



Q12 A systematic review of socioeconomic status measurement in thirteen years of US injury research[☆]

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ABSTRACT

Objective: The purpose of this review was to assess the impact of socioeconomic status (SES) on injury and to evaluate how US injury researchers have measured SES over the past 13 years in observational research studies. *Design & methods:* This systematic review included 119 US injury studies indexed in PubMed between January 1, 2002 and August 31, 2015 that used one or more individual and/or area-level measures of SES as independent variables. Study findings were compared to the results of a previous review published in 2002. *Results:* Findings indicate SES remains an important predictor of injury. SES was inversely related to injury in 78 (66%) of the studies; inverse relationships were more consistently found in studies of fatal injury (77.4%) than in studies of non-fatal injury (58%). Approximately two-thirds of the studies ($n = 73$, 61%) measured SES along a gradient and 59% used more than one measure of SES ($n = 70$). Studies that used a gradient measure of SES and/or more than one measure of SES identified significant relationships more often. These findings were essentially equivalent to those of a similar 2002 review (Cubbin & Smith, 2002). *Conclusions:* There remains a need to improve measurement of SES in injury research. Public health training programs should include best practices for measurement of SES, which include: measuring SES along a gradient, selecting SES indicators based on the injury mechanism, using the smallest geographic region possible for area-level measures, using multiple indicators when possible, and using both individual and area-level measures as both contribute independently to injury risk. Area-level indicators of SES are not accurate estimates of individual-level SES. *Practical applications:* Injury researchers should measure SES along a gradient and incorporate individual and area-level SES measures that are appropriate to the injury outcome under study.

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1. Introduction

The association between socioeconomic status (SES) and health outcomes has been observed for decades, and continues to be a major area of investigation in many areas of public health (Glymour, Avendano, & Kawachi, 2014). One of the four overarching goals of *Healthy People 2020* is to achieve health equity, eliminate disparities, and improve the health of all groups; within this goal, disparities are defined as a type of health difference that is closely linked with social, economic, and/or environmental disadvantage (U.S. Department of Health and Human Services Office of Disease Prevention and Health Promotion, 2015). Despite research and prevention efforts, injuries continue to disproportionately affect individuals and neighborhoods with lower SES (Centers for Disease Control and Prevention [CDC], 2013; Cubbin, LeClere, & Smith, 2000).

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1.1. Definition of injury

The World Health Organization defines injury as “the physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy” (Holder et al., 2001). In the United States in 2015, injuries were the leading killer of people ages 1 to 44, accounting for 214,008 deaths and 31.8 million emergency room visits (CDC-National Center for Injury Prevention and Control, 2017). Over 3 million of these individuals received further hospital or rehabilitation care; and injuries were responsible for 671 billion dollars of total lifetime medical and work loss costs (Florence, Haegerich, Simon, Zhou, & Luo, 2015).

1.2. Definition of SES

While there is no single definition of SES, and there is no one standard for measurement (Oakes & Rossi, 2003), for the purposes of this review this general definition is used: “SES is an indicator of an individual’s social and economic standing in society and often is determined by a combination of ratings on occupational status, income level, and education (Cralley, 2007).” SES is considered an important

75 predictor of health and wellbeing across public health disciplines
76 (Glymour et al., 2014). Individuals with high SES are likely to have
77 more advanced education, work in prestigious positions, and earn
78 higher salaries than individuals with low SES. These individuals have
79 greater access to resources that can contribute to their success and to
80 the perpetuation of similar benefits for their families (Cralley, 2007,
81 p. 928).

82 SES shows a consistent inverse relationship with many types of
83 injury (Bell, Arrington, & Adams, 2015; Denney & He, 2014). The
84 pathways between SES and injury, as well as other health outcomes,
85 may be causal, can indicate reverse causation (e.g., greater exposure to
86 injury lessens one's ability to earn money or advance one's education),
87 and can be confounded by third variables (Glymour et al., 2014). For
88 example, individuals with lower educational attainment and family
89 wealth are more likely to work in jobs with higher injury risk, such
90 as construction, production, and mining than individuals from higher
91 SES backgrounds (Krieger, 2010); these jobs also pay less, and during
92 times when workers are injured, they may earn nothing at all. Children
93 from families with lower SES are less likely to be restrained in child safe-
94 ty seats than children from families with higher indicators of SES (Macy
95 & Freed, 2012). Lower safety seat utilization among families with fewer
96 financial resources is attributable to a multitude of socioeconomic fac-
97 tors, including: income, which can affect the family's ability to purchase
98 a seat (Winston, Chen, Smith, & Elliott, 2006); education, which can im-
99 pact both using the seat correctly and access to the recommendations
100 for child passenger safety (Bilston, Finch, Hatfield, & Brown, 2008;
101 Wegner & Girasek, 2003; Winston et al., 2006); and sociocultural
102 norms about use of child safety seats in the community (Johnston
103 et al., 2008; Macy & Freed, 2012), among other factors. In other words,
104 there is not always a clear causal link between particular measures of
105 SES and injury, rather there is a "web of causation" between SES and
106 injury.

107 1.3. Methodological considerations for the measurement of SES

108 A number of individual- and household-level variables have been
109 used to assess SES in injury research (Cubbin et al., 2000), including in-
110 come, educational attainment, occupational or employment status,
111 health insurance status, and wealth. Studies also employ area-level
112 measures of SES such as poverty, concentrated poverty, income inequal-
113 ity, unemployment rates, and educational attainment. Each of these
114 factors varies in terms of their ease of measurement, usefulness, mean-
115 ing and relationship to health status overall and injury risk specifically.

116 Use of inadequate measures of SES in health and injury research is
117 widespread (Braveman et al., 2005; Cubbin et al., 2000; Shavers,
118 2007). This occurs for many reasons, but commonly this is due to a
119 lack of available data or insufficient inclusion of appropriate measures
120 (or conceptualization of the measures) for the causal pathway under in-
121 vestigation (Braveman et al., 2005; Shavers, 2007). Additionally, while
122 SES is often operationalized in a binary way that compares individuals
123 considered to be poor to those who are not, it is important to note
124 that SES generally has a graded association to health outcomes (Adler
125 et al., 1994).

126 Studies of racial/ethnic disparities in injury require accounting for
127 the role of SES. Severe socioeconomic disparities between racial/ethnic
128 groups persist, causing potential confounding by socioeconomic
129 variables in studies comparing injury and health outcomes between
130 racial groups (Kaufman, Cooper, & McGee, 1997). As SES is often inade-
131 quately measured and/or poorly conceptualized in studies of health,
132 racial/ethnic differences in health often persist after 'controlling' for
133 socioeconomic variables (Cubbin & Smith, 2002). As stated by Oakes
134 and Rossi (2003, p. 770), in the absence of appropriate measurement
135 of SES, "racial/ethnic disparities may continue to be construed as signs
136 of genetic differences or behavioral choices rather than powerful clues
137 about how forms of racial discrimination and structural constraints,
138 past and present, harm health."

1.4. Purpose statement

Cubbin and Smith (2002) reviewed epidemiological, population-
based studies investigating the link between SES and injury from 1960
to 2001. This review was intended to provide a critical examination of
the methods and measures of SES in studies of injury; the results eluci-
dated important methodological concerns. The purpose of the current
study is to update this review to assess whether the U.S. injury research
field has improved along the lines recommended by Cubbin and Smith
in terms of accounting for the effects of SES. The topic remains impor-
tant to the field, as there is evidence that SES disparities persist and
may be widening across many health outcomes and across racial lines
(Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Laflamme,
Hasselberg, & Burrows, 2010; Singh & Kogan, 2007).

2. Methods

2.1. Locating articles for review

On September 15, 2015 a search of the PubMed database (National
Library of Medicine, 2012) was conducted using the following key inju-
ry Medical Subject Heading (MeSH) terms: "wounds and injuries," "sui-
cide," "homicide," "violence," and "poisoning" and these SES terms:
"socioeconomic factors," "wealth," "deprivation," "crowding," "hous-
ing," "occupation," and "rent." Within PubMed the MeSH term "wounds
and injuries" encompasses all types of bodily injury, as well as burns,
submersions and drownings, asphyxia (suffocation) and a number of
additional terms. Similarly, the MeSH term "socioeconomic factors" in-
cludes: employment and employment characteristics (e.g., career mo-
bility, unemployment), family characteristics, education, income,
poverty, and social class and conditions, among other relevant terms.
The search terms "US, USA or United States" were added to eliminate
many of the studies from other countries. This search returned 4172
studies. Study abstracts, and the full studies when necessary, were
reviewed to determine whether they met the inclusion criteria.

2.2. Inclusion criteria

Original, peer-reviewed studies from the United States were
retained for analysis if they were: indexed in PubMed between January
1, 2002 and August 31, 2015, focused on predictors/correlates of an
injury outcome, and included one or more individual or area-level
measures of SES as independent, mediating, moderating, or control
variables. Articles were eliminated if they were intervention studies,
case reports, comments, controlled trials, reviews or meta-analyses.
Studies with an outcome variable such as violence, crime, abuse/
maltreatment, suicide attempt, or collision (as opposed to actual
injuries) were eliminated because injuries did not necessarily occur
during these events. Studies of alcohol or drug overdose with no phys-
ical injury were not included. Studies where there could be no or very
little variation in SES, including studies of institutionalized populations
(e.g., prisoners) or occupational studies of a single occupation, and stud-
ies which only conducted descriptive analyses of the SES variables, were
not included. Studies from the military were retained if rank and/or an-
other measure of SES was utilized. Similarly, in studies of occupational
injury, the studies were retained if there was a hierarchical assessment
of the occupations (as opposed to a listing of occupations) or another
measure of SES. Studies of poisoning were included as the prevention
of poisoning often falls within the purview of injury prevention profes-
sionals, and are included in the scope of the CDC's National Center for
Injury Prevention and Control (CDC - NCIPC, 2015). As the primary
focus was individual and area measures of SES, studies that only
examined large macro-level SES, such as gross domestic product or
state/national unemployment rates, were eliminated. Studies of injuries
secondary to a medical condition, such as cancer or osteoporosis, were
eliminated.

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