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CORRESPONDENCE

To the Editor:

Parker *et al*. (**31**, 549–553) analysed the monthly incidence of registered male and female suicides in the Republic of Singapore for the 120 consecutive months 1989–98. The study site of this welcomed augmentation to the literature of time-dependent suicide risks is a small city-state in Southeastern Asia, on islands between Malaysia and Indonesia. Owing to its location (1° 22′ northern latitude), the climate is tropical, hot and humid, with frequent rainfall and thunderstorms, and no pronounced seasons (Singapore data, here and below, from *CIA World Fact Book*, 2000; see URL http://www.odci.gov/cia/publications/factbook/).

For this equatorial study site, Parker *et al*. found 'no clear evidence of any seasonal pattern to suicidal deaths' (pp. 552–553) and concluded that their findings 'should assist narrowing the list of putative determinants of seasonal patterns in northern and southern hemispheres' (p. 553). In other words, since suicide seasonality has consistently been found for northern and southern hemisphere countries (Kevan, 1980; Preti, 2000; Preti *et al*. 2000), and was absent in this equatorial region, the main determinant of suicide seasonality has to be equatorial distance (i.e. latitude) and corresponding climate and pronouncedness of seasonal changes.

We do not concur with this reasoning. Rather, we believe that the authors' conclusion is logically fallacious, and therefore invalid, because for the study site investigated, the putative cause (equatorial proximity) is confounded with two well-known determinants for suicide seasonality, namely, urbanization and economic affluence.

First, urbanization – the land area of Singapore (637·5 km²) is approximately 3·5 times the size of Washington, DC. The current population is 4·151 million (July 2000 estimate), resulting in one of the world's highest population density numbers (6512 inhabitants per km²). Also, Singapore is completely urbanized. Since Durkheim, ample evidence has been accumulated for a negative relationship between degree of urbanization and magnitude of the suicide seasonality effect. Notably smaller suicide seasonality for rural areas, as compared to urban ones, has been reported in single-country studies for Italy (Micciolo *et al*. 1991), South Africa (Flisher *et al*. 1997), Sweden (Granberg & Westerberg, 1999), the United Kingdom (Wales) (Capstick, 1960) and the United States (Lester, 1998). In a study of 28 countries, Chew & McCleary (1995) found that the spring peak in suicides was substantially positively correlated with the percentage of the population with a rural living background (agricultural workforce). There is also evidence that the degree of urbanization is a stronger determinant for suicide seasonality effect size than latitude. After a quantitative literature review, Hakko *et al*. (1998*a*) found no statistically significant association between study sites' equatorial distance and a seasonality measure (peak-to-trough difference in monthly suicide numbers). Instead, they discovered an association between equatorial distance and calendar shift of suicide peak months, with the spring peak shifting to summer with increasing latitude of study site. Most revealing of the salience of urbanization, however, are accounts with competing tests of urbanization and latitude as determinants for suicide seasonality. In the United States, on a state-level, overall unevenness in monthly suicides was strongly and statistically significantly associated with low urbanization, while the respective association with latitude was statistically not significant (Lester, 1998). In the large-scaled cross-national analysis by Chew & McCleary (1995), latitude–seasonality association were outcompeted by far by urbanization–seasonality associations.

Secondly, economic affluence – the island city-state Singapore is one of the world's most prosperous countries, with a per capita GDP above that of leading industrialized Western European countries, resulting in ranking fifth in the world. A growing body of evidence demonstrates a sharp decrease in suicide seasonality, or even its disappearance, over the past few decades in the affluent industrialized countries in the northern and southern hemisphere. Such secular

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trends in the suicide seasonality effect magnitude have been reported for Finland (Hakko *et al.* 1998*a*, *b*), Japan (Abe *et al.* 1986), Sweden (Rihmer *et al.* 1998; Granberg & Westerberg, 1999), the United Kingdom (Yip *et al.* 2000), Australia and New Zealand (Yip *et al.* 1998), and Hong Kong and Taiwan (Ho *et al.* 1997; Yip *et al.* 2001).

In summary, cumulative evidence suggests that urbanization and economic affluence are salient determinants for suicide seasonality. Urbanization is a more salient determinant for suicide seasonality than latitude and climate, and economic affluence is associated with decreasing or vanishing suicide seasonality.

Parker *et al.* mention the influences of urbanization and industrialization on suicide seasonality and the secular trends in suicide seasonality in industrialized countries. They admit that the Singapore dataset is limited to the past decade. However, they fail to acknowledge the clear confounding of these variables for the study site and the salience of the confounders for suicide seasonality. They prefer to attribute the non-seasonality finding to equatorial proximity and tropical climate alone, thereby overlooking the obvious: the evidence is not only 'data from the equator' (p. 549); rather, it stems from a 100% urbanized and economically prosperous equatorial study site.

The principle of total evidence in scientific inductive reasoning requires that all relevant evidence must be included in an inductive argument. Parker's *et al.* inductive argument excludes relevant evidence from consideration. Their conclusion falls prey to the fallacy of exclusion (Downes, 1995–2000). As shown above, accounting for the omitted evidence considerably changes the conclusion. It would be interesting to hear of further contemporary equatorial suicide seasonality data, but from less urbanized and less economically prosperous regions.

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The Author's reply:

I appreciate the passionate response by Voracek & Fisher, who reject a latitude effect in favour of urbanization and economic affluence. They may well be correct. We conceded such a possibility in our introduction, noting that 'seasonal variation is greatest in the least industrialized nations and declines with industrialization, perhaps due to the influence of artificial lighting' (p. 550).

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Voracek & Fisher quote Hakko *et al*. (1998) as finding 'no statistically significant association' between 'equatorial distance and a seasonality measure' to reject a 'latitude effect'. This quote is technically correct but the correlation coefficient was 0·25, which more suggests a slight influence or insufficient power in their analysis to formalize the association as significant.

Singapore has been urbanized and economically prosperous for at least two decades. We examined Singapore data for 1989–98. However, and as noted in our paper, Kok & Tsoi (1993) reported Singapore data for 1980–89, and described a seasonal pattern similar to that reported in temperate countries. We had suspected that differences in results across the two Singapore studies reflected methodological and analytical approaches. However, if a previous seasonal phenomenon has attenuated in Singapore as appears to have occurred in northern and southern hemisphere regions (including those where urbanization and economic prosperity would appear to show some constancy), there may be a higher-order or independent factor determining a secular change across all regions. It could also be viewed as a 'fallacy of exclusion' for Voracek & Fisher to nominate only two alternate explanatory variables (i.e. urbanization and economic affluence) without addressing the last possibility.

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