Excessive Work Hours & Hypertension: Evidence from the NIOSH Survey Data

Transportation Research Board
ANB70 Truck and Bus Operator
Health and Wellness Subcommittee

January 14, 2020

Dr. Takahiko Kudo
Prof. Michael H. Belzer
Wayne State University, Detroit

We acknowledge assistance of Dr. Shengyang Ju

Workplace Safety and Health Requires Economic Analysis

- **Competition drives carriers to lowest price**
- Lowest price drives carriers to lowest cost
- Lowest cost drives rates down and squeezes drivers
  - Unqualified, dangerous drivers
  - Dangerous and unhealthy workplace pressure
  - Dangerous and unhealthy hours of work
- **High turnover in highway freight transport pushes freight operator cost to the public**
  - Safety cost pushed to public because carrier legal liability is limited
  - Health cost pushed to drivers – and public – because health costs are long-term

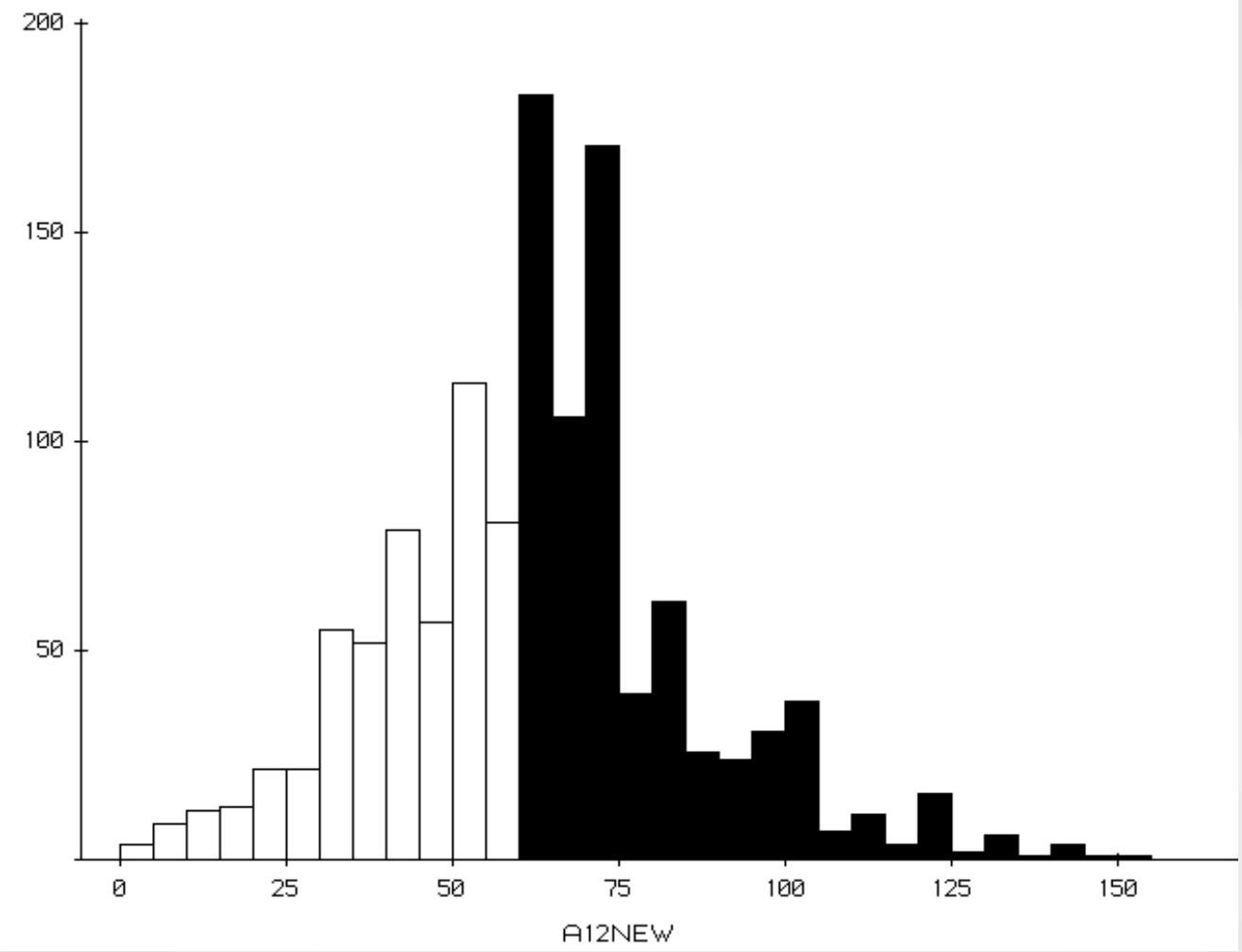
FACT: Truckers Work Long Hours

- UMTIP 1997 survey: median non-union driver worked 65 hr/wk
  - 55% of CMV drivers not paid for loading/unloading
  - 70% not paid for waiting or other on-the-job time.
- NIOSH 2010 survey: median employee driver works 60 hr/wk
- NIOSH 2010 survey also shows 20% exceed 75 hours/week
  - On average, 10.5 hours of work/week (22%) are unpaid
  - On average, 27% of employee drivers' work week is unpaid labor

- Truck drivers are not paid for all work time
- That is why surveys show long-haul drivers regularly work an impossible (illegal) number of hours.

Drivers in Black Work Excessive Hours

Number of drivers



Hours worked/week

- Median: 60 hours
- Average: 61.5 hours
- n = 1,254 long haul truck drivers

General Literature

- Generally, work hours associated with sleep loss and poor sleep quality
  Bannai et al. (2015); Afonso et al. (2017)
- Sleep loss can cause fatigue and physiological changes to human bodies, increasing hypertension and other risks
  National Academy of Science, Engineering, and Medicine (2016) and Czeisler (2015)

CMV-Driver Specific Literature

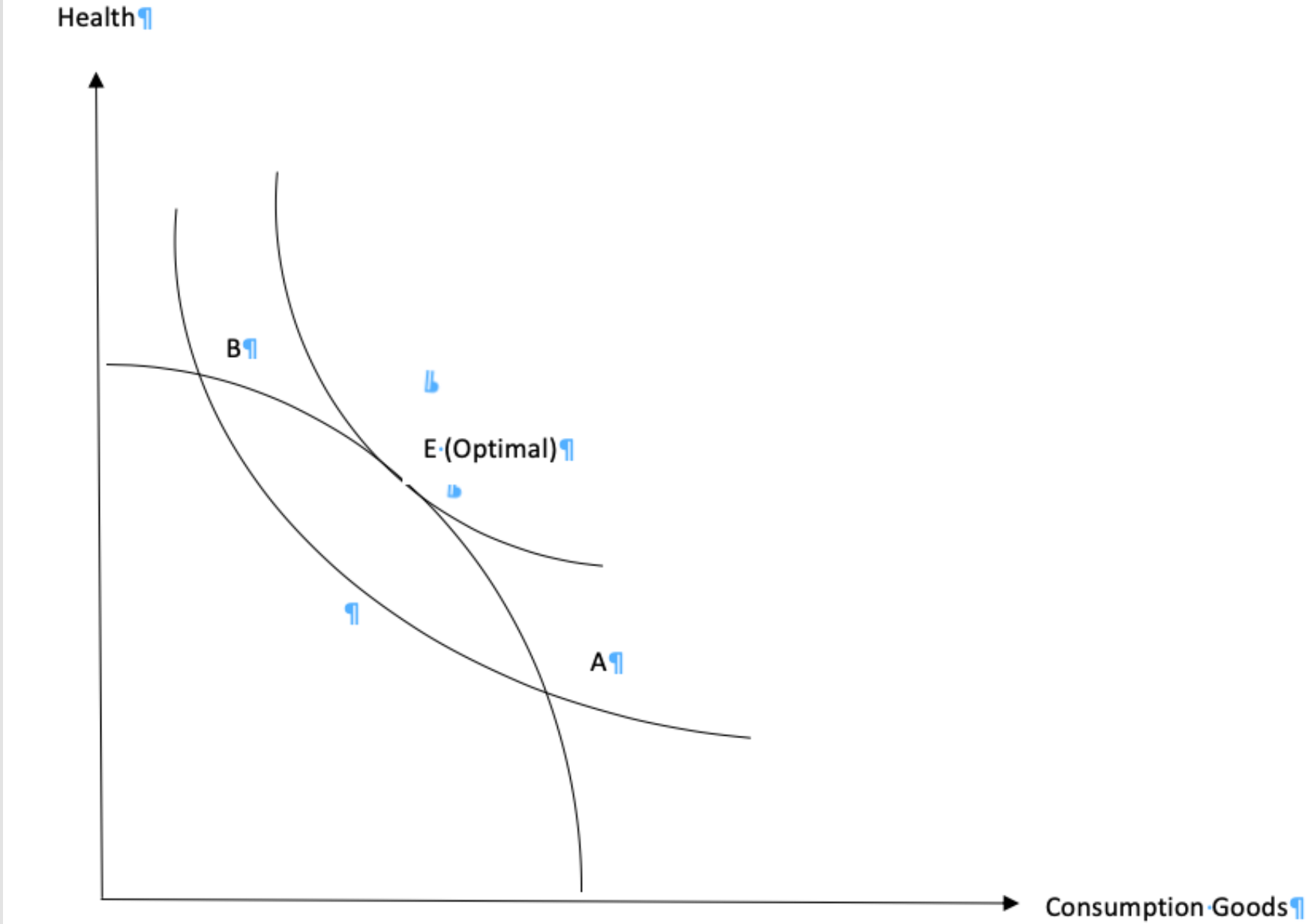
- CMV driver health attributed to long work hours
  Apostolopoulos et al. 2012
- Long work hours due to low wage rates
  Belzer and Sedo, 2018
- Longer work hours are positively related to the risk of hypertension
  Yang et al. (2006); Yoo et al. (2014); Chankaramangalam et al. (2017)

Theory

- Households tradeoff between income and health under a time constraint
  Folland et al. (2012); Grossman (1972)
  - There are 168 hours in a week
  - Households choose a balance between income to pay bills and health
  - Regulations that limit hours stand between these households and pure market choices
- Health is a product of health investment and this investment requires working fewer hours

Theory

- Truck drivers' utility function is an increasing function of consumption goods and health
- The marginal utility for either good is decreasing for each good
- Constraints
  - 1: truck drivers' purchase of consumption goods lies within their income
  - 2: Time (time tradeoff between health and income
  - 3: output of health as a return to health investment


Health
B
E (Optimal)
A
Consumption Goods

Multinomial Logistic Regression

Probability {i=k|(k=no hypertension, hypertension with medication, or hypertension without medication}

$$=\alpha + \beta_1 \times \ln(\text{WorkHours}) + \beta_2 \times \text{NondrivingPay} + \beta_3 \times \text{Health} + \beta_4 \times \text{LTL} + \beta_5 \times \text{White} + \beta_6 \times \text{Age} + \beta_7 \times \text{Edu} + \beta_8 \times \text{Team} + \beta_9 \times \text{Union} + \beta_{10} \times \text{BMI} + \beta_{11} \times \text{HighSchool} + \beta_{12} \times \text{Male} + \beta_{13} \times \text{Married} + \varepsilon$$

Problem arises trying to account for effect of medication. Medication confounds estimates.

Data

- National Survey of Long-Haul Truck Driver Health and Injury (NIOSH, 2010)
- We use employee drivers (60% of survey)
- We are trying to estimate the probability that drivers will have hypertension associated with work hours

Table 1: Descriptive Statistics

Hypertension History	Number	Percentage
Taking Medication	186	25.76
Diagnosed but not Taking Medication	64	8.86
No Hypertension History	472	65.37

Total without hypertension: 472

Total with hypertension: 250

Table 2: Descriptive Statistics

	ALL	N=722	MED	N=186	NOMED	N=64	HEALTH	N=472
Variable	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Weekly Work Hours	63.15	63.00	60.58	60.00	72.62	70.00	62.88	62.00
Age	46.52	47.00	51.68	53.00	44.81	45.50	44.72	45.00
BMI	32.41	31.43	34.84	34.36	31.90	29.98	31.52	30.51
Weekly Non-driving Work Hours	15.19	10.00	14.30	10.00	20.13	13.50	14.87	10.00
Non-driving Pay	48.34%		48.52%		43.75%		49.46%	
Health Insurance	62.33%		59.11%		68.75%		68.28%	
Less-than-Truckload	20.36%		22.03%		14.06%		18.28%	
Team	13.57%		14.62%		17.19%		9.68%	
High School	78.67%		78.81%		73.44%		80.11%	
White	70.64%		68.64%		73.44%		74.73%	
Married	51.66%		48.52%		50%		60.22%	
Male	93.35%		91.74%		93.75%		97.31%	
Union	2.63%		2.54%		3.13%		2.69%	

Multinomial Logit Regression Results

Reference Group: Drivers without Hypertension

	Medicated		Not Medicated	
Variables	Coefficient	Stdv	Coefficient	Stdv
Intercept	-8.22***	1.34	-6.61***	2.04
ln(Work Hours)	-0.17	0.20	**0.90****	**0.37**
Non-driving Pay	-0.091	0.19	-0.16	0.27
Health Insurance	0.25	0.20	0.37	0.29
Less-than-Truckload	0.058	0.24	-0.43	0.38
Team	-0.034	0.31	0.34	0.38
Age	0.081***	0.010	0.0044	0.013
Education	0.046	0.23	-0.23	0.31
White	0.064	0.21	0.26	0.30
Married	0.13	0.19	-0.037	0.27
Male	1.11**	0.51	0.36	0.56
Union	-0.30	0.60	0.0022	0.79
BMI	0.081***	0.014	0.0067	0.020
N	722			
Likelihood Ratio Test Statistics	131.3329 (p<0.0001)			

Notes: *p< .01; **p< .05; ***p< .1. All p values are for two-tailed test. The variables are defined in the notes in Table 2.

NEXT STEPS

- Multinomial regressions show significant effect of work hours on drivers with hypertension but without medication.
- Results provided little insight for effects on working hours on drivers with hypertension overall
- Change the model to estimate prevalence of hypertension, regardless of medication

Probability {i=k|(k=no hypertension, hypertension}

  - Data may not be sufficiently precise to estimate
  - Relationship may not exist

References

- *2018 Pocket Guide to Large Truck and Bus Statistics*. (2018). Retrieved from Washington: https://rosap.ntl.bts.gov/view/dot/36537
- Belman DL, Monaco KA and Brooks TJ. (2004) Sai*lors of the concrete sea: A portrait of truck drivers' work and lives*, East Lansing, Mich.: Michigan State University Press.
- Belzer MH. (2000) *Sweatshops on Wheels: Winners and Losers in Trucking Deregulation,* Oxford, UK and New York, NY: Oxford University Press.
- Belzer, MH. (2018) "Truck Drivers are Overtired, Overworked, and Underpaid." T*he Conversation. July 25.* https://theconversation.com/truck-drivers-are-overtired-overworked-and-underpaid-100218
- Belzer MH. (2018) "Work-stress factors associated with truck crashes: An exploratory analysis." *The Economic and Labour Relations Review* 29:3. 289-307.
- Belzer MH and Sedo SA. (2018) "Why Do Long Distance Truck Drivers Work Extremely Long Hours?" *The Economic and Labour Relations Review* 29:1. 59–79. https://goo.gl/M5Xx47.
- CHEN Guang X., Sieber WK, Lincoln JE, et al. (2015) NIOSH national survey of long-haul truck drivers: Injury and safety. Ac*cident Analysis & Prevention* 85: 66–72. https://www.ncbi.nlm.nih.gov/pubmed/26397196
- Dunn NJ, Hickman JS, Soccolich S, et al. (2014) Driver Detention Times in Commercial Motor Vehicle Operations. Washington: Federal Motor Carrier Safety Administration, xiv; 49. https://rosap.ntl.bts.gov/view/dot/193
- Faulkiner MR and Belzer MH. (2019) Returns to compensation in trucking: Does safety pay? *The Economic and Labour Relations Review* 30:2. 262-284.
- Hedlund J and Blower D. (2006) Using LTCCS Data for Statistical Analyses of Crash Risk. Large Truck Crash Causation Study Analysis Series. Washington: Federal Motor Carrier Safety Administration. https://ai.fmcsa.dot.gov/ltccs/data/documents/usingtheltccsdata.pdf
- Kudo T and Belzer MH. (2019) "The association between truck driver compensation and safety performance." *Safety Science* 120: 447-455.
- Kudo T & Belzer MH. (2019). Safe rates and unpaid labour: Non-driving pay and truck driver work hours. *The Economic and Labour Relations Review*, 30(4), 532–548.
- Office of the Inspector General. (2018) *Estimates Show Commercial Driver Detention Increases Crash Risks and Costs, but Current Data Limit Further Analysis*. https://www.oig.dot.gov/sites/default/files/FMCSA%20Driver%20Detention%20Final%20Report.pdf
- Panel on Research Methodologies and Statistical Approaches to Understanding Driver Fatigue Factors in Motor Carrier Safety and Driver Health. 2016. C*ommercial Motor Vehicle Driver Fatigue, Long-Term Health, and Highway Safety: Research Needs*. Washington: National Academies Press. http://www.nap.edu/24818
- Rodriguez DA, Targa F and Belzer MH. (2006) "Pay Incentives and Truck Driver Safety: A Case Study." *Industrial and Labor Relations Review* 59: 205-225.
- Speltz E and Murray D. (2019) "Driver Detention Impacts on Safety and Productivity". American Transportation Research Institute, 22. https://truckingresearch.org/

WAYNE STATE

Supplemental Resources

- Belzer MH and Thörnquist A. (2020, forthcoming) "Economic Liberalization and Governance: Road freight transport liberalization in the United States and the European Union." In: Sheldon P, Gregson S, Lansbury R, et al. (eds) *The Regulation and Management of Workplace Health and Safety: Historical and Emerging Trends*. London: Routledge.
- Boros C. (2018) *Romanian Trucker, Polish Wage, Dutch Workplace: How salaries migrate across the EU in the road haulage business*. Available at: https://theblacksea.eu/stories/romanian-trucker-polish-wage-dutch-workplace/
- Boros C and Eliassen I. (2018) *Exposed: Norwegian-owned firm making truck drivers cheat safety test; East European drivers are fed answers for road health and safety exam in Slovakia*. Available at: https://theblacksea.eu/stories/exposed-norwegian-owned-firm-making-truck-drivers-cheat-safety-test/
- Boros C and Poortmans J. (2018) *Deadlock in Brussels over Trucking Wages: Eastern and Western Europe are at war over the salaries of drivers. Only the European Parliament can resolve the crisis. But there is a stalemate*. Available at: https://theblacksea.eu/stories/deadlock-brussels-over-trucking-wages/
- Fink L. (2011) *Sweatshops at Sea: Merchant Seamen in the World's First Globalized Industry*, from 1812 to the Present: The University of North Carolina Press.
- Fair Labor Standards Act (FLSA)
  - https://www.employmentlawhandbook.com/flsa/fair-labor-standards-act-time-suffered-or-permitted-to-work/
  - https://www.law.cornell.edu/cfr/text/29/chapter-V
  - https://www.law.cornell.edu/cfr/text/29/part-785/subpart-C
- Hedlund J and Blower D. (2006) Using LTCCS Data for Statistical Analyses of Crash Risk. Large Truck Crash Causation Study Analysis Series. Washington: Federal Motor Carrier Safety Administration, 1-12. https://ai.fmcsa.dot.gov/ltccs/data/documents/usingtheltccsdata.pdf
- Saltzman GM and Belzer MH. (2007) *Truck Driver Occupational Safety and Health: 2003 Conference Report and Selective Literature Review*. Washington, DC: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. http://www.cdc.gov/niosh/docs/2007-120/.
- Federal Motor Carrier Safety Administration Regulations on Hours of Service for Drivers: https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=1&ty=HTML&h=L&mc=true&=PART&n=pt49.5.395 and Guidance: https://www.fmcsa.dot.gov/regulations/title49/part/395
- Viscelli, S. (2016). The Big Rig: Trucking and the Decline of the American Dream. Oakland, CA: University of California Press.

WAYNE STATE

Supplemental Resources

Airline subcontracting

- Young R. (2010) “Flying Cheap”. Frontline. USA: PBS, 56:32. February 9. https://www.pbs.org/wgbh/frontline/film/flyingcheap/

Amazon subcontracting

- O'Donovan, C., & Bensinger, K. (2019, August 31). “The Cost of Next-Day Delivery.” *BuzzFeed*. Retrieved from https://www.buzzfeednews.com/article/carolineodonovan/amazon-next-day-delivery-deaths
- Callahan, P. (2019, September 5). “How Amazon hooked America on fast delivery while avoiding responsibility for crashes.” *ProPublica*. Retrieved from: https://features.propublica.org/amazon-delivery-crashes/how-amazon-hooked-america-on-fast-delivery-while-avoiding-responsibility-for-crashes/
- Callahan, P. (2019, September 5). “The Human Cost of Amazon’s Fast, Free Shipping.” *New York Times*. Retrieved from: https://www.nytimes.com/2019/09/05/us/amazon-delivery-drivers-accidents.html

Professor Michael H. Belzer

Michael.H.Belzer@wayne.edu

go.wayne.edu/michael-belzer

LinkedIn: https://www.linkedin.com/in/soundscience