

HEALTH NOTE: Metro for D.C. Amendment Act of 2021 Bill 24-0429 Council of the District of Columbia, Council Period 24

Introduced by:

Councilmembers Allen, Nadeau, R. White, Pinto, Henderson, Bonds, Lewis George, Cheh, McDuffie, and Chairman Mendelson

Bill Summary:¹

As introduced, Bill 24-0429 establishes the District Resident Transit Subsidy Program to provide subsidies directly to District residents, prioritized by income level, for travel on any transportation that accepts payment through a SmarTrip card issued by WMATA. The bill also creates the Transit Equity Fund to improve transit access in priority areas.

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What is the goal of this health note?

Decisions made in sectors outside of public health and health care, such as in education, housing, and employment, can affect health and well-being. Health notes are intended to provide objective, nonpartisan information to help legislators understand the connections between these various sectors and health. This document provides summaries of evidence analyzed by the Health Impact Project at The Pew Charitable Trusts while creating a health note for Council of the District of Columbia Bill 24-0429. Health notes are not intended to make definitive or causal predictions about how a proposed bill will affect health and well-being of constituents. Rather, legislators can use a health note as one additional source of information to consider during policymaking. The analysis does not consider the fiscal impacts of this bill.

How and why was this bill selected?

With the help of the Council of the District of Columbia's Office of the Budget Director, the Health Impact Project identified this bill as one of several important policy issues being considered by the Council of the District of Columbia during Council Period 24 (2021–2022). The health note screening criteria were used to confirm the bill was appropriate for analysis (See Methodology Appendix on Page 8).

The project selected Bill 24-0429 for analysis because of its potential to affect the District residents' access to transportation, discretionary incomes, and rates of physical activity. Transportation infrastructure, access, and quality affect people's health and well-being. Transportation costs can also affect household expenses: for example, households commonly make trade-offs between less expensive housing and a longer commute, which may increase money spent on gas and vehicle ownership and maintenance.¹

SUMMARY OF HEALTH NOTE FINDINGS

Access to safe, affordable, and reliable public transit can support increased physical activity and improved access to jobs and services, which may help people—especially those from low-income households—maintain stable employment, meet basic needs, and access healthy foods and other resources.² Conversely, research has documented how the emphasis on motorized transportation in the United States has been associated with numerous negative health outcomes, including higher rates of obesity, air pollution, and transportation-related injuries and fatalities.³

- There is **strong evidence** that public transit costs and fare reductions affect ridership rates.⁴ While **strong evidence** shows that reducing or eliminating public transit fares can increase ridership, especially for older adults, there is **mixed evidence** regarding

¹ Summary as described by the Council of the District of Columbia, <https://lims.dccouncil.us/Legislation/B24-0429>. The Health Impact Project conducted this health note based on the bill as introduced.

² The Health Impact Project is committed to conducting non-partisan research and analysis.

discretionary transit riders’—individuals who have access to other forms of transportation such as a private vehicle—responsiveness to these incentives.⁵

- **Strong evidence** shows that public transit users achieve more daily physical activity than motor vehicle users, resulting in health benefits including reduced rates of obesity and associated health conditions, such as diabetes and cardiovascular disease; however, the evidence regarding the cause of this association is **mixed**.⁶
- Getting people out of cars and into public transit may reduce rates of traffic-related mortalities. There is **strong evidence** that public transportation is safer than riding in a car. One study found that increases in the share of transit ridership are associated with a decline in motor vehicle related fatalities.⁷

The Health Impact Project’s health note methodology focuses on identifying research conducted among populations in the United States to identify findings that are most relevant to the state and local context. By excluding studies conducted outside of the United States, health notes may exclude seminal research on similar policies that have been implemented in other countries. In conducting the literature review for this health note, the Health Impact Project staff identified, but excluded, several international studies investigating the effects of transit subsidies on people’s well-being that may be relevant for the D.C. Council to examine. This research included several studies examining the effects of providing free bus passes to older adults in the United Kingdom. They found free passes were associated with increased use of public transit, better self-reported quality of life and life satisfaction, fewer depressive symptoms, enhanced access to goods and services, improved social interaction, better physical health among female bus pass holders compared to those without passes, and higher levels of active travel, particularly among Black study participants.⁸ Another example investigated the effects of Canada’s Public Transit Tax Credit, which enabled Canadians to claim some of their public transit expenses against their federal income taxes, on ridership.⁹ The study found the tax credit did not significantly alter Canadians’ travel mode choices, and most of the recipients would have taken transit regardless of the policy. The D.C. Council could examine these studies, which are included in the list of references, and systematically search for relevant international studies to further inform its understanding of the effects of transit subsidy policies.

Methods Summary: To complete this health note, Health Impact Project staff conducted an expedited literature review using a systematic approach to minimize bias and identify recently published studies to answer each of the identified research questions. In this note, “health impacts” refer to effects on determinants of health, such as education, employment, and housing, as well as effects on health outcomes, such as injury, asthma, chronic disease, and mental health. The strength of the evidence is qualitatively described and categorized as: not well researched, mixed evidence, a fair amount of evidence, strong evidence, or very strong evidence. It was beyond the scope of analysis to consider the fiscal impacts of this bill or the effects any funds dedicated to implementing the bill may have on other programs or initiatives in the District. To the extent that this bill requires funds to be shifted away from other purposes or would result in other initiatives not being funded, policymakers may want to consider additional research to understand the relative effect of devoting funds for this bill relative to another purpose. A detailed description of the methods is provided in the Methodology Appendix on Page 8.

WHY DO THESE FINDINGS MATTER FOR THE DISTRICT OF COLUMBIA?

Over 35% of D.C. workers commute by public transit, making it the city's most popular mode of transportation.¹⁰ However, lower-income households spend a higher share of their income on transportation and are disproportionately burdened by transportation costs. According to a 2019 D.C. Transit report, over 65% of the highest-income Metrorail customers receive an additional transit subsidy through employer-sponsored programs and only 10% of Metro's lowest-income rail customers receive similar subsidies.¹¹ To the extent that the bill decreases transportation costs for low-income District residents, it could reduce inequities in transportation spending and increase the funds they have available for health-promoting expenditures such as utility bills, or facilitate additional transit trips to access health-promoting goods and services such as full-service grocery stores and medical care.

The Metro for D.C. Amendment Act would provide monthly SmarTrip card contributions to residents who are 18 and older and not eligible for other transit subsidy programs. The Act would prioritize funding for those earning 300% of the federal poverty level (FPL) or less, which includes individuals making \$38,640 per year or less.¹² While research for this health note did not yield data on transportation mode choice for D.C. residents earning 300% FPL or less, of the 104,374 workers in D.C. age 16 and over earning less than \$35,000 per year, nearly 31,000 reported driving alone to work.¹³ Furthermore, the total daily vehicle miles traveled (VMT) per capita in D.C. is 21.¹⁴ To the extent that initial recipients of this subsidy are responsive to the financial incentive and switch to public transit, this bill has the potential to alleviate congestion and reduce VMT in the District, potentially reducing car-related injuries or deaths and improving air quality.

WHAT ARE THE POTENTIAL HEALTH EFFECTS OF B24-0429?

Effects of free and reduced transit passes on public transit use

- Several studies, including those using economic modeling, show that public transit costs and fare reductions affect ridership rates.¹⁵ Some studies show that reducing or eliminating public transit fares can increase ridership among individuals who are already dependent on transit, while the evidence regarding discretionary transit riders' responsiveness to these incentives is mixed.¹⁶
 - Urban residents with lower incomes tend to be more transit-dependent than residents with higher incomes, so the subsidy proposed by B24-0429 may not increase the proportion of low-income D.C. residents who rely on transit.¹⁷ It may, however, increase the frequency or number of public transportation trips low-income District residents take.
 - Because older adults tend to have less discretionary income than younger adults, they are more likely to face financial barriers to accessing public transportation and may also be most responsive to fare subsidies.¹⁸
 - One qualitative study of older adults, including those with limited English language proficiency, late-life immigrants, and refugees, asked about factors that helped or hindered their transportation access. Affordability, including

access to a subsidized bus pass, was identified as important factor in using the bus.¹⁹

- A free-fare program for older adults in Illinois called the Seniors Ride Free Program resulted in a 75% increase in senior public transit trips in the Chicago metropolitan area. The operating expenses associated with the added trips led the state legislature to implement income restrictions for this program.²⁰ If implemented, B24-0429 may see increases in ridership among certain segments of the population, such as older residents with fixed incomes.
- The effect that B24-0429 will have on private automobile use and the share of public transit ridership is unclear, due to mixed evidence regarding the effects of reducing or eliminating public transit fares ridership among discretionary transit users.²¹ Some authors posit that motor vehicle users may be more likely to choose public transit based on a combination of service quality (e.g., reliability, speed, and comfort) and policies that make operating an automobile more expensive, such as road tolls or increased gasoline taxes and parking prices, rather than transit fare decreases.²²
 - Previous fare-free experiments reported that only 5-30% of additional transit trips were made by individuals switching from other forms of motorized transport, such as cars. Existing riders, students, and older adults accounted for a disproportionate amount of the surplus trips.²³
 - There is some evidence that financial incentives provided by employers can increase the share of commuters who use public transit instead of driving. Results from a 2020 study that examined the impacts of commuter benefits programs on transportation mode choice and automobile usage support earlier findings that the provision of commuter benefits significantly influences workers' commuting mode choices and makes workers more likely to adopt subsidized travel modes for commutes.²⁴ Specifically, workers offered transit benefits are more likely to commute by public transit.²⁵ For example, a study that evaluated the relationship between employer-sponsored commuter benefits and mode choice in the Washington, D.C. metropolitan area found commuters who only receive public transportation benefits, versus benefits such as free parking, are 11 times more likely to take public transportation than drive.²⁶ They are also more likely to choose walking over driving.²⁷ Furthermore, research has found that those offered transit benefits tend to drive less for both other work-related and non-work purposes.²⁸

Effects of public transit ridership on motor vehicle safety

- Because research links transit service and ridership with improvements in traffic safety, increasing transit ridership could reduce motor vehicle related injuries and deaths in Washington, D.C.²⁹ One study that examined data from 100 U.S. cities found that increased shares of mass transit ridership were associated with reduced motor vehicle fatalities.³⁰ To date, car travel remains the most dangerous mode of transportation. Early federal analysis of motor vehicle traffic fatalities nationally in 2020 shows an estimated 38,680

people died in crashes.³¹ The National Safety Council reported that, over the past 10 years, the passenger vehicle death rate per 100,000,000 passenger miles traveled in the United States was over nine times higher than for buses and 17 times higher than for passenger trains.³²

- Although public transit is safer than car travel, active commuters and individuals walking or bicycling to transit hubs are more likely than drivers to be injured in traffic or exposed to vehicle emissions. This is especially the case when using heavily trafficked routes, where sidewalks and bicycle lanes are lacking, or where walkers and bicyclists are not fully separated from vehicles.³³

Effects of transit subsidies on recipients' financial well-being

- Urban dwellers who are dependent on public transportation tend to be young and/or have low incomes. Unlike discretionary riders, they may not have access to alternate modes of transportation and changes in fares can have direct impacts on their discretionary budgets. Research shows many U.S. households, particularly those with lower incomes, have experienced material hardship, meaning they have had to make tradeoffs between basic needs important to health, such as food and medical care.³⁴ Households in poverty also spend a higher share of their income on transportation expenses and are disproportionately burdened by rising transportation costs.³⁵ Nearly a quarter of households in poverty do not own a vehicle.³⁶ To the extent that B24-0429 decreases transportation costs for low-income District residents, it could result in improved health outcomes associated with increased finances available for health-promoting expenditures such as utility bills and nutritious foods. This subsidy may also allow recipients, especially those in low-resource neighborhoods, to take more trips to access health-promoting goods and services such as full-service grocery stores and medical care.
- One conceptual model of the relationship between urban transportation and health cites the cost of public transportation as a barrier to finding a job.³⁷ The subsidy proposed in B24-0429 could benefit job seekers by funding their travel to job interviews or broadening the geographic radius in which they may consider seeking employment. Research has consistently demonstrated a strong link between employment and health, particularly through effects on workers' income, job stability, and access to health insurance and other benefits.³⁸

Effects of access to public transportation on health

- Lack of access to transportation is a well-documented barrier to receiving health care, particularly for individuals with chronic health conditions, and can lead to missed appointments, delayed care, and missed or delayed medication use.³⁹ One systematic literature search that analyzed 61 peer reviewed studies on transportation barriers to health care access found transportation access is a key obstacle to receiving medical care, especially for under- or uninsured and low-income individuals.⁴⁰ In 25 of the studies examined, 10-51% of patients reported transportation was a barrier to health care access.⁴¹ A 2019 systematic review of studies examined the impact of multi-faceted interventions that included transportation support for chronic care patients—including

free bus passes, transport vouchers or reimbursement, arranging participants' transportation, and a free shuttle service—on health care utilization. Although the studies' analytical methods did not determine the impact of transportation support alone, the review found an association between interventions that provide transportation assistance and overall improvements in health care utilization and chronic care medical outcomes.⁴²

- Access to public transportation is especially important for older adults and individuals with disabilities who often encounter transportation barriers. A 2013 survey that asked individuals with disabilities how transportation access affected their social participation found that 67% of respondents' social lives were hindered by their transportation needs.⁴³ The authors concluded that individuals with disabilities, especially significant ones, rely on public transportation and social networks to meet their transportation needs.⁴⁴ Social support and connection can directly benefit health by positively influencing behaviors and psychological well-being while protecting people from risk factors that might otherwise damage their health.⁴⁵ Furthermore, social isolation is associated with increased mortality.⁴⁶

Effects of public transit use on physical activity and health outcomes

- Improving access to public transit may provide health benefits through increasing physical activity.⁴⁷ A 2016 literature review yielded strong evidence of a positive association between transit use and physical activity.⁴⁸
 - Studies have shown public transit users engage in higher levels of physical activity, both in terms of energy expenditure and active time, than automobile-dependent commuters.⁴⁹ Activity associated with walking or bicycling to and from transit hubs can help to reduce rates of obesity and associated health conditions, such as diabetes or cardiovascular disease.
 - A 2017 study that analyzed 2012–13 California Household Travel Survey data to investigate the link between automobile dependence and physical inactivity found that employed urban California residents over the age of 16 with access to a car who choose to use public transit reported 29 more minutes of physical activity daily than their auto-dependent counterparts.⁵⁰ The transit users reported an average of 44 minutes of total daily physical activity, including 24 minutes of transit-related exercise, compared to auto-dependents' daily average of 15 minutes.⁵¹ Furthermore, transit users are more likely to walk or bike to non-work activities than car-dependent Californians.⁵²
 - One study used National Household Travel Survey data to estimate that public transit users walk over eight additional minutes per day compared to motorists. The analysis projected that transit use could save up to \$5,500 in obesity-related medical costs per person, and savings in quality-adjusted life years could be even greater.⁵³
- While there is evidence demonstrating transit users are more likely to meet daily physical activity recommendations, some scholars argue transit users may be people who are already healthier and physically active.⁵⁴ Other scholars posit transit may be used as a substitute for more active forms of transportation, such as cycling or walking, which is counter-effective in terms of health benefits.⁵⁵

- Past experiments with free transit programs found most new trips were taken by people who would have walked, bicycled, or foregone the trip altogether if it had cost money.⁵⁶
- The authors of one review caution that the association between transit use and physical activity is not necessarily causal. They note that due to known biases in the types of papers that get published, weak positive correlations presented in studies published many years ago self-perpetuate through future reviews, thereby driving policy decisions and “wrongly justified investments.”⁵⁷

Implementation considerations

- In 2012, the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine cautioned that ridership increases triggered by free or reduced fare public transit programs may result in a need for additional maintenance, security, and equipment to maintain prior levels of service and schedules.⁵⁸ Thus, the proposed subsidy has the potential to increase transit use and benefit health and the environment when paired with adequate investments to transit infrastructure, such as through the Transit Equity Fund proposed in this bill. Furthermore, it will be important that additional maintenance, equipment, and other investments occur equitably throughout the District.⁵⁹
- Transit cost is only one dimension of transit access. Ensuring that neighborhoods are designed to support safe access to and from transit stops for people of all ability levels should also be considered. To the extent that Transit Equity Fund investments improve physical and geographic transit accessibility, this bill has the potential to extend transit-related health benefits to D.C. residents with various accessibility needs and who live in neighborhoods that have been historically underserved by public transit.

WHICH POPULATIONS ARE MOST LIKELY TO BE AFFECTED BY THIS BILL?

In general, individuals with low incomes, people who have chronic health conditions or mobility challenges, and older adults are more likely to be considered transit dependent and sensitive to transit costs. While D.C. residents earning less than 270% FPL are more likely to use public transit (38%) to get to work than workers earning above 270% FPL (27%), they are less likely than higher-income residents to receive public transit subsidies through their employers.⁶⁰ D.C. residents who are transit dependent and meet the income requirements to benefit from the subsidy proposed in this bill are most likely to benefit through a rise in discretionary income due to reduced transportation spending and/or an increase in the number of trips they can afford to take each month. Furthermore, individuals who live in low-resource neighborhoods may benefit from taking more trips to access health services, job opportunities, or full-service grocery stores.

The Housing and Transportation Affordability Index maps annual household transportation costs and percentage of income spent on transportation by census tract. The higher costs and shares of income are more prolific in neighborhoods closest to the D.C. borders in the Southeast, Northeast, and Northwest quadrants. For example, someone in Northern D.C. near Silver Spring spends over \$12,000 annually on transportation on average, whereas someone in Kalorama will spend an average of around \$5,000.⁶¹ To the extent that qualifying residents of the neighborhoods

mentioned above make use of the Metro for D.C. subsidy, this bill has the potential to reduce inequities in transportation spending by those who live in neighborhoods far from employment and education centers and effectively make it more affordable to live in neighborhoods that require residents to travel farther for employment or education opportunities.

HOW LARGE MIGHT THE IMPACT BE?

Where possible, the Health Impact Project describes how large the impact may be based on the bill language and literature, such as describing the size, extent, and population distribution of an effect. This bill has the potential to affect all eligible D.C. residents, first prioritizing those earning 300% FPL or less. While research for this health note did not yield data on transportation mode choice for D.C. residents earning 300% FPL or less, of the 104,374 workers in D.C. age 16 or over earning less than \$35,000 per year, nearly 31,000 reported driving alone to work.⁶² This bill could provide a transportation alternative that is more affordable, reduces traffic congestion, and produces less emissions, assuming residents have access to convenient public transit routes. Furthermore, the District averages approximately 21 vehicle miles traveled per capita each day. While many of those miles traveled are likely attributed to residents of nearby counties, this bill could reduce the city's VMT average, thereby reducing traffic-related congestion, pollution, and injury.⁶³

It was beyond the scope of this analysis to consider the fiscal impacts of this bill or the effects any funds dedicated to implementing the bill may have on other programs or initiatives in the District. To the extent that this bill requires funds to be shifted away from other purposes or would result in other initiatives not being funded, policymakers may want to consider additional research to understand the relative effect of devoting funds for this bill relative to another purpose.

APPENDIX: METHODOLOGY

Once the bill was selected for analysis, a research team from the Health Impact Project hypothesized connections, or pathways, among the bill, health determinants, and health outcomes. These hypothesized pathways were developed using research team expertise and a preliminary review of the literature. The selected bill components were mapped to steps on these pathways and the team developed research questions and a list of keywords to search. The research team reached consensus on the final conceptual model, research questions, contextual background questions, keywords, and keyword combinations. The conceptual model, research questions, search terms, and list of literature sources were peer-reviewed by two external subject matter experts. One of the experts also reviewed a draft of the health note. A copy of the conceptual model is available upon request.

The Health Impact Project developed and prioritized two research questions related to the bill components examined:

- To what extent could transit subsidies or reduced transportation costs affect access to:
 - Healthy foods?

- Medical care and essential services?
- Employment opportunities?
- Healthy, quality, or affordable housing?
- Parks and recreation?
- Social opportunities?
- To what extent do transit subsidies affect:
 - Discretionary income?
 - Physical activity?
 - Self-reported health and well-being?
 - Exposure to extreme heat or weather events?
 - Vehicle miles traveled or traffic congestion?
 - Vehicular emissions or air quality?
 - The frequency of motor vehicle accidents or pedestrian/cyclist injuries?

The research team next conducted an expedited literature review using a systematic approach to minimize bias and answer each of the identified research questions.^c The team limited the search to systematic reviews and meta-analyses of studies first, since they provide analyses of multiple studies or address multiple research questions. If no appropriate systematic reviews or meta-analyses were found for a specific question, the team searched for nonsystematic research reviews, original articles, and research reports from U.S. agencies and nonpartisan organizations. The team limited the search to electronically available sources published between 2016 and 2021.

To explore each research question, the research team searched PubMed and EBSCO databases along with the following leading journals in public health and sector-specific journals suggested by subject matter experts: American Journal of Public Health, Social Science & Medicine, Health Affairs, Journal of Transportation & Health, Journal of Urban Health, Health and Place, Transportation Research Part A.^d For each search, the team used the following search terms: public transit subsidy, medical care, employment, housing, physical activity, stress, household finances, discretionary income, vehicle miles traveled, motor vehicle accidents, congestion, pollution, air quality, environmental impact, heat exposure, healthy foods, and social interaction. The team also searched Urban Institute, Centers for Disease Control and Prevention, and Transportation Research Board for additional research and resources outside of peer-reviewed literature.

^c Expedited reviews streamline traditional literature review methods to synthesize evidence within a shortened timeframe. Prior research has demonstrated that conclusions of a rapid review versus a full systematic review did not vary greatly. M.M. Haby et al., "What Are the Best Methodologies for Rapid Reviews of the Research Evidence for Evidence-Informed Decision Making in Health Policy and Practice: A Rapid Review," *Health Research Policy and Systems* 14, no. 1 (2016): 83, <https://doi.org/10.1186/s12961-016-0155-7>.

^d American Journal of Public Health, Social Science & Medicine, and Health Affairs were selected using results from a statistical analysis completed to determine the leading health research journals between 1990 and 2014 and in consultation with policing and criminal justice experts. Merigó, José M., and Alicia Núñez. "Influential Journals in Health Research: A Bibliometric Study." *Globalization and Health* 12.1 (2016), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4994291/>.

After following the above protocol, the team screened 46 titles and abstracts,^e identified 20 abstracts for potential inclusion, and reviewed the full text corresponding to each of these abstracts. After applying the inclusion criteria, eight articles were excluded. Six additional sources were identified upon review of the included articles. A final sample of 31 articles, including one systematic review and one meta-analytic review, was used to create the health note. In addition, the team used 13 references to provide contextual information.

Of the studies included, the Health Impact Project qualitatively described and categorized the strength of the evidence as: not well researched, mixed evidence, a fair amount of evidence, strong evidence, or very strong evidence. The evidence categories were adapted from a similar approach from Washington state.⁶⁴

Very strong evidence: the literature review yielded robust evidence supporting a causal relationship with few if any contradictory findings. The evidence indicates that the scientific community largely accepts the existence of the relationship.

Strong evidence: the literature review yielded a large body of evidence on the association, but the body of evidence contained some contradictory findings or studies that did not incorporate the most robust study designs or execution or had a higher-than-average risk of bias; or some combination of those factors.

A fair amount of evidence: the literature review yielded several studies supporting the association, but a large body of evidence was not established; or the review yielded a large body of evidence, but findings were inconsistent with only a slightly larger percent of the studies supporting the association; or the research did not incorporate the most robust study designs or execution or had a higher-than-average risk of bias.

Mixed evidence: the literature review yielded several studies with contradictory findings regarding the association.

Not well researched: the literature review yielded few if any studies, or yielded studies that were poorly designed or executed or had high risk of bias.

EXPERT REVIEWERS

This document benefited from the insights and expertise of Dr. Celeste Chavis, associate professor of transportation & urban development studies at Morgan State University, and Dr. Ipek Sener, research scientist at Texas A&M Transportation Institute. Although they reviewed the materials and found the approach to be sound, neither they nor their organizations necessarily endorse the note's findings or conclusions.

ACKNOWLEDGMENTS

The Health Impact Project thanks the Council of the District of Columbia's Office of the Budget Director for providing insights into the policy context of B24-0429.

^e Many of the searches produced duplicate articles. The number of sources screened does not account for duplication across searches in different databases.

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- ¹ American Public Health Association, "At the Intersection of Public Health and Transportation: Promoting Healthy Transportation Policy" (2009), https://www.apha.org/~media/files/pdf/topics/transport/at_the_intersection.ashx.
- ² American Public Health Association, "The Hidden Health Costs of Transportation" (2010), https://www.apha.org/~media/files/pdf/factsheets/hidden_health_costs_transportation.ashx; Safe Routes to School National Partnership, "At the Intersection of Active Transportation and Equity: Joining Forces to Make Communities Healthier and Fairer" (2015), <https://www.saferoutespartnership.org/resources/report/intersection-active-transportation-equity>.
- ³ National Research Council Committee on Health Impact Assessment, *Improving Health in the United States: The Role of Health Impact Assessment* (Washington (DC): National Academies Press (US), 2011), [10.17226/13229](https://doi.org/10.17226/13229).
- ⁴ T.A. Litman, "Transit Price Elasticities and Cross-Elasticities," *The Journal of Public Transportation* 7 (2004): 2, <https://www.nctr.usf.edu/wp-content/uploads/2010/03/IPT-7-2-Litman.pdf>; Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Implementation and Outcomes of Fare-Free Transit Systems* (Washington, DC: The National Academies Press, 2012), [doi:10.17226/22753](https://doi.org/10.17226/22753).
- ⁵ Litman, "Transit Price Elasticities and Cross-Elasticities.;" J.-D. Saphores, D. Shah, and F. Khatun, "A Review of Reduced and Free Transit Fare Programs in California" (University of California Institute of Transportation Studies, 2020), <https://escholarship.org/uc/item/74m7f3rx>.
- ⁶ I.N. Sener, R.J. Lee, and Z. Elgart, "Potential Health Implications and Health Cost Reductions of Transit-Induced Physical Activity," *Journal of Transport & Health* 3, no. 2 (2016): 133-40, <https://pubmed.ncbi.nlm.nih.gov/27347481/>; R.D. Edwards, "Public Transit, Obesity, and Medical Costs: Assessing the Magnitudes," *Preventive Medicine* 46, no. 1 (2008): 14-21, <https://pubmed.ncbi.nlm.nih.gov/18037480/>; S. Chakrabarti and E.J. Shin, "Automobile Dependence and Physical Inactivity: Insights from the California Household Travel Survey," *Journal of Transport & Health* 6 (2017): 262-71, <https://www.sciencedirect.com/science/article/pii/S2214140516303085>; J.F. Sallis et al., "Physical Activity in Relation to Urban Environments in 14 Cities Worldwide: A Cross-Sectional Study," *The Lancet* 387, no. 10034 (2016): 2207-17, <https://www.sciencedirect.com/science/article/pii/S0140673615012842>; A. Ermagun and D. Levinson, "'Transit Makes You Short': On Health Impact Assessment of Transportation and the Built Environment," *Journal of Transport & Health* 4 (2017): 373-87, <https://www.sciencedirect.com/science/article/pii/S2214140516302390>.
- ⁷ T. Litman, "The Hidden Traffic Safety Solution: Public Transportation" (American Public Transportation Association, 2016), <https://www.apta.com/wp-content/uploads/Resources/resources/reportsandpublications/Documents/APTA-Hidden-Traffic-Safety-Solution-Public-Transportation.pdf>; J.P. Stimpson et al., "Share of Mass Transit Miles Traveled and Reduced Motor Vehicle Fatalities in Major Cities of the United States," *Journal of Urban Health* 91, no. 6 (2014): 1136-43, <https://doi.org/10.1007/s11524-014-9880-9>.
- ⁸ J. Green, A. Jones, and H. Roberts, "More Than A to B: The Role of Free Bus Travel for the Mobility and Wellbeing of Older Citizens in London," *Ageing and Society* 34, no. 3 (2014): 472-94, <https://www.cambridge.org/core/journals/ageing-and-society/article/more-than-a-to-b-the-role-of-free-bus-travel-for-the-mobility-and-wellbeing-of-older-citizens-in-london/C680A7256B40D65683A1AD466388A5EA>; S.E. Jackson et al., "Social Isolation and Physical Activity Mediate Associations between Free Bus Travel and Wellbeing among Older Adults in England," *Journal of Transport & Health* 13 (2019): 274-84, <https://www.sciencedirect.com/science/article/pii/S2214140519300271>; R. Patterson et al., "Ethnic Group Differences in Impacts of Free Bus Passes in England: A National Study," *Journal of Transport & Health* 11 (2018): 1-14, <https://www.sciencedirect.com/science/article/pii/S2214140518300197>; E. Webb, G. Netuveli, and C. Millett, "Free Bus Passes, Use of Public Transport and Obesity among Older People in England," *Journal of Epidemiology and Community Health* 66, no. 2 (2012): 176-80, <https://pubmed.ncbi.nlm.nih.gov/21911850/>; E. Webb et al., "Free Bus Travel and Physical Activity, Gait Speed, and Adiposity in the English Longitudinal Study of Ageing," *American Journal of Public Health* 106, no. 1 (2016): 136-42, <https://pubmed.ncbi.nlm.nih.gov/26562118>.
- ⁹ N. Rivers and B. Plumpton, "The Effectiveness of Public Transit Tax Credits on Commuting Behaviour and the Environment: Evidence from Canada," *Case Studies on Transport Policy* 6, no. 4 (2018): 651-62, <https://www.sciencedirect.com/science/article/pii/S2213624X18300853>.
- ¹⁰ U.S. Census Bureau, Means of Transportation to Work by Poverty Status in the Past 12 Months, 2015-2019, accessed October 4, 2021, last modified 2019, 2019,

<https://data.census.gov/cedsci/table?t=Commuting%3AIncome%20and%20Poverty&g=0400000US11&tid=ACSDT5Y2019.B08122&hidePreview=true>.

¹¹ Washington Metropolitan Area Transit Authority, "D.C. Low-Income Fare Pilot" (2019),

<https://www.wmata.com/about/board/meetings/board-pdfs/upload/9C-DC-Low-Income-Fare-Pilot.pdf>.

¹² American Council on Aging, "2021 Federal Poverty Levels/Guidelines & How They Determine Medicaid Eligibility," last modified January 26, 2021, accessed October 4, 2021, 2021,

<https://www.medicaidplanningassistance.org/federal-poverty-guidelines/>.

¹³ U.S. Census Bureau, Means of Transportation to Work by Workers' Earnings in the Past 12 Months (in 2019 Inflation-Adjusted Dollars), 2010-2019, accessed Oct. 4, 2021,

<https://data.census.gov/cedsci/table?t=Commuting%3AIncome%20and%20Poverty&g=0400000US11&tid=ACSDT5Y2019.B08119&hidePreview=false>.

¹⁴ U.S. Department of Transportation, "Transportation and Health Indicators: Washington, DC," accessed Oct. 4, 2021,

<https://www.transportation.gov/transportation-health-tool/indicators/detail/dc/uza/washington#indicators>.

¹⁵ Litman, "Transit Price Elasticities and Cross-Elasticities"; Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Implementation and Outcomes of Fare-Free Transit Systems*.

¹⁶ Litman, "Transit Price Elasticities and Cross-Elasticities."

¹⁷ Ibid.

¹⁸ H. Dabelko-Schoeny et al., "'We Want to Go, but There Are No Options': Exploring Barriers and Facilitators of Transportation among Diverse Older Adults," *Journal of Transport & Health* 20 (2021): 100994,

<https://www.sciencedirect.com/science/article/pii/S2214140520301985>.

¹⁹ Ibid.

²⁰ P. Metaxatos, "Ridership and Revenue Implications of Free Fares for Seniors in Northeastern Illinois," *Journal of Public Transportation* 16 (2013): 131-50, <https://digitalcommons.usf.edu/jpt/vol16/iss4/7/>.

²¹ Litman, "Transit Price Elasticities and Cross-Elasticities."

²² Ibid.; Saphores, Shah, and Khatun, "A Review of Reduced and Free Transit Fare Programs."

²³ Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Implementation and Outcomes of Fare-Free Transit Systems*.

²⁴ E.J. Shin, "Commuter Benefits Programs: Impacts on Mode Choice, VMT, and Spillover Effects," *Transport Policy* 94 (2020): 11-22, <https://www.sciencedirect.com/science/article/pii/S0967070X1930469X>.

²⁵ Ibid.

²⁶ A. Hamre and R. Buehler, "Commuter Mode Choice and Free Car Parking, Public Transportation Benefits, Showers/Lockers, and Bike Parking at Work: Evidence from the Washington, DC Region," *Journal of Public Transportation* 17 (2014): 67-91, <https://digitalcommons.usf.edu/jpt/vol17/iss2/4/>.

²⁷ Ibid.

²⁸ Shin, "Commuter Benefits Programs."

²⁹ Litman, "The Hidden Traffic Safety Solution: Public Transportation"; Stimpson et al., "Share of Mass Transit Miles."

³⁰ Stimpson et al., "Share of Mass Transit Miles."

³¹ National Highway Traffic Safety Administration, "Early Estimate of Motor Vehicle Traffic Fatalities in 2020" (2021), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813115>.

³² National Safety Council Injury Facts, "Deaths by Transportation Mode," National Safety Council, accessed Sept. 27, 2021, 2021, <https://injuryfacts.nsc.org/home-and-community/safety-topics/deaths-by-transportation-mode/>.

³³ Sener, Lee, and Elgart, "Potential Health Implications."

³⁴ A. Conrad and M. Ronnenberg, "Hardship in the Heartland: Associations between Rurality, Income, and Material Hardship," (2020, under review), <https://www.researchsquare.com/article/rs-31196/v1>; M. Karpman et al., "What Explains the Widespread Material Hardship among Low-Income Families with Children?" (Urban Institute, 2018),

<https://www.urban.org/research/publication/what-explains-widespread-material-hardship-among-low-income-families-children#:~:text=Physical%20and%20mental%20health%20problems.after%20controlling%20for%20other%20characteristics>.

³⁵ Federal Highway Administration, "FHWA NHTS Brief: Mobility Challenges for Households in Poverty" (2014),

<https://nhts.ornl.gov/briefs/PovertyBrief.pdf>.

³⁶ Ibid.

-
- ³⁷ A. Glazener et al., "Fourteen Pathways between Urban Transportation and Health: A Conceptual Model and Literature Review," *Journal of Transport & Health* 21 (2021): 101070, <https://www.sciencedirect.com/science/article/pii/S2214140521001006>.
- ³⁸ Health Impact Project, "Employment Strongly Influences Health," accessed November 2, 2021, August 13, 2018, <https://www.pewtrusts.org/en/research-and-analysis/data-visualizations/2018/employment-strongly-influences-health>.
- ³⁹ L.E. Starbird et al., "A Systematic Review of Interventions to Minimize Transportation Barriers among People with Chronic Diseases," *Journal of Community Health* 44, no. 2 (2019): 400-11, <https://pubmed.ncbi.nlm.nih.gov/30206755/>; Glazener et al., "Fourteen Pathways."
- ⁴⁰ S.T. Syed, B.S. Gerber, and L.K. Sharp, "Traveling Towards Disease: Transportation Barriers to Health Care Access," *Journal of community health* 38, no. 5 (2013): 976-93, <https://pubmed.ncbi.nlm.nih.gov/23543372>.
- ⁴¹ Ibid.
- ⁴² Starbird et al., "A Systematic Review."
- ⁴³ G.W. Bascom and K.M. Christensen, "The Impacts of Limited Transportation Access on Persons with Disabilities' Social Participation," *Journal of Transport & Health* 7 (2017): 227-34, <https://www.sciencedirect.com/science/article/pii/S2214140517300075>.
- ⁴⁴ Ibid.
- ⁴⁵ Office of Disease Prevention and Health Promotion, "Healthy People 2030: Social Cohesion," U.S. Department of Health & Human Services, accessed Sept. 30, 2021, <https://health.gov/healthypeople/objectives-and-data/social-determinants-health/literature-summaries/social-cohesion#cit24>.
- ⁴⁶ J. Holt-Lunstad, T.B. Smith, and J.B. Layton, "Social Relationships and Mortality Risk: A Meta-Analytic Review," *PLoS Medicine* 7, no. 7 (2010): e1000316, <https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1000316>.
- ⁴⁷ Sallis et al., "Physical Activity"; Sener, Lee, and Elgart, "Potential Health Implications."
- ⁴⁸ Sener, Lee, and Elgart, "Potential Health Implications."
- ⁴⁹ Chakrabarti and Shin, "Automobile Dependence and Physical Inactivity."
- ⁵⁰ Ibid.
- ⁵¹ Ibid.
- ⁵² Ibid.
- ⁵³ Edwards, "Public Transit."
- ⁵⁴ Ermagun and Levinson, ""Transit Makes You Short"."
- ⁵⁵ Ibid.
- ⁵⁶ Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Implementation and Outcomes of Fare-Free Transit Systems*.
- ⁵⁷ Ermagun and Levinson, ""Transit Makes You Short"."
- ⁵⁸ Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, *Implementation and Outcomes of Fare-Free Transit Systems*.
- ⁵⁹ C. Stacy et al., "How Can Cities Create More Equitable Transportation Systems?" (Urban Institute, 2020), <https://www.urban.org/research/publication/how-can-cities-create-more-equitable-transportation-systems>.
- ⁶⁰ U.S. Census Bureau, Means of Transportation to Work by Workers' Earnings in the Past 12 Months (in 2019 Inflation-Adjusted Dollars); Washington Metropolitan Area Transit Authority, "D.C. Low-Income Fare Pilot."
- ⁶¹ Center for Neighborhood Technology, "Housing and Transportation Affordability Index," accessed Oct. 4, 2021, <https://htaindex.cnt.org/map/>.
- ⁶² U.S. Census Bureau, Means of Transportation to Work by Workers' Earnings in the Past 12 Months (in 2019 Inflation-Adjusted Dollars).
- ⁶³ U.S. Department of Transportation, "Transportation and Health Indicators: Washington, DC."
- ⁶⁴ Washington State Board of Health, "Executive Summary: Health Impact Review of HB 2969," <http://sboh.wa.gov/Portals/7/Doc/HealthImpactReviews/HIR-2016-05-HB2969.pdf>.