

Police homicides ... gun culture, population density and ethnic density?¹

Some thoughts on a study by Edwards, Esposito and Lee²

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Police deaths

Geographical divisions of the USA

Geographical divisions and police deaths

Metropolitan type and police deaths

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Police deaths

Table 1 in Edwards et al presents the numbers of police deaths and the associated rates. The rate is measured in deaths per 100,000 people. The two variables are related via the population size: the number n of police deaths divided by the population size N gives the death rate p . The number of deaths can be thought of as the dependent variable, depending on the rate and on the population size. Hence the focus on rates in the following.

$$p = n / N$$

$$n = p N$$

Geographical divisions of the USA

The USA census specifies four regions and nine geographical divisions. A pair of divisions are contiguous if they share a border. Figure 1 presents the contiguity network for the divisions; and also indicates the regions. Running west to east, there is a northern chain of divisions from Pacific to Mountain to ... to New England and a southern chain of divisions from Pacific to Mountain to ... to South Atlantic.

(In addition to the contiguity links shown in Figure 1, there is a short border between West North Central and East South Central; and a not so short border between East North Central and South Atlantic.)

Figure 1 The contiguity network for the census divisions of the USA; [regions]

https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf

[West]

[Mid West]

[North East]

¹ This is Paper 78.2, part of ANA Commentary for June 2020.

<https://sites.google.com/site/gordonburtmathsocsci/home/a-new-agenda>;

² Frank Edwards, Cornell, Michael H. Esposito, Seattle, Hedwig Lee, St Louis

<https://news.cornell.edu/stories/2018/07/new-study-finds-police-related-fatalities-may-occur-twice-often-reported>;

<https://ajph.aphapublications.org/doi/10.2105/AJPH.2018.304559>.

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		WN Central	EN Central	Mid Atlantic	New England
Pacific	Mountain...				
		WS Central	ES Central	S Atlantic	

[South]

Geographical divisions and police deaths

Figure 2 presents the police deaths (number and rate) for each of the divisions in relation to the contiguity network.

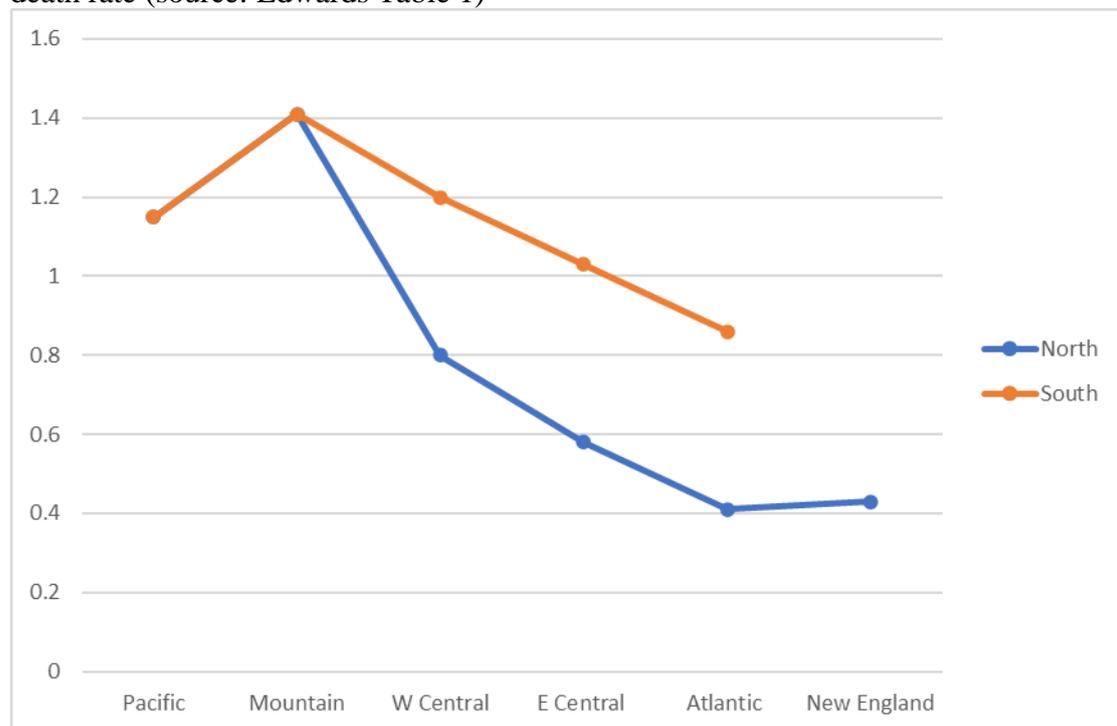
Figure 2 Police deaths (number and rate) in relation to the contiguity network for divisions. Source Edwards Table 1.

		WN Central	EN Central	Mid Atlantic	New England
		382, 0.80	615, 0.58	391, 0.41	145, 0.43
Pacific	Mountain				
1361, 1.15	739, 1.41				
		WS Central	ES Central	S Atlantic	
		1008, 1.20	437, 1.03	1217, 0.86	

The death rates have a particularly simple relationship with the contiguity network (whereas the number of deaths do not). Mountain has the highest death rate. To the west, Pacific has a lower death rate. On the northern chain the death rate declines to the east; and on the southern chain also the death rate declines to the east. Southern rates are lower than northern rates. Mid Atlantic has the lowest rate.⁴ This allows the simple representation in Figure 3.

Figure 3 Contour structure of police death rates for geographical divisions

death rate (source: Edwards Table 1)

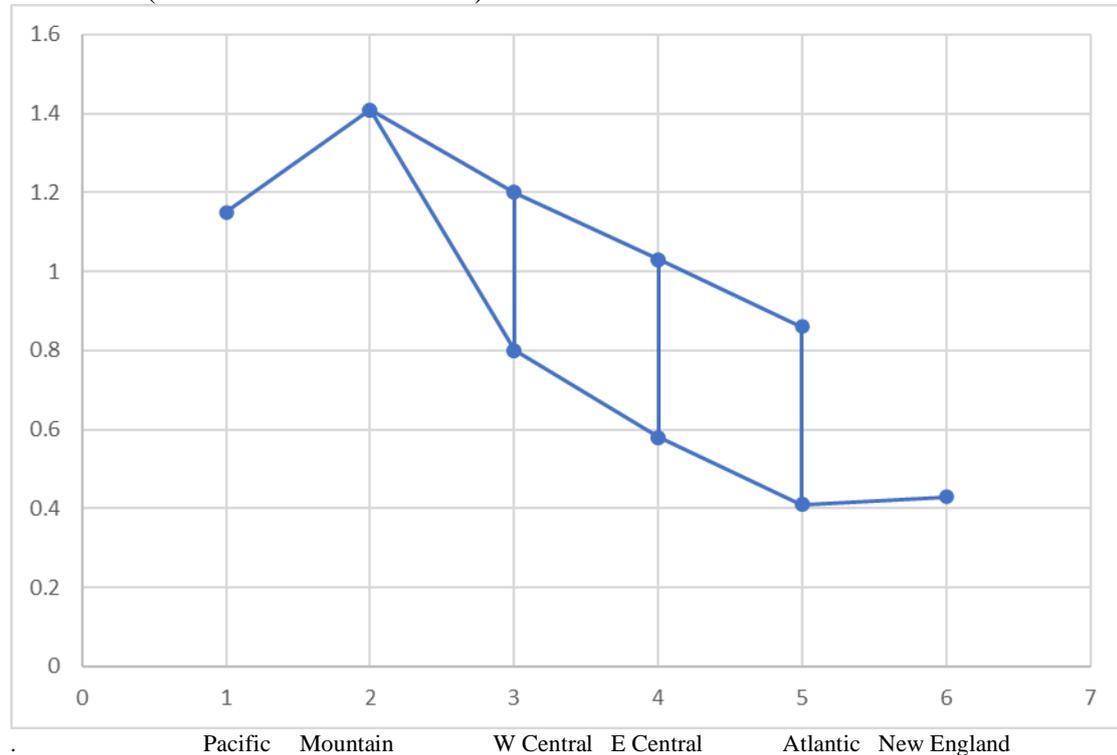


⁴ It seems likely that a regression rate=West-East+North-South would give a good fit.

More precisely, in relation to the contiguity network, there are two peaks, Mountain and New England (a very low peak), and two troughs, Pacific (a very high trough) and Mid Atlantic. This allows the simple representation in Figure 4.

Figure 4 Contour structure in relation to the contiguity network

death rate (source: Edwards Table 1)



A thought: is gun culture an underlying variable?

Metropolitan type and police deaths

“Urban–rural differences in health measures have long been recognized. The National Center for Health Statistics’ (NCHS) Urban–Rural Classification Scheme for Counties was developed for use in studying associations between urbanization level of residence and health and for monitoring the health of urban and rural residents. The scheme groups U.S. counties and county-equivalent entities into six urbanization levels (four metropolitan and two nonmetropolitan), on a continuum ranging from most urban to most rural. (Note: In this report, the term counties will be used to refer to counties and county-equivalent entities.)

Metropolitan categories

Large central metro—Counties in MSAs of 1 million or more population that: 1. Contain the entire population of the largest principal city of the MSA, or 2. Have their entire population contained in the largest principal city of the MSA, or 3. Contain at least 250,000 inhabitants of any principal city of the MSA.

Large fringe metro—Counties in MSAs of 1 million or more population that did not qualify as large central metro counties.

Medium metro—Counties in MSAs of populations of 250,000 to 999,999.
Small metro—Counties in MSAs of populations less than 250,000.
Nonmetropolitan categories Micropolitan—Counties in micropolitan statistical areas.
Noncore—Nonmetropolitan counties that did not qualify as micropolitan.”
Pp 1-2 in https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf;
<https://www.census.gov/programs-surveys/metro-micro/about.html>.

It would be convenient if the empirical data conformed to the official ordering in the above quote. However it does not. Edwards Table 1 data gives a different ordering and Edwards Figure 3 data gives yet another ordering.

The ordering given by Edwards Table 1 data on death rates is:

Large Central Metropolitan	1.02
Medium Metropolitan	0.99
Small Metropolitan	0.93
Noncore	0.86
Micropolitan	0.81
Large Fringe Metropolitan	0.59

Thus, compared with the official ordering, Large Fringe Metropolitan (suburbs) has the lowest rate; and Micropolitan and Noncore have swapped places.

A thought: is population density an underlying variable?

Geographical divisions and Metropolitan type combined

We now seek to combine the work of the two previous sections. Edwards Table 1 gives the death rates for combinations of geographical divisions and metropolitan types. The simplest hypothesis is that the combined effect is the addition of the two separate effects. To some extent this is borne out by Figure 5 which gives the division profiles for each of the metropolitan types and for the TOTAL. In addition, somewhat deviating from this simple model are the following interactions between division and types:

Large Central Metro is above average in W and E North Central.

Small Metro is above average in Mountain and W South Central (and below in South Atlantic).

Large Fringe Metro is above average in W and E South Central.

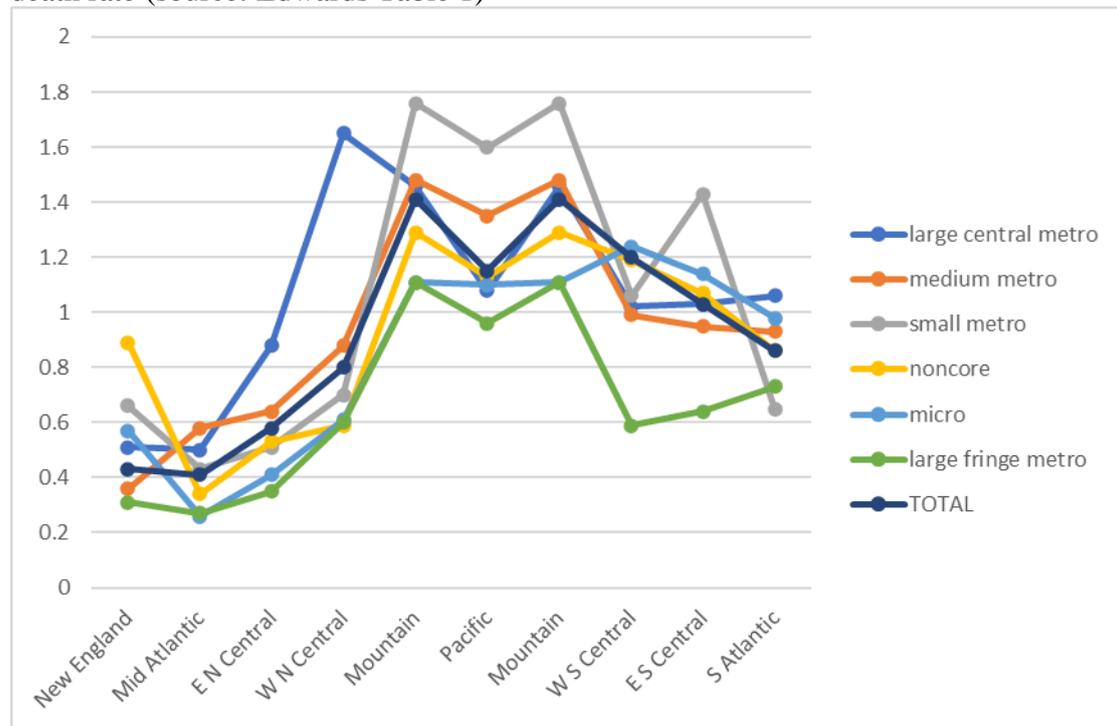
Noncore and Small Micro are high in New England.

... relative to the simple additive model.

Note that the x-axis in Figure 5 travels round the perimeter of the network in an anti-clockwork direction; and that Mountain is represented twice (because it is the only link to Pacific.)

Figure 5 Division profiles for each metropolitan type and TOTAL

death rate (source: Edwards Table 1)



<https://www.census.gov/programs-surveys/metro-micro/about.html>;
https://www.cdc.gov/nchs/data/series/sr_02/sr02_166.pdf.

A thought: do the metropolitan types ‘mean the same thing’ in different divisions?

Black–White adult male police homicide risk ratios

Edwards et al⁵ plot Mortality Risk Ratios, MRR, against *metropolitan type* m for nine geographical divisions.⁶ [Figure 3] Here I focus on the Black/White ratio. Each of the nine graphs is roughly linear and can be made more so if ‘Large Fringe Metropolitan’ (suburbs) and ‘Medium Metropolitan’ switch places on the metropolitan type scale. A generic equation is:

$$MRR = a + b m$$

⁵ Frank Edwards, Cornell, Michael H. Esposito, Seattle, Hedwig Lee, St Louis
<https://news.cornell.edu/stories/2018/07/new-study-finds-police-related-fatalities-may-occur-twice-often-reported>;
<https://ajph.aphapublications.org/doi/10.2105/AJPH.2018.304559>.

⁶ FIGURE 3—Adult Male Police Homicide Risk Ratios, by Race/Ethnicity, Census Division, and Metropolitan Type: Fatal Encounters Dataset, United States, January 1, 2012–February 12, 2018
 Note. MRR = mortality risk ratio. Large points indicate that the 95% posterior prediction interval does not include 1.

Those *Geographical divisions* which have steeper Black-White metropolitan slopes b appear to have larger intercepts a. [I need to check this.]

Ordering the geographical divisions by increasing slope gives:

Mountain (least slope), East South Central, West South Central, South Atlantic ... Pacific, New England, East North Central, West North Central, Middle Atlantic (greatest slope). [By inspection ... I need to check this.]

It would appear that:

divisions with higher overall police homicide rates (e.g. Mountain) have less steep Black-White metropolitan slopes;
divisions with lower overall police homicide rates (e.g. Middle Atlantic) have steeper Black-White metropolitan slopes.

A thought:

Are divisions with steeper Black-White metropolitan slopes associated with higher Black-White ethnic density?

Are divisions with lower overall police homicide rates (e.g. Middle Atlantic) associated with higher Black-White ethnic density?

Ethnic density and ethnic inequality: a totally different social sphere

Finally we look at a totally different social sphere, namely coronavirus deaths in Florida by age and ethnicity. Is ethnic density (in different age groups) associated with ethnic inequality? A recent news article provides an example.

	Age:	25-44	45-64	65-89	90+
x	Ethnic density = black share of state population	18	14	9	7
y	Ethnic inequality = % of coronavirus deaths	44	33	18	9
z	<u>Ethnic inequality = y/x</u>	<u>2.44</u>	<u>2.36</u>	<u>2.00</u>	<u>1.29</u>

Sources: Florida Department of Health; Census Bureau

Robles, Frances, Robert Gebeloff, Danielle Ivory and Kimiko De Freytas-Tamura. "Younger, and increasingly at risk from the coronavirus." *New York Times International Edition*, August 13 2020: 6.