



Review

Resolving the vulnerability paradox in the cross-national prevalence of posttraumatic stress disorder



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ABSTRACT

Socioeconomically disadvantaged individuals are at heightened risk for developing posttraumatic stress disorder (PTSD) following exposure to trauma. Yet a study of cross-national lifetime prevalence rates of PTSD revealed that countries scoring high on an index reflecting cultural and socioeconomic disadvantage exhibited *lower* rates of PTSD in response to trauma, evincing what the authors called “a vulnerability paradox in the cross-national prevalence of post-traumatic stress disorder” Dückers, Alisic, & Brewin (2016a, p. 300). Drawing on classic studies in sociology and political science concerning the *ecological fallacy*, the author suggests ways to resolve the striking paradox discovered by Dückers et al.

1. Introduction

Although posttraumatic stress disorder (PTSD) occurs throughout the world (Osterman & de Jong, 2007), lifetime prevalence rates differ dramatically across countries (Dückers, Alisic, & Brewin, 2016a). The likelihood of someone developing the disorder depends on the severity of the stressor, moderated by diverse risk factors (McNally, 2003, pp. 78–104). For example, socioeconomically disadvantaged individuals are at heightened risk for developing PTSD in response to trauma (e.g., Bonanno, Brewin, Kaniasty, & La Greca, 2010; Hobfoll et al., 2009). Accordingly, reasoned Dückers et al. (2016a), the variables that predict PTSD among *individuals* – trauma and vulnerability – may explain differences among *countries* in the prevalence of PTSD.

To investigate this issue, Dückers et al. (2016a) examined aggregate data from population studies reporting lifetime PTSD and extent of trauma exposure. Moreover, they used a composite vulnerability index to characterize a country's degree of cultural and socioeconomic disadvantage. Compiled annually by the authors of the *World Risk Report* (Welle, Birkmann, Rhyner, Witting, & Wolfertz, 2013), this index comprises 23 indicators (e.g., malnutrition, income inequality, gross domestic product per capita, political corruption, number of physicians per 1000 citizens, adult literacy rate, public and private health expenditure) that presumably reflect a country's capacity to withstand harm. Dückers et al. expected that both trauma exposure and vulnerability would be positively associated with lifetime prevalence across countries.

Consistent with expectation, the more trauma experienced by a country's citizens, the higher was its lifetime prevalence of PTSD

($r = 0.60$). Yet the greater a country's vulnerability index, the *lower* was its lifetime prevalence of PTSD ($r = -0.49$). The pathogenic impact of trauma varied inversely with a country's overall vulnerability when exposure to trauma was high. For example, low-vulnerability countries (e.g., Canada, USA) had higher PTSD prevalence rates than did high-vulnerability countries (e.g., South Africa, Mexico) despite similar levels of trauma. Surprised by this counterintuitive finding, the authors dubbed it “a vulnerability paradox in the cross-national prevalence” of PTSD (Dückers et al., 2016a, p. 300).

The purpose of this article is to show that the paradox vanishes if we avoid falling prey to the *ecological fallacy* (Robinson, 1950; Selvin, 1958). This fallacy arises when one assumes that associations between variables at the ecological (group or aggregate) level necessarily apply to associations between these variables at the level of the individual. As a prelude to examining the vulnerability paradox further, I discuss three classic cases that illustrate how easily one can go astray by assuming that associations necessarily hold across group and individual levels of analysis.

2. Case studies relevant to the ecological fallacy

Durkheim (1897/2006, pp. 156–178) found that suicide rates were higher in German provinces that were predominantly Protestant than in those that were predominantly Catholic. He concluded that Protestants were more likely than Catholics to kill themselves. Durkheim hypothesized that the confessional diversity among Protestants undermined their social integration, thereby heightening their risk of suicide. In contrast, he said, the obligatory uniformity of belief among Catholics

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forged stronger social bonds with their co-religionists, reducing their risk of suicide (Durkheim, 1897/2006, p. 178).

Nearly a century later, Morgenstern (1995) submitted Durkheim's data to formal statistical analysis, finding that predominantly Protestant provinces had a suicide rate nearly eight times higher than predominantly Catholic provinces. Yet when he examined data at the level of the individual, he discovered that Protestants were only about twice as likely as Catholics to commit suicide. Hence, the ecological correlation between Protestantism and suicide greatly overestimated the correlation at the level of the individual. Morgenstern suggested that Catholics living as a religious minority in predominantly Protestant provinces may have been the ones driving up the suicide rate in these regions.

As Dückers et al. (2016a) discovered, sometimes the sign of a correlation between two variables *reverses* when one compares associations at the ecological versus individual level of analysis. For example, Robinson (1950) examined the association between illiteracy and foreign birth in the United States at the ecological level of the state and again at the level of the individual. For each of the 48 states, he obtained two data points: the percentage of illiterate residents and the percentage of immigrants. The correlation between these two values across the 48 states was -0.526 .¹ That is, the greater the proportion of native-born Americans in a state, the higher the rate of English-language illiteracy. Yet this startling finding reversed at the individual level. The correlation between foreign birth and illiteracy was 0.118: immigrants were less likely than native-born Americans read and write in English. The paradoxical ecological correlation arose because states whose native-born residents have high rates of literacy are precisely those that tend to attract many immigrants, many of whom were illiterate in English.

Another striking example of correlations reversing sign between the ecological and individual levels of analysis concerns the third-party candidacy of George Wallace in the 1968 American presidential race. Studying 77 Congressional districts in the southern United States, Schoenberger and Segal (1971) found that Wallace performed extremely well in districts having a large proportion of African-Americans, paradoxically suggesting that a militant segregationist was especially popular among black voters. However, post-election surveys revealed that almost no African-Americans in these districts voted for Wallace (Firebaugh, 2009). The discrepancy between the ecological and individual correlations was attributable to whites being especially prone to vote for Wallace in districts having a large proportion of black residents (Schoenberger & Segal, 1971).

3. What accounts for the vulnerability paradox in PTSD?

There are two steps to resolving the vulnerability paradox discovered by Dückers et al. (2016a). First, familiarity with the ecological fallacy should diminish the surprise provoked when the direction of association between variables reverses across group and individual levels of analysis. There is no mathematical reason for assuming they should be the same (Robinson, 1950). Accordingly, Dückers et al.'s (2016a) study is not "fatally flawed" as Vermetten, Stein, and McFarlane (2016, p. 527) claimed in a critique convincingly rebutted by Dückers, Alisic, and Brewin (2016b).

Second, the next step is to explain why the direction of the association reversed between levels. In a nutshell, why are trauma-exposed people more likely to develop PTSD in a low-vulnerability country than in a high-vulnerability one?

One possibility is that term *vulnerability* means something rather different at the ecological and individual levels of analysis. Indeed, some of the variables that figure in the vulnerability index used by

Dücker et al. (2016a) apply to groups, not individuals (e.g., number of physicians per 10,000 inhabitants, a country's Gini index [measure of income inequality]; Welle et al., 2013). Accordingly, researchers must be careful to avoid the *fallacy of division* (Aristotle, 350 BCE/1958, p. 23) whereby one assumes that an attribute of a group applies to its members. For example, a hung jury is indecisive as it cannot reach a verdict regarding the guilt or innocence of the defendant. But the indecisiveness of the jury does not apply to its members, each of whom is very decisive about his or her judgment of guilt or innocence (G. Zito, cited in Schwartz, 1994).

The classic social science studies cited earlier suggest another possible explanation. In each case, a subgroup was strikingly different from the group as a whole, thereby producing a paradoxical ecological correlation (e.g., illiterate immigrants being disproportionately likely to live in states with many native-born residents; Robinson, 1950). Likewise, the citizens of low-vulnerability countries most likely to encounter trauma may be those least likely to experience the socioeconomic advantages enjoyed by their affluent fellow citizens. For example, assaultive violence in America is highly concentrated in the most socioeconomically disadvantaged communities (e.g., inner city Detroit; Breslau et al., 1998), and certain subgroups, such as incarcerated female adolescents, have histories of extreme cumulative trauma exposure (Lansing, Plante, & Beck, 2017). If so, then this would explain Dücker et al.'s (2016a) paradoxical inverse correlation between the vulnerability index and PTSD prevalence among countries with high levels of trauma exposure.

Finally, extrapolating from classic work on the "hedonic treadmill" (Brickman & Campbell, 1971, p. 289; Brickman, Coates, & Janoff-Bulman, 1978), one might hypothesize that societal context moderates the pathogenic impact of a stressor (McNally, 2016). Hence, traumatic events occurring in countries with a high vulnerability index may be less shockingly discrepant than those occurring in countries with a low vulnerability index. An automobile accident occurring in a war-torn country may be less likely to trigger PTSD than one occurring in a peaceful, affluent country. If so, then this may partly explain why Dücker et al. found that high-vulnerability countries had lower rates of PTSD than did low-vulnerability countries with similarly high levels of trauma.

4. Conclusion

In summary, the purpose of this article is to provide plausible explanations for Dücker et al.'s (2016a) important, counterintuitive discovery. However, the paradox cannot be definitively resolved without access to individual data. Indeed, as Dücker et al.'s (2016a) emphasized, researchers need to use a multilevel approach involving individual, group, and country levels of analysis to test hypotheses concerning the vulnerability paradox.

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¹ Correcting several methodological oversights in Robinson's study, Te Grotenhuis, Eisinga, and Subramanian (2011) computed the correlation as -0.462 .

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