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Original Article

Scarcity of female mates predicts regional variation in men's and women's sociosexual orientation across US states☆

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ABSTRACT

Previous studies have linked regional variation in willingness to engage in uncommitted sexual relationships (i.e., sociosexual orientation) to many different socio-ecological measures, such as adult sex ratio, life expectancy, and gross domestic product. However, these studies share a number of potentially serious limitations, including reliance on a single dataset of responses aggregated by country and a failure to properly consider intercorrelations among different socio-ecological measures. We address these limitations by (1) collecting a new dataset of 4,453 American men's and women's sociosexual orientation scores, (2) using multilevel analyses to avoid aggregation, and (3) deriving orthogonal factors reflecting US state-level differences in the scarcity of female mates, environmental demands, and wealth. Analyses showed that the scarcity of female mates factor, but not the environmental demand or wealth factors, predicted men's and women's sociosexual orientation. Participants reported being less willing to engage in uncommitted sexual relationships when female mates were scarce. These results highlight the importance of scarcity of female mates for regional differences in men's and women's mating strategies. They also suggest that effects of wealth-related measures and environmental demands reported in previous research may be artifacts of intercorrelations among socio-ecological measures or, alternatively, do not necessarily generalize well to new datasets.

1. Introduction

Some previous research suggests that environmental demands may be important for regional variation in individual mating strategies, such as willingness to engage in uncommitted sexual relationships (i.e., sociosexual orientation, Simpson & Gangestad, 1991). For example, people in countries with higher parasite stress (Barber, 2008; Schaller & Murray, 2008; Thornhill, Fincher, Murray, & Schaller, 2010) or with higher incidence of low birth weight and child malnutrition, higher infant mortality rates, and shorter life expectancy (Schmitt, 2005) report being less willing to engage in uncommitted sexual relationships.

These links between sociosexual orientation and environmental demands could occur because engaging in uncommitted sexual relationships increases exposure to infectious diseases and such behaviors will be more costly in more demanding environments (Schaller & Murray, 2008). Alternatively, they may occur because committed relationships reduce the negative consequences of demanding environments on offspring viability by increasing the amount of parental investment available, meaning that preferences for committed relationships are likely to be higher in regions with greater environmental demands (Schmitt, 2005). That these links between environmental demands and sociosexual orientation tend to be stronger among women than men (Schaller & Murray, 2008; Schmitt, 2005; Thornhill et al., 2010, but see Barber, 2008) may reflect that the fitness costs incurred in demanding environments, such as increased risk of contracting infectious diseases, are greater for women than for men and that the fitness benefits of engaging in uncommitted sexual relationships are greater for men than for women (Schaller & Murray, 2008; Thornhill et al., 2010).

In addition to links between environmental demands and sociosexual orientation, several lines of evidence suggest that the scarcity of female mates in the local population may be an important factor. For example, in countries with a higher ratio of men to women, higher fertility and teen pregnancy rates, or lower mean age at marriage for women, people report being less willing to engage in uncommitted sexual relationships (Schmitt, 2005, see also Barber, 2008). Men's sociosexual orientation tends to be less restricted than women's (Penke & Asendorpf, 2008; Simpson & Gangestad, 1991). Consequently, scarcity of female mates in the local population may predict *women's* sociosexual orientation because women are better able to pursue their preferred mating strategy when intrasexual competition for mates among women is less intense and they can be more selective in their mate choices (Schmitt, 2005). Scarcity of female mates in the local population may predict *men's* sociosexual orientation because men are more likely

☆ Data accessibility: Data and analysis scripts are included as electronic supplementary materials. State-level variables can be accessed from the Measure of America (http://www.measureofamerica.org/measure_of_america2013-2014/) and the American Community Survey (http://factfinder2.census.gov/).

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to align their mating strategy with those that are preferred by women when intrasexual competition for mates among men is more intense and men may need to be willing to alter their preferred mating strategy in order to obtain mates (Schmitt, 2005). Consistent with this interpretation, women do show greater selectivity in their mate preferences (Pollet & Nettle, 2008; Watkins, Jones, Little, DeBruine, & Feinberg, 2012) and men are more willing to commit to and invest in monogamous relationships (Pedersen, 1991; Pollet & Nettle, 2009) when women are relatively scarce. Recent research also demonstrates that, across bird species, pair bonds are more stable when sex ratios are male-biased (Liker, Freckleton, & Székely, 2014).

In addition to scarcity of female mates and aspects of environmental demand, such as parasite stress and other health risks, people report being more willing to engage in uncommitted sexual relationships in wealthier countries (Schmitt, 2005). This effect of wealth may occur because individuals in wealthier countries tend to have more resources to invest in their offspring and, consequently, biparental care is less important for offspring viability (Schmitt, 2005). In one study, wealth was related to women's, but not men's, sociosexual orientation (Barber, 2008), potentially reflecting women's greater engagement with offspring care.

Although the studies described above suggest that socio-ecological factors predict regional differences in sociosexual orientation (Barber, 2008; Schaller & Murray, 2008; Schmitt, 2005; Thornhill et al., 2010), they have a number of potentially important limitations.

First, the studies all analyzed scores on Simpson and Gangestad's (1991) Sociosexual Orientation Inventory (SOI) that were taken from the same dataset, which was collected by Schmitt (2005). Consequently, it is important to establish which of these results generalize to other, independent datasets.

Second, because they rely on a single dataset using Simpson and Gangestad's (1991) SOI, all of the studies analyzed global sociosexual orientation only. More recently, Penke and Asendorpf (2008) have argued that sociosexual orientation consists of three components (attitudes, desires, and behaviors) and developed a revised Sociosexual Orientation Inventory (SOI-R) to measure each of these components, in addition to a global measure of sociosexual orientation. Socio-ecological factors need not necessarily have identical effects on the three different components. For example, because attitudes and desires are not constrained in the same way that behaviors are (Penke & Asendorpf, 2008), links between socio-ecological conditions and sociosexual orientation may be more apparent when measured via attitudes and desires than when measured via behaviors.

Third, the studies all correlated measures of socio-ecological conditions with aggregated SOI scores for each country. This approach has recently been criticized because aggregating data in this way may give a misleading impression of responses typical of individuals in each region (Pollet, Tybur, Frankenhuis, & Rickard, 2014). This concern can be addressed through the use of multilevel analyses, in which individual participants' data are grouped, but not aggregated, by region (Pollet et al., 2014). Multilevel analyses also account for differences in the number of samples in each region and the variance of scores in each region. These problems arising from the analysis of aggregated data also extend to prior research linking regional differences in sex ratio to other aspects of mating strategy, such as choosiness in mate preferences (Stone, Shackelford, & Buss, 2007), access to financial resources (Griskevicius et al., 2012), and various marriage statistics (Kruger, 2009; Lichter, McLaughlin, Kephart, & Landry, 1992; South & Trent, 1988).

Fourth, although measures of the scarcity of female mates, environmental demands, and wealth are often intercorrelated (Barber, 2008; Schmitt, 2005), the studies have not always controlled for the possible effects of these intercorrelations. For example, Schmitt (2005) presents only simple correlations between socio-ecological factors and sociosexual orientation, while Thornhill et al. (2010) only considered the possible effects of parasite stress. Schaller and Murray (2008) demonstrate that the effect of disease prevalence on women's sociosexual orientation was not due to the possible effects of wealth and life expectancy, but did not consider the possible effects of measures of the scarcity of female mates. Barber (2008) tested for independent effects of several aspects of environmental demand, scarcity of female mates, and wealth, reporting evidence that some of these measures have independent effects. However, these analyses also suggested that controlling for multiple, correlated socio-ecological factors can dramatically alter the nature of their effects. For example, the effect of infectious disease on women's sociosexual orientation was significant and negative in a simple correlation analysis, but significant and positive when effects of other measures were controlled (Barber, 2008). Consequently, it is unclear whether scarcity of female mates, environmental demands, and wealth do have independent effects on regional variation in sociosexual orientation.

To address the problems described above, we tested for possible relationships between sociosexual orientation and regional variation in scarcity of female mates, environmental demands, and wealth in a new dataset of men and women from 50 U.S. states (and Washington DC). First, we used principle component analysis to investigate the factor structure of measures of state-level variation in scarcity of female mates (i.e., adult sex ratio, fertility rate, teenage pregnancy rate, women's age at first marriage), environmental demands (i.e., infant mortality, low birth weight, life expectancy at birth, children living in poverty), and wealth (gross domestic product per capita, Human Development Index). These specific variables were selected because they are the closest US state-level analogues to the measures of country-level variation that were analyzed by Schmitt (2005). This initial analysis produced a three-factor solution in which the factors primarily reflected state-level variation in scarcity of female mates, environmental demands, and wealth (see Table 1). We then used multilevel analyses to test for independent relationships between these factors and participants' scores on Penke and Asendorpf's (2008) revised Sociosexual Orientation Inventory (SOI-R). Each of the three different components of sociosexual orientation (attitudes, desires, and behaviors) was analyzed, in addition to the global measure.

2. Methods

2.1. Participants

A total of 3209 heterosexual women (mean age = 23.4 years, SD = 5.94 years) and 1244 heterosexual men (mean age = 25.9 years, SD = 7.59 years) participated in the online study (total N = 4453). Online data collection has been used in many previous studies of sociosexual orientation (Penke & Asendorpf, 2008) and regional differences in both mate preferences (DeBruine, Jones, Crawford, Welling, & Little, 2010; DeBruine, Jones, Crawford, & Welling, 2011) and mating-related attitudes (e.g., Price, Pound, & Scott, 2014). Participants were recruited by following links from social bookmarking websites (e.g., stumbleupon.com) and were not compensated for their participation.

Table 1
Component matrix for principle component analysis of all state-level variables.

State-level variables	Environmental demand factor	Scarcity of female mates (SoFM) factor	Wealth factor
Infant mortality rate	.853	−.175	−.007
% of low-birth-weight infants	.846	−.245	.167
Teenage pregnancy rate	.867	.371	−.003
Life expectancy at birth	−.935	−.043	.075
% of children living in poverty	.866	−.045	−.275
Adult sex ratio	−.342	.791	−.204
Fertility rate	.083	.901	.082
Women's median age at first marriage	−.140	−.822	.415
Gross domestic product per capita	−.030	−.147	.943
Human development index	−.735	−.347	.541