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Are low income and minority households more likely to die from traffic-related crashes?

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ABSTRACT

An analysis of motor vehicle mortality is conducted using data from the Census Bureau's National Longitudinal Mortality Study for 1980, 1990, and 2000. The likelihood of being a motor vehicle crash fatality is compared to all other causes of death and not dying within the six year follow up period of the data. Using a multinomial logistic regression, mortality associations with the socioeconomics and demographics of individuals is examined. No association is found with a greater likelihood of being a motor vehicle mortality, based on family income, ethnicity, or race. Those living in rural areas, are unemployed or disabled, and residents of southern states are more likely to be a motor-vehicle fatality. These results conflict with those of many ecological studies that assume lower income neighborhoods (and their residents) are more likely to die due to motor-vehicle crashes.

1. Introduction

Fatalities associated with motor-vehicle crashes have dropped substantially in the United States, but are now increasing with an improving economy. Fatalities increased by 5.6 percent in 2016 and 8.4 percent in 2015 (National Highway Traffic Safety Administration, 2017). The causes of the decline and subsequent increase have been associated with a number of policies implemented in states, but the economic recovery is also associated with increases in fatalities (Noland and Zhou, 2017).

While increases in total national economic activity and total income are associated with increased traffic fatalities, there has long been a suggestion that areas with lower incomes suffer from a greater risk of traffic-related fatalities (Graham et al., 2005; Noland and Quddus, 2004). Prior research also suggests that racial and ethnic minority populations, people with lower educational attainment, and those who are unemployed have a greater risk of dying in a motor vehicle crash compared to others (Burrows et al., 2012).

In this paper we examine motor vehicle crash mortality risk of individuals, rather than ecological associations. The focus is on how fatality risk is associated with race, ethnicity, and socioeconomic status while controlling for other individual-level factors, and whether these variables have any distinctive patterns that increase the probability of mortality compared to the population at large. Whereas prior work in the U.S. has mostly used data from the Fatality Analysis Reporting System (FARS), we use data from the National Longitudinal Mortality Study (1980s–2000s). Our analysis is based on individual mortality, rather than deaths within a specified area or region. Prior ecological studies tend to associate crash mortality frequency with the spatial characteristics of an area. For example, Census data on median income or population percentages of different minority groups might be used to represent an area, among other measures. These studies have usually found that lower income areas have a greater propensity for both motor-vehicle crashes and mortality from those crashes (Fleury et al., 2010; Graham et al., 2005; Green et al., 2011; Noland and Quddus, 2004). The NLMS dataset provides information on the household income of crash victims, their employment status, and education level, none of which is provided in FARS data or state-maintained databases.

One previous study used the National Longitudinal Mortality Study data which we also use, but only from 1979 to 1989 (Singh and Siahpush, 2001). Their focus was to examine the risks of all-cause and cause specific mortality. This included mortality from motor vehicle crashes with the objective of examining differences between native-born and immigrant populations; for motor-vehicle crashes there were no statistically significant differences. The only effect found was that males with lower levels of educational attainment were more likely to die in a motor vehicle crash. Our study examines motor-vehicle crash mortality compared to other causes of mortality in more detail and provides an individual-based analysis of relationships between socioeconomic status, race, ethnicity and the likelihood of dying in a traffic crash, relative to dying from other causes.

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2. Data

The analysis was based on public-use microdata from the National Longitudinal Mortality Study (NLMS). This is a longitudinal data set sponsored by the National Heart, Lung, and Blood Institute, the U.S. Census Bureau, and the National Center for Health Statistics, the National Cancer Institute, and the National Institute on Aging, and was designed for the purpose of examining the effects of demographic, occupational, and socio-economic characteristics on mortality (Rogot et al., 1988; Singh and Siapush, 2002; Sorlie et al., 1995). Mortality data is derived from death certificates and linked to data from the Current Population Survey (CPS), which is a representative sample that provides the source for detailed individual characteristics. We use "file 6a", "file 6b", and "file 6c" which are based on representative CPS data from the 1980′s, 1990′s, and 2000′s respectively (the most recent available) with follow up durations of six years. Each file is weighted to represent the US non-institutionalized population in April 1983, 1993, and April 2002, respectively (National Heart, Lung and Blood Institute, 2015).

The dependent variable in the analysis, collected by the National Center for Health Statistics, is cause of death. The CDC's National Center for Health Statistics publishes a standardized list of 113 selected causes of death[1] including motor vehicle crashes that were matched to the samples in the National Longitudinal Mortality Study. A summary of the unweighted data for each of our three cohort periods and for motor-vehicle mortality versus all other causes of death is shown in Table 1. For all time periods, motor vehicle crash deaths after six years are less than 0.1% of the sample, and an additional 3.2–4.4% of the sample has died from other causes.

The NLMS also includes socioeconomic and demographic data from the CPS. The CPS involves a complex probability sample of households that are surveyed monthly to obtain demographic, economic, and social information about the U.S. population with particular emphasis on employment, unemployment, and other labor force characteristics (Sorlie et al., 1995). These variables include sex, race and ethnicity, Hispanic origin, residential location, education, employment status, family income, and the state of residence, and health insurance status. Family income is adjusted to 1990 dollars with the Consumer Price Index.

Employment status was classified as employed (working during the past week), unemployed (seeking work during the past 4 weeks), houseworkers (managing the care of their own home and/or children), retired and other (retired, performing volunteer work, discouraged from seeking work), or unable to work (long term physical or mental illness or disability) (Sorlie et al., 1995).

Urban or rural area definitions follow the 1970, 1980, or 1990 Census. An urban area consists of all persons living in urbanized areas and in places of 2500 or more inhabitants outside of urbanized areas (National Heart, Lung and Blood Institute, 2015). The state of residence at the date of the interview was also included in the questionnaire; we grouped these by US Census Regions and Divisions.[2]

3. Analysis and results

To examine the associations between socio-economic, demographic, and regional location on motor vehicle crash mortality a multinomial logit model was estimated to determine the probability of a death at the six-year follow up period. Relative risk ratios[3], P-values, and 95% confidence intervals are presented for each decennial cohort, comparing motor vehicle crash mortality, all other causes of mortality, against those who had not passed away during the six-year follow up period of the data (see Tables 2–4).[4]

Models are estimated for each cohort separately. One rationale for doing this is that various policies have changed over time (e.g. safety-belt laws and increased enforcement of laws for driving while intoxicated). These could have different effects on individuals from different races, ethnic groups, and income levels. Thus, estimating each cohort separately partially removes any effects from change over time.

Those who are white, black, and of Hispanic ethnic origin do not have associations with an increased probability of being a motor vehicle crash mortality. American Indian or Alaska Native have a positive association in the 1980 cohort (*P = 0.09; 95% confidence interval, 0.91, 3.43*) but this disappears in the 1990 and 2000 cohorts. The 2000 cohort does suggest that those of Hispanic – other origin have a smaller likelihood of being a motor vehicle fatality (*P = 0.10; 95% confidence interval, 0.38, 1.09*). White, black, and American Indian or Alaska Native individuals have increased mortality risk for all other causes relative to Asian/Pacific Islanders/Other Nonwhite individuals in all cohorts. Those of Mexican or Hispanic origin are associated with reduced other cause mortality risk in all cohorts.

No strong associations are found with family income for motor vehicle mortality. Results are shown compared to those with the lowest income level. Probability of a motor vehicle mortality is slightly higher for those in the second income group (12.5 K–25 K). In the 1980 cohort this has the largest relative risk ratio (*P = 0.16; 95% confidence interval, 0.94, 1.46*). Lower income households have a higher probability of other causes of death.

A lower level of educational attainment is associated with a higher probability of being a motor vehicle mortality, particularly in the 1980 and 2000 cohort. Increased mortality from a motor vehicle crash is positively associated with having no education or elementary school only (*P = 0.00; 95% confidence interval, 1.48, 3.84*) in the 1980 cohort, as does intermediate education (*P = 0.00; 95% confidence interval, 1.55, 3.78*). The 2000 cohort has similar associations, for no education or elementary school only (*P = 0.09; 95% confidence interval, 0.91, 3.45*), and intermediate education (*P = 0.02; 95% confidence interval, 1.14, 3.62*). Less educational attainment is positively associated with all other causes of mortality. The education categories and income categories were not strongly multi-collinear in the data.

There are generally positive associations between being unemployed or disabled (and not working) and motor vehicle crash mortality (especially in the 1980 and 1990 cohorts), relative to those not in the workforce and those who are employed. For example, in the 1980 and 1990 cohorts, being unemployed is positively associated with motor vehicle crash mortality (*P = 0.02, 95% confidence interval, 1.06, 1.90*) in the 1980 cohort and (*P = 0.02, 95% confidence interval, 1.11, 2.26*) in the 1990 cohort. The direction of the associations are similar for all other causes of mortality.

Those living in urban locations are less likely to be a motor vehicle crash fatality, for example in the 2000 cohort (*P = 0.00; 95% confidence interval, 0.49, 0.76*). There is a slightly higher risk of being a mortality from all other causes for those who live in urban locations in the 1980 and 1990 cohorts, but this is not present in the 2000 cohort (*P = 0.47, 95% confidence interval, 0.98, 1.05*).

[1] www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr4911.pdf.

[2] https://www.census.gov/econ/census/help/geography/regions_and_divisions.html.

[3] Relative risk ratios are reported instead of odds ratios. The concept is similar and both are equal to exp(β). A simple explanation is provided in Andrade (2015). Relative risk ratios are interpreted as the percent increase or decrease in risk associated with each covariate, compared to the control group (in this case, those who were still alive). It is also considered a better measure when estimating rare events, such as fatalities in traffic crashes.

[4] An alternative estimation approach is to use Cox proportional hazard models. We tested estimates for motor-vehicle mortalities and all other causes of mortality. Results for the motor-vehicle mortality models are essentially the same (i.e., the parameter estimates have very small differences); differences are a bit larger for all other causes of mortality, but directional effects in all models are the same. We opted for the multinomial logit model as we wish to compare probability of death after six-years, and the hazard models, to our knowledge, cannot be estimated to compare deaths from two causes against not dying.