No man is an island: living in a more disadvantaged neighborhood increases the likelihood of developing persistent moderate or severe neck pain 6 weeks after motor vehicle collision

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Background and objective:

- The *Bone and Joint Decade 2000-2010 Task Force on Neck Pain* recently synthesized the medical literature regarding predictors of persistent neck pain after motor vehicle collision (MVC). No studies were identified that investigated social or neighborhood level factors, such as neighborhood socioeconomic status (nSES), on chronic pain development after MVC.[1]
- A disadvantaged neighborhood environment (low nSES) has been associated with increased stress system activation and dysregulated cortisol levels.[2]
- Biological systems involved in the physiologic response to stress have been implicated in the pathogenesis of persistent neck pain after MVC.[3,4]
- In this study, we hypothesized that low nSES would be associated with increased development of persistent neck pain six weeks after MVC.

Methods:

Study population: European Americans ≥18 years old presenting to one of eight emergency departments (EDs) in four no-fault insurance states within 24 hours of MVC who did not have injuries requiring hospital admission enrolled.

Assessments: Baseline ED assessment included collection of participant home address and an evaluation of current neck pain intensity (0-10 NRS) and neck pain intensity during the month prior to MVC (0-10 NRS). Six week and six month telephone follow-up evaluation included an assessment of neck pain intensity during the past week (0-10 NRS). Pain scores ≥ 4 were defined as moderate/severe neck pain (MSNP) if the pain was attributed to MVC by participant. Participant addresses were geocoded and matched with 2006-2010 American Community Survey (ACS) data. Socioeconomic placement (SEP),[5] a well-validated aggregate measure of nSES, was calculated using ACS data and split into quartiles representing most disadvantaged (1st Q), moderately disadvantaged (2nd Q), and not or least disadvantaged (3rd Q and 4th Q).

Analyses: Binary logistic regression (SAS 9.3) was used to assess the effect of the nSES on moderate to severe neck pain at six weeks, while a mixed model was used to assess the effect of nSES on neck pain (0-10 NRS) in the ED, at six weeks, and at six months. Both models controlled for individual level factors (prior pain, age, sex, education, income, and full time employment) while only mixed models estimated random effects of clustering between counties.

Results:

- 948 participants enrolled in the ED, 859/948 (91%) and 940/948 (89% completed six week and six month follow-up, and 935/948 (99%) were geocoded (Figure 1).
- The cohort was relatively wealthy ($64,015 v. $52,762 median household income) and educated compared to US means (87.4% v 85.4% high school graduates) (Table).
- nSES predicted MSNP attributed to MVC six weeks after MVC and results were similar, but attenuated at six months, while there was no association detected between nSES and neck pain in the ED (Figure 2).
- In a mixed model controlling for neighborhood clustering, mean neck pain scores were not significantly higher in the ED ($F=0.69$, $p=0.50$), but were significantly higher in the most disadvantaged quartile (1st Q) and moderately disadvantaged quartile (2nd Q) than the not/least disadvantaged quartiles (3rd & 4th Q) at six weeks ($F=6.53$, $p=0.0016$) and at six months ($F=3.10$, $p=0.046$) (Figure 3).

Table Cohort characteristics

Individual (n, %)	n=948
Sex	
Male	373 (39)
Female	575 (61)
Age	
18-27	315 (33)
28-41	302 (32)
42-65	331 (35)
Education	
High school or less	226 (24)
Some college or other training	369 (39)
College grad or post-grad	351 (37)
Income	
Below $20K	117 (12)
$20k to $40k	176 (19)
$40k to $80k	277 (29)
>$80k	273 (29)
Overall Pain in the ED	
None	38 (4)
Mild (0.5 to 3.5)	150 (16)
Moderate (4.0 to 6.5)	407 (43)
Severe (7.0 to 10.0)	344 (37)
Neighborhood (mean, SD)	
Percent unemployed	8.4 (4.2)
Percent below US poverty line	7.9 (8.3)
Percent high school education or less	12.6 (8.3)
Percent expensive homes	33.3 (33.6)
Percent working class	69.5 (11.8)
Median household income	64,015 (25,560)

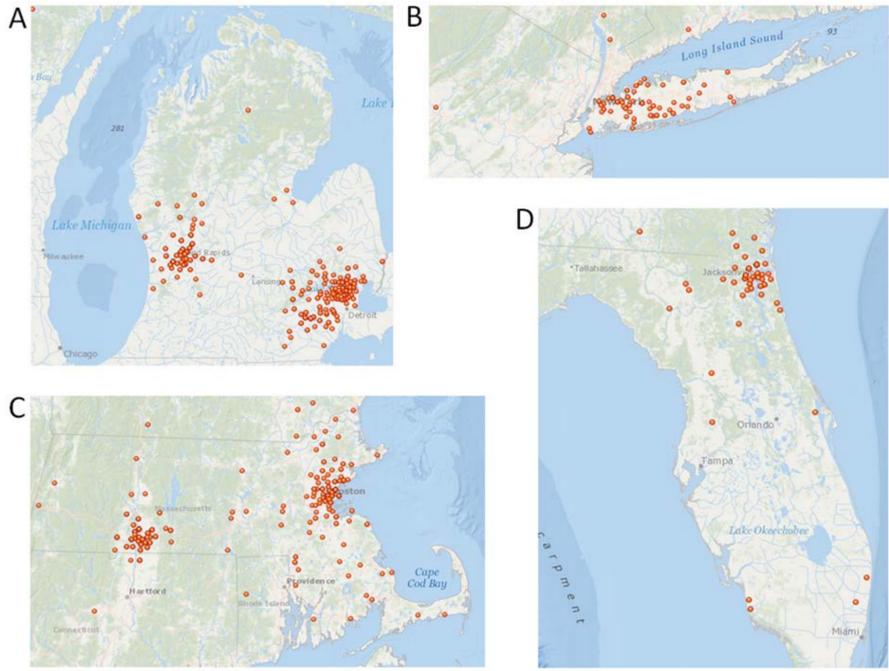**Figure 1.** Census tract cohort representation in **A** Michigan **B** New York **C** Massachusetts **D** Florida
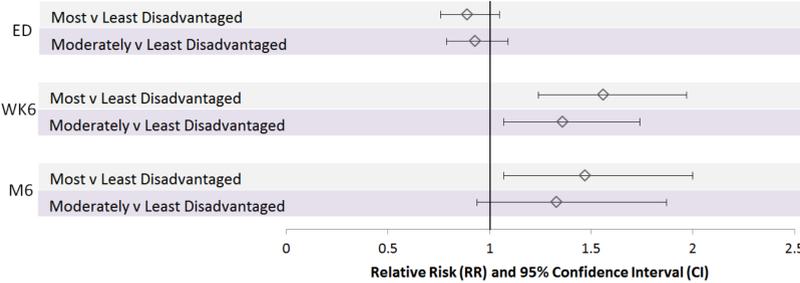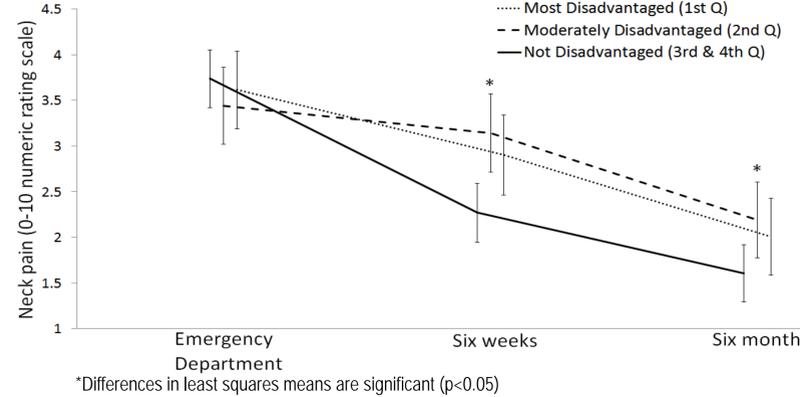

Figure 2. RRs of MVC-related neck pain by nSES

Figure 3. LS-mean neck pain over time by nSES

*Differences in least squares means are significant (p<0.05)

Conclusion:

Persistent neck pain rates in individuals experiencing MVC are higher in more disadvantaged neighborhoods, areas which are likely high stress environments. These results add further evidence supporting the biopsychosocial model[6] of pain. Further studies are needed to determine the exact mechanism of living in a disadvantaged neighborhood on pain persistence after trauma.

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