income respondents live over 10 miles from the nearest grocery stores. The survey results (Table 4) showed that people who owned or leased a personal vehicle were significantly twice as likely to have good access to fresh food (OR: 2.398, CI: 1.128–5.101, Sig. 0.023) and were five times less likely to go hungry (OR: 0.196, CI: 0.068–0.559, Sig. 0.002) than those who did not have a car. Alternatively, those who used public transit weekly were over three times less likely (OR: 0.350, CI: 0.155–0.791, Sig. 0.012) to have access to fresh food and were nine times more likely (OR: 9.722 CI: 2.885–32.762, Sig. 0.001) to be hungry than those who use public transportation occasionally a month, or annually. In addition to increased difficulties in going grocery shopping, the interviewees also mentioned difficulties with growing food at a distant location, such as a community garden, due to lack of transportation. This concern was more prominent among the immigrant communities who might live in dense neighborhoods while the gardening or farming spaces available to them were not easily accessible by public transportation. They needed to either own a personal vehicle or rely on others for transportation. Car owners (81%) were more likely to spend time outdoors than those who did not own a car (72%) in the survey results, but this observation was not significant (Table 4).



**Table 4.** Access to food, health and jobs by car ownership and use of public transport.

		Use of Public Transport		Own/Lease a Car	
		Monthly/Yearly	Daily/Weekly	No	Yes
Have access to fresh, healthy food	n(%)	276(92.9%)	46(82.1%)	63(84%)	277(92.6%)
	OR(CI)	0.350(0.155–0.791)	0.012	2.398(1.128–5.101)	0.023
Go hungry in a month	n(%)	6(4.6%)	7(31.8%)	8(26.7%)	9(6.6%)
	OR(CI)	9.722(2.885–32.762)	0.001	0.196(0.068–0.559)	0.002
Asthma	n(%)	61(20%)	19(33%)	26(34%)	62(20%)
	OR(CI)	1.941(1.048–3.593)	0.035	0.485(0.280–0.840)	0.010
Allergies	n(%)	80(26%)	21(36%)	28(37%)	83(27%)
	OR(CI)	1.589(0.878–2.876)	0.126	0.632(0.372–1.074)	0.090
Health concerns	n(%)	183(60%)	37(64%)	55(72%)	180(58%)
	OR(CI)	1.165(0.651–2.086)	0.607	0.537(0.309–0.932)	0.027
Access to healthcare	n(%)	84(27%)	16(28%)	19(25%)	92(30%)
	OR(CI)	0.998(0.532–1.870)	0.994	1.278(0.720–2.268)	0.402
Have a primary care doctor	n(%)	270(90%)	43(77%)	59(79%)	274(91%)
	OR(CI)	0.368(0.178–0.760)	0.007	2.654(1.350–5.215)	0.005
Time spent outdoor	n(%)	242(80%)	49(84%)	54(72%)	250(81%)
	OR(CI)	1.350(0.628–2.901)	0.442	1.706(0.955–3.047)	0.071

Transportation restrictions also caused difficulties among underserved populations in utilizing public Food Assistance Programs. An interviewee described an example of Vermont's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). The program used to offer delivery options, which were discontinued in 2015. The program then transitioned into an Electronic Benefit Transfer (EBT) system that required participants to go to a grocery store to obtain their WIC foods. This change significantly reduced the participation rate. Fewer people were using WIC, likely due to transportation issues. In consequence, the federal government reduced funding for Vermont's WIC program, which posed more limits on the services provided by the program and access to food. A staff member of an agriculture and food organization described the connection between lack of transportation access and food insecurity: *"The first thing I did when I was working here was [to] spend time in the [food] pantry asking people what your barriers are, and it was amazing that people didn't say food even though they were in the food pantry. They said transportation"*.

The onset of the COVID pandemic worsened food insecurity, especially for those who do not drive. While city services offered free transportation during COVID in Burlington, the rural residents in Vermont faced increased food insecurity, sometimes tied to the loss of employment. A mobile home resident shared: *"the pandemic has greatly affected my ability to get food because I don't drive. I have a disability . . . Then we came upon COVID-19 where I was not able to go into stores, grocery shop because of my compromised immune system and I had no family that was able to do it"*. Groups such as the Latinx Farmworkers are particularly vulnerable in situations such as this, as the existing social support system could crumble without other options. *"Less than half of community [Latinx farmworkers in Vermont] have personal vehicles; many depended on volunteers, largely retired elders, for rides. Those rides stopped with the onset of the pandemic"*, but Latinx workers that have cars have stepped in.

*Health care access:* Our survey results (Table 3) found that BIPOC respondents were significantly three times more likely to live less than ten miles from a hospital (OR: 0.291, CI: 0.121–0.697) compared to white respondents. Since many BIPOC relied on public transportation and were less likely to own a vehicle, this result made sense that more BIPOC lived in areas with better access to health care or in more concentrated urban areas. The transportation barrier to obtaining health care was especially prominent among certain sociodemographic groups. One interviewee working at a community organization in Rutland shared an incident with one of her clients, who had a high-risk pregnancy and needed to get to Burlington for delivery (about 1.5 h by car). *"She was qualified for Medicaid rides but had to give a 24-h notice for the ride, which made it difficult for her to determine when"*

*she needed to call before or during labor". She also mentioned that the transportation services reimbursed by insurance policies were limited and "not incredibly reliable". "Sometimes they [the transportation service drivers] forget to go back and get people, so people don't use it". The uninsured individuals did not even have access to these inconvenient options.*

Resettled refugees, new immigrants, and undocumented farmworkers were said to be especially vulnerable to transportation barriers to health care. Several interviewees working with these groups talked about how inadequate transportation access made it difficult for them to make it to doctor appointments. One interviewee working with refugee families talked about the health consequences of not having transportation for health care: *"One of the implications is, if I don't know what to tell my doctor, we are not able to communicate over the phone, I may just not go. So my health concern becomes worse because I didn't go and because I know I have to take two buses to get there, and two buses back. And I have to be back in time to pick up my kids from the bus when they get off from school. It's just too complicated. I'd rather not go. So I'm just going to cough and cough and cough for an extra couple week. Maybe until it gets worse maybe until it gets better".*

In our surveys as well, those without a car also had less access to a primary care physician and were more likely to have health concerns and asthma. The respondents who have a car were also twice as likely to have a primary care physician (OR: 2.654, CI: 1.350–5.215, Sig. 0.005) as those who did not own cars (Table 4). Moreover, car owners were significantly twice as less likely to have asthma (OR: 0.485, CI: 0.280–0.840, Sig. 0.010) and health concerns (OR: 0.537, CI: 0.309–0.932, Sig. 0.027) compared to those without cars. Similarly, those who used public transportation daily or weekly were over two times less likely (OR: 0.368, CI: 0.178–0.760, Sig. 0.007) to have a primary care doctor and close to twice as likely to have asthma (OR: 1.941, CI: 1.048–3.593, sig. 0.035) than those who used public transit occasionally monthly or annually. The COVID outbreak eased the transportation issues to access health care for some, with the accessibility to telemedicine. However, some, especially those with language difficulties, found telemedicine quite challenging, especially in communicating with their health provider. Those who did not have digital access especially had a harder time.

*Access to jobs:* The interviewees talked about how transportation created barriers to accessing job opportunities. One interviewee working at a community justice center noted that: *"People might have employment but can't get there. Or they have employment but lose their driver's license, and then they lose their job".* Some also mentioned that the bus schedule was not direct, frequent enough, and sometimes not on time, causing late arrival and job loss. The public transportation services, accommodated for peak hour services, but they did not accommodate for evening and night shifts, making it difficult at times to get back home or to work.

For refugees and immigrants, it was mentioned that lack of access to transportation led to worse socioeconomic outcomes and having to be clustered within certain types of neighborhoods. One interviewee at a community organization talked about how difficult it was for refugees and immigrants to work without a vehicle: *"So this stuff is important . . . helping someone get a job. if you are struggling to get a job and you have to take a job that isn't that easy to get to . . . Maybe you can take a taxi, but that costs money. All of this stuff is difficult and because you missed the bus, you might lose your job. . . . you kind of don't realize . . . how hard it would be if you didn't have that car".* While the pandemic introduced remote work opportunities, not all workers, especially the essential workers, had that as an option, making it more difficult and stressful to travel during the pandemic.

As seen in these examples, lack of transportation compounded inequality and created vicious cycles, impacting basic functionality and quality of life to access basic services such as food, health care, and jobs, essential to break the vicious cycle and regain economic agency.

### 3.3. Transportation Policies and Procedural Inequities

Transportation regulations and fines were said to be especially hard on low-income and communities of color in the study. Not paying fines induced by traffic violations, such as driving with an expired inspection sticker, speeding, or failing to maintain required liability insurance, could lead to a suspended driver's license. An individual must go through the state of Vermont's Civil DLS (Driving with License Suspended) Diversion Program to regain a suspended license. The program requires meetings, paying fees and fines, and/or community services, which costs money and requires transportation. A staff member of a community justice center described a specific case about this issue: *"And if they can't keep their cars inspected, whether either the emissions or the safety, then it hits them harder. And so they were often driving around without inspection stickers, and then they would get caught and get a ticket. But then they couldn't afford the \$2000 to get the car inspected"*. Unable to work through the program, afford the fines, and reinstate a driver's license, people faced the choice between risking being caught again for DLS or losing their job and income. Multiple DLS offenses could lead to criminal charges and time in prison. These consequences again could cause job losses, major economic setbacks, and self-perpetuating vicious cycles.

Vermont follows the California emissions standards for light-duty vehicles, which are stricter than the federal standards [48]. This is a meaningful measure to act against climate change, but several interviewees voiced concerns that strict regulation was especially harsh on low-income and BIPOC. In some cases, not being able to afford inspection fees and repair costs needed for passing inspection prohibited people from keeping their inspection up to date. Racial profiling is common in Vermont, and people of color in the state are more likely to be stopped for traffic violations [49]. When caught driving with an expired inspection sticker, the owners obtained a fine that they could not afford. This further worsened their economic conditions and made the inspection and car maintenance even less affordable.

Vermont is also a leader in renewable energy transitions [50]. A proposed measure to reduce greenhouse carbon emissions in Vermont is a carbon tax, which would add a regressive tax on fossil fuels, including fuels for passenger vehicles [51]. In the ESSEX plan (a plan formed by legislators, academics, and business stakeholders that led to a carbon tax bill in 2018), the tax burden on low-income populations would be addressed by rebates on energy bills [52]. Even with these mitigation measures, a few interviewees were clearly opposed to the concept of a carbon tax as it would inevitably impose an inequitable burden on rural, low-income residents. A farmer in a rural area said: *"I hate the carbon tax because it'll punish the people around here. A lot of them drive older cars that aren't fuel efficient"*. Another interviewee who worked at a district office of a state agency expressed the same concern about the imbalanced impact of the proposed carbon tax: *"Essex County has the lowest per capita income in the state, and then they're paying higher prices . . . . They also have the longest . . . commute times in the state. It's a constant double whammy. . . . Chittenden County people are talking about fuel and carbon taxes to try and offset some of the environmental pressure. I'm like that is great for Chittenden County. You guys have public transport, people don't drive a lot. But here you have poor people who are driving, and every cent counts. And you're going to tax the only way they can get to work?"*.

As part of its effort to achieve emissions reduction goals, Vermont has been promoting electric vehicles (EVs) at the state level [53]. Similarly, interviewees talked about the equity issues caused by EVs for underserved populations. They mentioned that EVs were expensive, and not many used vehicles (less expensive) were available. It was difficult for low-income individuals to benefit from the incentives associated with EV purchases, such as rebates and tax credits. Traditional hybrids, especially used vehicles, did not come with any incentives. The infrastructure, such as charging stations, was only utilized by those who could afford EVs. Charging stations were sporadic in rural areas in the state, as well.

All of these regulations and measures are supposed to facilitate the sustainable transition in Vermont and provide better opportunities for all Vermonters. However, some interviewees pointed out that discussions about sustainable transportation, organized by the state and legislature, largely did not involve the voice of underserved populations.

These groups, in general, had less access to information and knowledge of public participation and activism. Isolation and restrictions caused by a lack of transportation resources could further inhibit their participation in meetings and discussions around transportation planning and just transitions. One interviewee, a legislator who represented a rural area, said: “A lot of people didn’t know or want to talk about [the fact that these discussions are not inclusive], like the House Committee on Transportation. I said, well you should really have low-income advocates into your committee to talk about transportation. Like have Reach Up workers come in. And they were like, this is an air quality issue, why would we have a low-income person? You should talk to them about what the impact is . . . ”.

#### 4. Discussion

Our study demonstrates (1) How transportation issues disproportionately impact low-income and communities of color; (2) Inadequate public transit and lack of personal vehicles limit access to combined capabilities of food, health, and jobs, and (3) Transportation policies and just transition measures are procedurally unjust and continue to burden low-income and communities of color. Below we discuss the implications and possible measures to address these issues.

##### 4.1. Transportation Issues Disproportionately Impact Low-Income and Communities of Color

In the analysis, BIPOC respondents were more likely to consider lack of transportation a social issue, three times more likely to use public transportation, and over 2.5 times less likely to have access to a personal vehicle than white respondents. However, these accessibility issues were heightened when access issues of those below the federal poverty line were considered, who were four times more likely to rely on public transportation and 6.5 times less likely to own a personal vehicle. Our interviews further highlighted the challenges to accessing these services. Even in the more urbanized Chittenden County, accessibility issues reported included a long distance to the bus stop, lack of sidewalks or handicapped access, long, convoluted routes and duration, and having to take multiple buses to get to the final destination. Public transportation facilities are even more acute in rural Vermont, where there is a high dependency on personal vehicles, which causes different levels of barriers based on personal conditions. This observation concurs with transportation access issues reported among immigrant populations in Vermont [54]. These observations were consistent with the evaluation of multiple studies that have pointed out that people-based transportation measures should be based on observations of an individual’s ability, behavior, and space/time constraints [55–57]. Few studies have systematically examined the transportation disparities by race and income across the state, and these observations should be further explored to effectively address the needs of the most vulnerable sociodemographic groups.

Since low-income and communities of color heavily rely on public transportation, a better public transportation system, including relevant bus stops at convenient times to accommodate the varying shifts of the essential workers and more effective routes to key relevant and recreational destinations, is required to address the needs of this community who otherwise have poor mobility and accessibility to essential destinations and services. It is important to understand the differential needs, travel behavior, and transport modes used by different marginalized groups and underserved communities in transportation planning to improve benefits and achieve distributive justice in transportation. Pereira and colleagues assert that an individual’s ability to access resources varies; hence, focusing on improving accessibility instead of resource availability is important. Therefore, applying the maximum criterion of improving accessibility to the least advantaged in society, the poor, disabled, elderly, and the communities of color, by understanding their specific needs and space/time constraints have to be prioritized within transportation planning. The issue is not that some people enjoy greater accessibility than others, but how to minimize the inequality of opportunities and freedom [37] (p. 6). While Pereira and colleagues emphasize accessibility over resource availability, in Vermont, resource availability such

as good public transportation infrastructure and sufficient governmental investments in public transportation, including bus and rail, is lacking, but such interventions to improve accessibility should procedurally engage the most disadvantaged sociodemographic groups and communities in transportation planning [58].

#### *4.2. Inadequate Public Transit and Lack of Personal Vehicles Limit Access to Combined Capabilities of Food, Health, and Jobs*

Our study demonstrated how transportation injustices (public transportation and personal automobile access) limit access to essential services and opportunities. Those with cars were twice as likely to have access to fresh and healthy food, five times less likely to go hungry, twice as less likely to have asthma and health concerns, and twice as likely to have a primary care physician than those who do not own a personal vehicle. Moreover, those relying on weekly public transportation were 2.8 times less likely to have access to fresh food, nine times more likely to go hungry, twice as likely to have asthma, and over two times as likely to not have a primary care doctor. According to Pereira et al. [37], mobility and freedom to move around are basic capabilities that are essential to meeting people's basic needs and rights, and are fundamental moral principles for transportation justice. The Yale School of Public Health [38] report also noted that a lack of transportation restricted food access. McEntee and Agyeman [59] used a GIS method to identify rural food deserts based on the distance to food stores in Vermont, and several of the areas at a higher risk of inadequate food access overlap with the environmentally vulnerable areas identified in our study.

Farther distance to food providers, transportation barriers, and higher environmental risks can pose multi-layered cumulative risks to public health in these areas [60]. Strout et al. [61] have similarly shown the linkage between a lack of accessible transportation and missed healthcare appointments among older adults in Chittenden County, Vermont. Caro et al. [62] found that transportation services were key to the success of adult daycare programs. Without reliable public transportation or a personal vehicle, our interviewees also talked about the difficulty of getting to job interviews and the training needed to find work. Bose [54] similarly indicated that the bus schedule does not accommodate second and third-shift workers and people who work on Sundays. In addition to public transportation difficulties, the vicious cycle formed by unaffordable inspection costs, DLS, and lost jobs and economic opportunities is also a prominent pattern identified in our study.

Few studies have explored how transportation impacts personal capabilities, opportunities, and freedom. Our study shows that an intersectional lens is required to better design transportation research and policies that improve not just sustainable transportation, but just, accessible transportation. Our results show that it is not sufficient to just understand the space/time needs and behavior of the most vulnerable population, but that we should also explore how transportation access provides more equitable opportunities and access to essential and recreational needs that improve the capabilities, wellness, and quality of life of those that rely heavily on public transportation to get around. One of the key components of this framework is to support the idea of setting minimum standards of accessibility to key essential and recreational destinations in Vermont and also out of state. Other scholars have similarly proposed to set minimum transport access to basic destinations, such as food stores, schools, and medical services, to reduce inequality of opportunities [58,63]. Hence, to achieve distributive justice in transportation, the state should prioritize mobility and accessibility opportunities for underserved populations by procedurally engaging the disadvantaged communities in designing mobility pathways that set minimum standards of accessibility and connectivity to essential and recreational destinations, and accommodate the differentiated needs by age, income, and ethnic needs to enhance greater ease, comfort, flexibility, and safety to advance their capabilities, opportunities, and freedom [9].

#### *4.3. Transportation Policies and Just Transition Measures Are Procedurally Unjust and Continue to Burden Low-Income and Communities of Color*

Lastly, we explored how transportation policies and just transition initiatives are non-inclusive and exacerbate injustices. Distributive justice attracts much attention as it attempts to equitably redistribute basic goods and services. However, distributive justice cannot be examined independently from the planning and procedural justice, as inequitable distribution of resources, benefits, and opportunities are tightly related to the structural biases and under-representation of vulnerable populations in the decision-making process [6,34,64,65]. In our analysis, some interviewees identified the lack of procedural inclusion of underserved populations to represent and advocate their interests in transportation planning. New immigrants were not aware of the knowledge and resources to request a new bus stop near their important destination. Many people were not aware of transportation services such as Medicaid rides for the elderly and people with disabilities and commuter co-ops. People who cannot afford inspection-related costs, traffic fines, and costs for license reinstatement are often not included in transportation planning decisions. Our data also showed that the emergent conversations in the state on EVs, related infrastructure, and greenhouse gas reduction were highly contested. The stakeholders involved in the planning of such policies were more likely to be people who could afford EVs, energy companies, and businesses. Underserved populations were almost excluded from the decision-making processes. The Yale School of Public Health report [38] indicates that the policy-making around climate change should include input from all groups, “particularly people with disabilities, seniors, migrants, low-income residents, and people of color, who are likely to face disproportionate impacts of climate change and compounding problems from transportation burdens” (p. 6). While EV and just transition policies minimize greenhouse gases and benefit all, particular steps need to be taken to address how such policies can be made without restricting accessibility, combined capabilities, and generating negative externalities to the most disadvantaged population [7,9,66].

Just transition and climate action measures taken in Vermont have prioritized transitioning to EV as an important strategy to address both impacts of climate change and goals to achieve sustainability. However, just transition measures should prioritize an effective and sustainable public transportation system that includes both bus, rail, and bike path systems and increase ridership to reduce reliance on personal vehicles, which has a higher carbon footprint. It would be valuable to explore how public transportation can be made more appealing for current non-users to introduce more sustainable modes and behaviors of transportation in Vermont. Ensuring the recognition, procedural, and capability justice measures apart from distributional measures should be part of any transportation planning and decision-making to ensure minimum thresholds of accessibility and in developing just, sustainable transition measures that do not burden individual freedom, functionality, and capabilities. A just transport policy should also be “equitable” in the distribution of transport investments and services, even to rural areas, to improve accessibility and reduce inequality of opportunity to the most disadvantaged communities. Producing comprehensive, environmentally just, and ethical accessibility approaches that attend to the history and values and that do not discriminate by income, race, age, or gender orientations are required in the state to ensure that political decisions are made through a legitimate, just, sustainable, and democratic process.

## **5. Conclusions**

As Sheller [9] (p. 20) has identified, mobilities are uneven, differential, and unequal. Our study, exploring transportation-related injustices, finds that low-income and communities of color disproportionately face inequitable access to adequate transportation services, and those who do not have a personal vehicle and rely more heavily on public transportation, have reduced access to essential services, including healthy food, health benefits, and jobs. These disadvantages, combined with higher exposures to environmental risks, also produce adverse consequences on public health and well-being. The current

transportation system and policies in the state also intensify inequality and perpetuate vicious cycles that unfairly impact liberty and quality of life among vulnerable communities. The marginalized groups are oftentimes excluded from decision-making and planning in transportation.

A good transportation system broadens individual and community accessibility, enhances access to social and environmental benefits, and promotes access to opportunities, individual capabilities, and freedom. A combined transition toward sustainable mobility and transportation justice, therefore, fundamentally requires greater equity in the distribution of transportation investment in infrastructure and services; recognition of historical patterns that inform current uneven and unequal mobilities; procedural and democratic engagement of the marginalized in transportation design, planning and policy-making; and a capabilities approach in planning transportation systems that improve opportunities, wellness, and quality of life of the most disadvantaged population. It requires that we expose and understand the relationship between unequal mobility systems and uneven spatiality. It requires exploring an intersectional and multi-scalar approach to addressing mobility and transportation justice and how it perpetrates other forms of injustice, such as to food, health, jobs and uneven mobilities that impact everyday life. It would also design transportation research and policies that improve not just accessibility, but also provide more equitable opportunities and access to social and environmental benefits that are critical to improving wellness and quality of life. Consideration should also be given to designing sustainable transportation that prioritizes attention to all modes of transport accessibility and mobility, including non-motorized and public transit modes in planning and policies so that streets are not dominated by a single mode of transportation, such as cars. Minimum thresholds for accessibility and sustainable transitions should be reached through procedural inclusion and recognition to enhance the capabilities of the most disadvantaged in transportation decision-making.

**Author Contributions:** Conceptualization: Q.R. and B.P.; methodology: Q.R. and B.P.; data collection: Q.R. and B.P.; data analysis: Q.R., B.P. and F.B.; Writing—original draft preparation: Q.R.; writing—review and editing: Q.R., B.P. and F.B.; funding acquisition: B.P. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research is supported by the Lintilhac Foundation and James Jeffords Fund from the University of Vermont.

**Institutional Review Board Statement:** This study and its data collection methods are approved by the Institutional Review Boards at the University of Vermont (protocol number: STUDY00000022; approved 31 May 2019).

**Informed Consent Statement:** Oral and written consent messages were approved by the Institutional Review Boards at the University of Vermont. Either oral or written consent was obtained from all interviewees and survey participants.

**Data Availability Statement:** Requests to obtain quantitative data should be directed to the corresponding author and will be considered on a case-by-case basis. Qualitative data are not available for sharing because of confidentiality.

**Conflicts of Interest:** The authors declare no conflict of interest or financial ties.

## References

1. Chavis, B.F.; Lee, C. *Toxic Wastes and Race in the United States: A National Report on the Racial and Socioeconomic Characteristics of Communities with Hazardous Waste Sites*; United Church of Christ: New York, NY, USA, 1987.
2. Mohai, P.; Pellow, D.; Roberts, J.T. Environmental justice. *Annu. Rev. Environ. Resour.* **2009**, *34*, 405–430. [[CrossRef](#)]
3. Bullard, R.D.; Johnson, G.S. *Just Transportation: Dismantling Race & Class Barriers to Mobility*; New Society Publishers: Gabriola Island, BC, Canada, 1997.
4. Deakin, E. Equity and environmental justice in sustainable transportation: Toward a research agenda. In *Institutions and Sustainable Transport*; Rietveld, P., Stough, R.R., Eds.; Edward Elgar Publishing: Cheltenham, UK, 2007.

5. Feitelson, E. Introducing environmental equity dimensions into the sustainable transport discourse—issues and pitfalls. *Transp. Res. D Transp. Environ.* **2002**, *7*, 99–118. [[CrossRef](#)]
6. Schlosberg, D. *Defining Environmental Justice: Theories, Movements, and Nature*; Oxford University Press: Oxford, UK, 2009.
7. Martens, K.; Di Ciommo, F. Travel time savings, accessibility gains and equity effects in cost–benefit analysis. *Transp. Rev.* **2017**, *37*, 152–169. [[CrossRef](#)]
8. Karner, A.; London, J.; Rowangould, D.; Manaugh, K. From transportation equity to transportation justice: Within, through, and beyond the state. *J. Plan. Lit.* **2020**, *35*, 440–459. [[CrossRef](#)]
9. Sheller, M. *Mobility Justice: The Politics of Movement in an Age of Extremes*; Verso: Brooklyn, NY, USA, 2018; pp. 19–25. ISBN 13. 978-1788730952.
10. American Public Transportation Association. Economic Impact of Public Transportation Investment. Available online: <https://www.apta.com/research-technical-resources/research-reports/economic-impact-of-public-transportation-investment/> (accessed on 17 August 2021).
11. Martens, K. Ageing, impairments and travel: Priority setting for an inclusive transport system. *Transp. Policy* **2018**, *63*, 122–130. [[CrossRef](#)]
12. Blumenberg, E.; Manville, M. Beyond the spatial mismatch: Welfare recipients and transportation policy. *J. Plan. Lit.* **2004**, *19*, 182–205. [[CrossRef](#)]
13. Blumenberg, E.; Ong, P. Cars, buses, and jobs: Welfare participants and employment access in Los Angeles. *Transp. Res. Rec.* **2001**, *1756*, 22–31. [[CrossRef](#)]
14. Taylor, B.D.; Ong, P.M. Spatial mismatch or automobile mismatch? An examination of race, residence and commuting in US metropolitan areas. *Urban Stud.* **1995**, *32*, 1453–1473. [[CrossRef](#)]
15. Thomopoulos, N.; Grant-Muller, S.; Tight, M.R. Incorporating equity considerations in transport infrastructure evaluation: Current practice and a proposed methodology. *Eval. Program Plan.* **2009**, *32*, 351–359. [[CrossRef](#)]
16. Murray, A.T.; Davis, R. Equity in Regional Service Provision. *J. Reg. Sci.* **2001**, *41*, 557–600. [[CrossRef](#)]
17. Ong, P.M. Car ownership and welfare-to-work. *J. Policy Anal. Manag.* **2002**, *21*, 239–252. [[CrossRef](#)]
18. Bills, T.S.; Sall, E.A.; Walker, J.L. Activity-based travel models and transportation equity analysis. *Transp. Res. Rec.* **2012**, *2320*, 18–27. [[CrossRef](#)]
19. Karlström, A.; Franklin, J.P. Behavioral adjustments and equity effects of congestion pricing: Analysis of morning commutes during the Stockholm Trial. *Transp. Res. Part A Policy Pract.* **2009**, *43*, 283–296. [[CrossRef](#)]
20. Chakraborty, J.; Schweitzer, L.A.; Forkenbrock, D.J. Using GIS to assess the environmental justice consequences of transportation system changes. *Trans. GIS* **1999**, *3*, 239–258. [[CrossRef](#)]
21. Forkenbrock, D.J.; Schweitzer, L.A. *Environmental Justice and Transportation Investment Policy*; Department of Transportation, Office of Investment Management: St Paul, MN, USA, 1997. [[CrossRef](#)]
22. Rowangould, D.; Karner, A.; London, J. Identifying environmental justice communities for transportation analysis. *Transp. Res. Part A Policy Pract.* **2016**, *88*, 151–162. [[CrossRef](#)]
23. Forkenbrock, D.J.; Schweitzer, L.A. Environmental justice in transportation planning. *J. Am. Plan. Assoc.* **1999**, *65*, 96–112. [[CrossRef](#)]
24. Brugge, D. *Particles in the Air, The Deadliest Pollutant is One You Breathe Every Day*; Springer: Cham, Switzerland, 2018.
25. Li, Y.; Lane, K.J.; Corlin, L.; Patton, A.P.; Durant, J.L.; Thanikachalam, M.; Woodin, M.; Wang, M.; Brugge, D. Association of long-term near-highway exposure to ultrafine particles with cardiovascular diseases, diabetes and hypertension. *Int. J. Environ. Res. Public Health* **2017**, *14*, 461. [[CrossRef](#)]
26. Bolte, G.; Pauli, A.; Hornberg, C. Environmental justice: Social disparities in environmental exposures and health: Overview. In *Encyclopedia of Environmental Health*; Nriagu, J.O., Ed.; Elsevier: Burlington, MA, USA, 2011; pp. 459–470.
27. Cutter, S.L.; Shirley, W.L.; Boruff, B.J. Social vulnerability to environmental hazards. *Soc. Sci. Q.* **2003**, *84*, 242–261. [[CrossRef](#)]
28. Shrestha, R.; Flacke, J.; Martinez, J.; van Maarseveen, M. Environmental health related socio-spatial inequalities: Identifying “hotspots” of environmental burdens and social vulnerability. *Int. J. Environ. Res. Public Health* **2016**, *13*, 691. [[CrossRef](#)]
29. Golub, A.; Marcantonio, R.A.; Sanchez, T.W. Race, space, and struggles for mobility: Transportation impacts on African Americans in Oakland and the East Bay. *Urban Geogr.* **2013**, *34*, 699–728. [[CrossRef](#)]
30. Howland, S. “I Should Have Moved Somewhere Else”: The Impacts of Gentrification on Transportation and Social Support for Black Working-Poor Families in Portland, Oregon. Ph.D. Dissertation, Portland State University, Portland, OR, USA, 2020.
31. Dawkins, C.; Moeckel, R. Transit-induced gentrification: Who will stay, and who will go? *Hous. Policy Debate* **2016**, *26*, 801–818. [[CrossRef](#)]
32. Padeiro, M.; Louro, A.; da Costa, N.M. Transit-oriented development and gentrification: A systematic review. *Transp. Rev.* **2019**, *39*, 733–754. [[CrossRef](#)]
33. Schweitzer, L.; Valenzuela, A. Environmental injustice and transportation: The claims and the evidence. *J. Plan. Lit.* **2004**, *18*, 383–398. [[CrossRef](#)]
34. Pereira, R.H.M.; Schwanen, T.; Banister, D. Distributive justice and equity in transportation. *Transp. Rev.* **2017**, *37*, 170–191. [[CrossRef](#)]



35. Schlosberg, D.; Collins, L.B.; Niemeyer, S. Adaptation policy and community discourse: Risk, vulnerability, and just transformation. *Environ. Polit.* **2017**, *26*, 413–437. [CrossRef]
36. Bose, P.S. Refugees in Vermont: Mobility and acculturation in a new immigrant destination. *J. Transp. Geogr.* **2014**, *36*, 151–159. [CrossRef]
37. Johnke, P. Rural Transportation: A Vermont Perspective. Available online: <https://advocacymonitor.com/rural-transportation-a-vermont-perspective/> (accessed on 17 August 2021).
38. Yale School of Public Health; Vermont Law School. *Vermont Rural Transportation*; Yale School of Public Health: New Haven, CT, USA, 2021.
39. Kolodinsky, J.M.; DeSisto, T.P.; Proppen, D.; Putnam, M.E.; Roche, E.; Sawyer, W.R. It is not how far you go, it is whether you can get there: Modeling the effects of mobility on quality of life in rural New England. *J. Transp. Geogr.* **2013**, *31*, 113–122. [CrossRef]
40. Seekins, T.; Spas, D.; Hubbard, M. *Inequities in Rural Transportation*; Independent Living and Community Participation; University of Montana Rural Institute: Missoula, MT, USA, 1999; Volume 23.
41. United States Department of Transportation. Rural Areas Planning. Available online: [https://www.fhwa.dot.gov/planning/publications/rural\\_areas\\_planning/page03.cfm](https://www.fhwa.dot.gov/planning/publications/rural_areas_planning/page03.cfm) (accessed on 4 January 2023).
42. Nordbakke, S.; Schwanen, T. Transport, unmet activity needs and well-being in later life: Exploring the links. *Transportation* **2015**, *42*, 1129–1151. [CrossRef]
43. Office of the Assistant Secretary for Planning and Evaluation. 2019 Poverty Guidelines. Available online: <https://aspe.hhs.gov/topics/poverty-economic-mobility/poverty-guidelines/prior-hhs-poverty-guidelines-federal-register-references/2019-poverty-guidelines> (accessed on 4 January 2023).
44. McHugh, M.L. Interrater reliability: The kappa statistic. *Biochem. Med.* **2012**, *22*, 276–282. [CrossRef] [PubMed]
45. Rural Environmental Justice Opportunities Informed by Community Expertise (REJOICE) COVID 19 Virtual Community Community Conversations: Detailed Summaries by Communities and Topic. Available online: <https://environmentaljusticevt.org/rejoice/> (accessed on 7 January 2023).
46. Petenko, E. Dollar Stores are Filling Vermont’s Food Deserts. Are They Helping? 2011. Available online: <https://vtdigger.org/2019/11/24/dollar-stores-are-filling-vermonts-food-deserts-are-they-helping/> (accessed on 17 August 2021).
47. Dougherty, M.; Petenko, E. Vermonters Struggle with Social Isolation. Available online: <https://vtdigger.org/2019/12/09/the-deeper-dig-when-vermonters-struggle-with-social-isolation/> (accessed on 17 August 2021).
48. Vermont Department of Environmental Conservation: Low Emission Vehicles. Available online: <https://dec.vermont.gov/air-quality/mobile-sources/lev> (accessed on 17 August 2021).
49. Seguíno, S.; Brooks, N. driving while black and brown in Vermont: Can race data analysis contribute to reform? *RBPE* **2021**, *48*, 42–73. [CrossRef]
50. Keady, W.; Panikkar, B.; Nelson, I.L.; Zia, A. Energy justice gaps in renewable energy transition policy initiatives in Vermont. *Energy Policy* **2021**, *159*, 112608. [CrossRef]
51. Doane, J. State-based Climate Legislation: A Policy Analysis of Carbon Tax Proposals in Vermont, New York, and Massachusetts. Bachelor’s Thesis, University of Vermont, Burlington, VT, USA, 2018.
52. Curran, M.; Erickson, J.D.; Hausman, R.; Hoxworth, D.; Jones, R.M.; Kimmich, J.; Kleppner, B.; Lafayette, K.; Mears, D.; Miller, C.; et al. The Essex Plan: An Economy Strengthening Strategic Energy Exchange. 2017. Available online: <https://www.eanvt.org/2017-ean-convention/the-essex-plan-an-economy-strengthening-strategic-energy-exchange/> (accessed on 4 August 2022).
53. State of Vermont Office of Governor Phil Scott. Governor Phil Scott Details Initiatives to Increase Electric Vehicles in Vermont. Available online: <https://governor.vermont.gov/press-release/governor-phil-scott-details-initiatives-increase-electric-vehicles-vermont> (accessed on 17 August 2021).
54. Bose, P.S. Building sustainable communities: Immigrants and mobility in Vermont. *Res. Transp. Bus. Manag.* **2013**, *7*, 81–90. [CrossRef]
55. Kwan, M. Space-time and integral measures of individual accessibility: A comparative analysis using a point-based framework. *Geogr. Anal.* **1998**, *30*, 191–216. [CrossRef]
56. Neutens, T.; Schwanen, T.; Witlox, F.; Maeyer, P.D. Equity of urban service delivery: A comparison of different accessibility measures. *Environ. Plan. A Econ. Space* **2010**, *42*, 1613–1635. [CrossRef]
57. Recker, W.W.; Chen, C.; McNally, M.G. Measuring the impact of efficient household travel decisions on potential travel time savings and accessibility gains. *Transp. Res. Part A Policy Pract.* **2001**, *35*, 339–369. [CrossRef]
58. Wee, B.; van Geurs, K. Discussing equity and social exclusion in accessibility evaluations. *Eur. J. Transp. Infrastruct. Res.* **2011**, *11*, 350–367.
59. McEntee, J.; Agyeman, J. Towards the development of a GIS method for identifying rural food deserts: Geographic access in Vermont, USA. *Appl. Geogr.* **2010**, *30*, 165–176. [CrossRef]
60. Hoesen, J.V.; Bunkley, B.; Currier, C. A GIS-based methodology toward refining the concept of rural food deserts: A case study from Rutland County, Vermont. *J. Agric. Food Syst. Community Dev.* **2013**, *3*, 61–76. [CrossRef]
61. Strout, E.H.; Fox, L.; Castro, A.; Haroun, P.; Leavitt, B.; Ross, C.; Sayan, M.; Delaney, T.; Platzer, A.; Hutchins, J.; et al. Access to transportation for Chittenden County Vermont older adults. *Aging Clin. Exp. Res.* **2016**, *28*, 769–774. [CrossRef] [PubMed]

62. Caro, F.G.; Robnett, R.H.; Higgins, J. *Transportation: A Crucial Issue for Adult Day Care in Vermont*; Paper 3; Gerontology Institute, University of Massachusetts: Boston, MA, USA, 2002.
63. Delbosc, A.; Currie, G. Using Lorenz curves to assess public transport equity. *J. Transp. Geogr.* **2011**, *19*, 1252–1259. [[CrossRef](#)]
64. Rawls, J. *A Theory of Justice*; Oxford University Press: Oxford, UK, 1999.
65. Fraser, N. *Justice Interruptus: Critical Reflections on the 'Postsocialist' Condition*; Routledge: New York, NY, USA; London, UK, 1997.
66. Viegas, J.M. Making urban road pricing acceptable and effective: Searching for quality and equity in urban mobility. *Transp. Policy* **2001**, *8*, 289–294. [[CrossRef](#)]

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.