

## **Executive Summary**

# **Improving the Health and Safety of Transit Workers with Corresponding Impacts on the Bottom Line**

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## Executive Summary

### ES.1. Background

Transit workers experience more health and safety problems than the general workforce, primarily due to physical demands, environmental factors, and stresses related to their jobs. Finding explanations for these poor health outcomes and identifying potential solutions is the primary focus of this report. To accomplish these objectives, the Econometrica Team undertook a multifaceted research project that used diverse sources of information, including case studies, interviews with industry and health experts, primary data collection, and rigorous statistical-econometric analysis.

Health and safety risk factors for transit workers include the sedentary nature of the job, shift work, environmental factors (e.g., noise and air quality in and around the vehicle), constant daily interaction with hundreds of passengers (any of whom might engage in unruly or risky behavior), continual stressful engagement (performing difficult maneuvers) in traffic, responsibility for fare collection, and a work schedule that limits the ability to maintain healthy habits such as regular exercise, sufficient sleep, and a healthy diet. Additionally, prior research has demonstrated that transit work has been associated with higher rates of risky behaviors (including poor diet, smoking, and alcohol use) and chronic conditions (such as diabetes, primarily type 2; cardiovascular disease; and musculoskeletal disorders).

This report identifies and examines the reasons for these outcomes and provides potential strategies to improve transit worker health. We provide a summary of previous research on methods to improve the workplace environment and establish effective practices for health promotion and wellness programs. Research in this area includes reports previously published by the Transportation Research Board, including *Transit Cooperative Research Program (TCRP) Report 169: Developing Best Practices Guidelines for Improving Bus Operator Health and Retention (F-17)*, *TCRP Report 174: Improving Safety Culture in Public Transportation (A-35)*, and additional public and private sources (National Academies of Sciences, Engineering, and Medicine, 2015; National Academies of Sciences, Engineering, and Medicine, 2014). To date, there is limited research on the effectiveness of health promotion programs for transit workers as measured by the reduction of sick or personal days, workers' compensation payments, or health claims. Econometrica builds on the scant existing research by estimating the potential beneficial effects of health promotion programs based on data collected from five locations.

Our team gathered data in five locations: Rochester, NY; Louisville, KY; Indianapolis, IN; Des Moines, IA; and Los Angeles, CA. This report contributes to the literature with an econometric and statistical analysis, using primary source individual-level data collected from the wellness programs of four metropolitan transit agencies (the exception is Los Angeles, which only provided aggregate data). The results obtained using these data provide additional information on the participation in and effectiveness of health promotion programs for transit workers. In addition to identifying and examining the reasons for these health outcomes and providing strategies to improve them, Econometrica also completed an investigation of the costs associated with health and safety issues to accurately chronicle the full extent of the problem. These costs include out-of-pocket (medical, safety, and other job-related) expenditures by transit workers, payments by insurers, costs of covering shifts for workers absent due to sickness and injury, and costs of supporting disabled workers through State workers' compensation or Federal disability programs.

## ES.2. Prevalence and Costs of Health Conditions

Econometrica identified national estimates of healthcare costs and worker productivity to establish a baseline for the health outcomes discussion and subsequent quantitative analyses. These estimates are presented in relation to transit worker illness and injuries for comparison and eventual evaluation of transit agency health promotion programs. The report reviews studies on the prevalence of health conditions of transit and transportation workers compared to the general population. We then develop health cost estimates associated with health conditions relevant to transit/transportation workers.

Table ES-1 presents prevalence estimates of six chronic conditions for transit workers identified from Government sources or peer-reviewed journals: cardiovascular disease, diabetes, hypertension, musculoskeletal disorders, mental health, and respiratory illness. For comparison purposes, we also present the prevalence rate in the general population.

**Table ES-1. Prevalence of Chronic Conditions Affecting Transit Workers Compared With the General Workforce**

Condition	Source	Period	Transit Workers	General Workers
Cardiovascular	Highmark, Inc. (CDC–NIOSH)*, a	2002–2005	14.5%	8.1%
Diabetes	Highmark, Inc. (CDC–NIOSH)*, a	2002–2005	17.3%	7.8%
Hypertension	Highmark, Inc. (CDC–NIOSH)*, a	2002–2005	41.5%	27.6%
Musculoskeletal	Survey of Occupational Injuries and Illnesses <sup>b</sup>	2016	1.7%	0.3%
Mental health	Highmark, Inc. (CDC–NIOSH)*, a, c	2002–2005	16.2%	10.5%
Respiratory	Survey of Occupational Injuries and Illnesses <sup>d</sup>	2016	0.04%	0.01%

\* Researchers with the Centers for Disease Control–National Institute for Occupational Safety and Health (CDC–NIOSH) worked with Highmark, Inc., to assemble a multi-year database for the purpose of calculating industry-specific prevalence rates of 15 diseases. Highmark, a BlueCross BlueShield insurer, provides health insurance for the majority of the working population in Western Pennsylvania, plus other areas not covered by these data. The Highmark information included in this table was reported in Bushnell, Li, & Landen (2011). The code titles used for the various conditions followed BLS (2012).

Sources: <sup>a</sup> Bushnell, Li, & Landen (2011); <sup>b</sup> BLS (2017a); <sup>c</sup> Wulsin, Alterman, Bushnell, et al. (2014); <sup>d</sup> BLS (2019b).

Table ES-1 shows that transit workers experience much higher rates of all six of these chronic conditions; for diabetes, musculoskeletal, and respiratory conditions, the rates are at least twice as high for transit workers. For cardiovascular, hypertension, and mental health, where the rates for the general worker population is high to begin with, occurrence rates for transit workers are still at least 50 percent greater. The analysis starts from this baseline: Transit workers are in worse health than the general population.

The additional medical expenditure costs as a result of these health differences are high. Table ES-2 displays the average annual medical expenditure for a person in the United States by each of these same six conditions as reported in the 2015 Medical Expenditure Panel Study. This information is presented next to the prevalence rate for the transit worker population as displayed in Table ES-1. The fourth column takes the number of transit workers afflicted by this condition and multiplies it by their per-person medical expense amount (e.g., \$4,556 for cardiovascular) to provide the total annual expenditures for the transit worker population for that particular chronic condition (i.e., approximately \$238 million per year for cardiovascular). The fifth column shows the costs for transit workers beyond that of the general population due to their greater prevalence (that is, the costs beyond what it would be if transit workers experienced only the prevalence of

the general population). For example, the estimated annual expenditures for transit workers for cardiovascular disease is \$238 million per year—that is, \$4,556 (the average medical expenditure per person per year) multiplied by 14.5 percent, the prevalence rate for the transit worker population. If transit workers instead experienced the same prevalence rate as the general population, the cost would be \$133 million (\$4,556 multiplied by 8.1 percent of the general worker population). Consequently, the costs for transit workers above that of the general population (due to the greater prevalence in transit workers) is \$105 million (\$238 million minus \$133 million).

**Table ES-2. Medical Expenditure Approximations for the Transit Worker Population**

Condition	U.S. Average Medical Expenditures per Person (2015)	Prevalence: Transit Workers <sup>a</sup> (Table ES-1)	Prevalence: General Workers (Table ES-1)	Approximated Annual Expenditures for Transit Workers (2015 Dollars) <sup>b</sup>	Approximated Annual Expenditures for Transit Workers Above Those of General Workers (2015 Dollars) <sup>c</sup>
Cardiovascular	\$4,556	14.5%	8.1%	\$238,000,000	\$105,000,000
Diabetes	\$3,402	17.3%	7.8%	\$212,000,000	\$116,000,000
Hypertension	\$823	41.5%	27.6%	\$123,000,000	\$41,000,000
Musculoskeletal	\$2,000	1.7%	0.3%	\$12,000,000	\$10,000,000
Mental health	\$1,992	16.2%	10.5%	\$116,000,000	\$41,000,000
Respiratory	\$1,633	0.04%	0.01%	\$234,000	\$175,500

<sup>a</sup> Calculations are based on a transit worker population base of 359,669 workers (APTA 2018).

<sup>b</sup> Calculated as transit worker population × transit worker prevalence × average medical expenditure per person.

<sup>c</sup> Calculated as transit worker population × (difference between transit worker and general population prevalence) × average medical expenditure per person.

Sources: Highmark, Inc. (CDC–NIOSH) as reported in Bushnell, Li, & Landen (2011); BLS (2017a); Wulsin, Alterman, Bushnell, et al. (2014); and BLS (2019b).

Our research shows the additional chronic condition medical expenditures of transit workers above that of the general population. The large difference suggests that directing resources toward the alleviation and prevention of transit worker health problems should result in some cost savings in addition to potential improvements in health and quality of life for transit workers themselves. Our findings suggest that the higher prevalence of chronic conditions in transit workers relative to the general working population (Table ES-1) may translate into considerable expenditures by workers, employers, and society through out-of-pocket spending, employer insurance, and Federal insurance sources (Table ES-2). Directing resources to prevent or attenuate these conditions could result in savings.

### ES.3. Additional Costs to Individuals, Employers, and Society of Transit Worker Health

We examined the processes by which health issues convert to expenditures and costs. The focus is on quantitative estimates of expenditures because those are more easily tracked through the existing data. Examples of expenditures by workers and their families, employers, and State and Federal agencies are provided. We compare transit workers to the general population and estimate the difference between their costs and those of the general population. The categories we examine include:

- Injury costs.

- Mortality costs.
- Absenteeism.
- Workers’ compensation.
- Social Security Disability Insurance (SSDI) (a form of disability payment).
- Supplemental Security Income (SSI) (a form of disability payment).
- Medicare.

**Table ES-3. Compilation of Annual Excess Cost Estimates (in 2018 U.S. Dollars)**

Cost (Payment Category)	Transit Worker Cost	Cost per Transit Worker	Excess Cost*	Excess Cost per Transit Worker
<b>Workers</b>				
Injury costs	\$853,768,760	\$2,374	\$403,284,268	\$1,121
Mortality costs	\$189,174,784	\$526	\$61,171,511	\$170
<b>Employers and Society</b>				
Absenteeism	\$314,301,144	\$874	\$25,144,092	\$70
Workers’ compensation	\$261,780,645– \$413,826,181	\$728–\$1,151	\$121,139,893– \$140,199,032	\$337–\$390
Disability (SSDI)	\$405,770,309	\$1,128	\$128,342,087	\$357
Disability (SSI)	\$115,238,954	\$320	\$36,445,966	\$101
Medicare	\$315,484,742	\$877	\$99,780,303	\$277

\* Excess cost is calculated as the difference between the average transit worker cost and the average general worker cost. Source details about both transit worker costs and general worker costs are provided in Chapter 5.

Table ES-3 summarizes the results of calculations made in Chapter 5 to understand the costs associated with transit worker health conditions. We identified mechanisms through which costs are transmitted, such as workers’ compensation and disability. A better understanding of these mechanisms can help transit agencies decide which conditions to target in order to reduce costs. Similar to Chapter 4, we found that transit workers have excess costs in all the expenditure categories we examined, ranging from tens of millions to hundreds of millions of dollars.

The excess cost for transit workers across six chronic health conditions (cardiovascular, diabetes, hypertension, musculoskeletal, mental health, respiratory) is related to their excess costs in some of the categories listed in Table ES-3. Chronic conditions can lead to higher injury and mortality rates, as well as the necessity of drawing on disability and Medicare at earlier ages. The costs we find across “payment” categories are a direct result of the costs of the conditions we calculated.

#### ES.4. Case Studies

These findings on expenditures, health conditions, and costs served as a basis for our case study analysis. Cataloging the degree to which transit agencies target areas where cost savings might be achieved was a key objective. The case studies provide considerable new information on wellness programs and their potential impact on transit worker health. The case studies were selected based on specific criteria. First, using TCRP F-17 survey results, the team created a list of 17 agencies and 5 unions that reported tracking metrics for programs or estimated a past or projected return on investment. Next we sent a query to the American Public Transportation Association’s Workforce Development Committee Listserv, asking for interest in the study. We received 14 leads from this query, and 4 sites met the criteria of having both a comprehensive health promotion program *and*

individual-level data (agencies in Rochester, NY; Louisville, KY; Indianapolis, IN; and Des Moines, IA). A fifth site with aggregate data (Los Angeles, CA) was included as well.

The case studies help identify scalable and sustainable strategies that have been successfully initiated and implemented in transit agencies. These programs provide multiple features to participants, such as workshops on diet and exercise, biometric screenings, targeted education to avoid common types of injury (e.g., musculoskeletal), financial planning, fitness challenges, and onsite gyms. For four of five of the case studies, we conducted a benefit–cost analysis to determine if there are measurable benefits associated with participation in these programs.

We collected baseline data from both before and after the comprehensive health and wellness programs began. The data included individual records of absenteeism (both sick and personal days taken), workers’ compensation payments, and measures of participation (after). Because data were also available on age, gender, race, day of hire/termination, and rates of turnover (in some cases), we were able to compare participants vs. non-participants based on their characteristics and tenure in the program.

Each case study location had unique work organization and environment characteristics and faced different health, wellness, and safety challenges. Commonalities are found across the locations, however: For example, at all five locations, the majority of bus operators work split shifts. This impacts their access to healthy food, sleep patterns, and ability to participate in certain health and wellness program activities.

Comparing the top three health, wellness, and safety concerns expressed by management and labor representatives and insurance claims data, we found that hypertension, musculoskeletal injuries (back and neck pain), and diabetes are the most commonly shared concerns for frontline transit workers across locations. Other issues include sleep apnea, cardiovascular diseases (i.e., heart conditions), injuries from bus accidents, obesity, stress/fatigue, and cholesterol disorders (hyperlipidemia).

Using newly available, primary source employee-level data, we generated informative descriptive statistics that expand on research in recent literature on the effectiveness of health promotion programs. While these case studies produced limited results that could translate into quantifiable cost savings for agencies, the information gathered is of substantial value. The data collected adds a host of new information on employee absence/sick leave patterns as they relate to health, wellness, and safety program participation among different segments of the employee population.

### ES.5. Study Limitations

The research in this report is subject to several limitations. First, there were additional cost categories that could not be itemized, including quality of service, which primarily resulted from a lack of available data. In addition, cost categories can overlap and are not additive as a function of co-morbidities. The research primarily used cross-sectional data because it is the only data readily available for a sufficient number of transit workers to answer the fundamental research questions. However, cross-sectional data can distort the results because it cannot account for the life-trajectory of transit workers who are forced to leave transit work early due to health issues or whose lives are shortened by health and safety issues related to their work. The study also could not include controls for differences in gender and age in the data analysis on condition costs and



prevalence, as this level of detail was beyond the scope of our research. Exploring differential response patterns affected by gender and age would be worth examining, recognizing that transit workers are disproportionately older and more likely to be male in comparison to the general population. Lastly, this study could not account for differences in local regulations, as the number and diversity of local agencies is considerable. Examining how these local regulations might affect outcomes could be a fruitful area for future research. The conclusions of this research recognize and have accommodated these limitations and reflect a careful implementation and consideration of the level of detail represented in the original research work plan.

## ES.6. Summary

The goal of this study was to identify ways to improve employee health and safety outcomes resulting from work conditions and broader health promotion practices and their impacts on the bottom line. Our research focused on the prevalence of conditions, costs associated with conditions, and statistical analysis of data on participation in and the results of health and wellness promotion programs. We documented the chronic conditions that are most prevalent among transit workers (cardiovascular disease, diabetes, hypertension, musculoskeletal disorders, mental health, respiratory disorders) and documented that annual costs are higher for transit workers compared to the average worker. These excess costs were also observed in the payment types examined (injury, death, absenteeism, workers' compensation, disability (SSDI and SSI), and Medicare). In all cases, the annual costs of these categories for transit workers was in excess of that for the average worker.

Our team extended this work through case studies on health and wellness programs at five transit agencies. We documented not only the substance of the programs offered to transit workers, but the resources and organizational strategies agencies and unions used to put the programs in place and make them sustainable. While no programs address all of the chronic conditions most common among transit workers (few seemed to address respiratory health), they do focus on issues that affect transit workers overall health and work performance. We further undertook a statistical analysis of the four sites that provided individual-level data. While our analysis is more suggestive than definitive, it does provide a model for analysis that sites with the appropriate data could use to evaluate their own programs.

Our implementation strategy provides an analysis of how well the programs are doing in terms of following the “roadmap for transit and health safety” provided in the TCRP F-17 report. The information provided about the health and wellness programs in the case studies and the implementation strategy chapter provide detailed information that could guide transit agencies currently designing new health, wellness, and safety programs or provide guidance on how to improve current programs. In terms of how to use this report to design wellness programs that benefit the health of transit workers, we recommend a two-step approach:

1. Review the background research on the types of health issues workers are most likely to experience and the programs that are most effective in addressing them. While the programs we studied were considered beneficial by employees and transit agencies, we could not find measurable impacts; we could not detect statistically valid effects.
2. Determine (1) the issues facing your employees and the types of programs they would use, and (2) a means of evaluating impact prior to initiation. Over time, assess the programs' return on investment and make adjustments as needed. Prior TCRP publications include

resources to help design and track programs—in particular, the spreadsheet titled “Transit Operator Workplace Health Protection and Promotion Planning, Evaluation, and ROI Template.”<sup>1</sup>

This report adds another layer of research to past studies that explored health and safety outcomes for transit workers and health promotion programs by quantifying the costs of widespread and consistently poor health and safety outcomes and the cost savings, if any, of those health promotion programs. Dangerous and strenuous work environments exact a toll on workers that has effects on their employers and on society. Better understanding of that toll, its costs, and the potential means of mitigating it are valuable contributions to the literature on the subject.

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<sup>1</sup> You may download the spreadsheet from <http://www.trb.org/Publications/Blurbs/171189.aspx>.

## References

- American Public Transportation Association. (2018). *2017 public transportation fact book*. Retrieved from <https://www.apta.com/wp-content/uploads/2017-APTA-Fact-Book.pdf>
- BLS. (2012). *Nature of injury or illness code titles*. Retrieved from [https://www.bls.gov/iif/osh\\_oiics\\_2010\\_3\\_1.pdf](https://www.bls.gov/iif/osh_oiics_2010_3_1.pdf)
- BLS. (2017a). *2016 Survey of Occupational Injuries & Illnesses chart data*. Retrieved from BLS: <https://www.bls.gov/iif/soii-chart-data-2016.htm>
- BLS. (2019b). *Industry injury and illness data*. Retrieved from BLS: <https://www.bls.gov/iif/oshsum.htm>
- Bushnell, P. T., Li, J., & Landen, D. (2011). Group medical claims as a source of information on worker health and potentially work-related diseases. *Journal of Occupational and Environmental Medicine*, 53, 1430-1441.
- National Academies of Sciences, Engineering, and Medicine. (2014). *Developing best-practice guidelines for improving bus operator health and retention*. Washington, DC: The National Academies Press. doi:10.17226/22322
- National Academies of Sciences, Engineering, and Medicine. (2015). *Improving safety culture in public transportation*. Washington, DC: The National Academies Press. doi:10.17226/22217
- Wulsin, L., Alterman, T., Bushnell, P. T., Li, J., & Shen, R. (2014). Prevalence rates for depression by industry: A claims database analysis. *Social Psychiatry and Psychiatric Epidemiology*, 49(11), 1805–1821. doi:10.1007/s00127-014-0891-3