The City College of New York

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Environmental Factors Spread Obesity, CCNY-Led Team Reports

Study Finds Similar Patterns in Epidemic's Movement Across United States and Marketing and Distribution of Food Products

An international team of researchersô study of the spatial patterns of the spread of obesity suggests Americaôs bulging waistlines may have more to do with collective behavior than genetics or individual choices. The team, led by City College of New York physicist Hernán Makse, found correlations between the epidemicôs geography and food marketing and distribution patterns.

ñWe found there is a relationship between the prevalence of obesity and the growth of the supermarket economy,ò Professor Makse said. ñWhile we canôt claim causality because we donôt know whether obesity is driven by market forces or vice versa, the obesity epidemic canôt be solved by focus on individual behavior.ò

The teams findings, published online this week in ñScientific Reports,ò come as a policymakers are starting to address the role of environmental factors in obesity. For example, in New York Mayor Michael Bloomberg wants to limit serving sizes of soda sweetened with sugar to 16 ounces as a way to combat obesity.

The World Health Organization considers obesity a global epidemic similar to cancer or diabetes. It is a non-communicable disease for which no prevention strategy has been able to contain the spread.

Because obesity is related to increased calorie intake and physical inactivity, prevention has focused on changing individualsô behaviors. However, prevalence of non-communicable diseases shows spatial clustering, and the spread of obesity has shown ñhigh susceptibility to social pressure and global economic drivers.ò

Professor Makse and his colleagues hypothesized that these earlier findings suggest collective behavior plays a more significant role in the spread of the epidemic than individual factors such as genetics and lifestyle choices. To study collective behaviorôs role, they implemented a statistical clustering analysis based on the physics on the critical phenomena.

Using county-level microdata provided by the U.S. Centers for Disease Control Behavior Risk Factor Surveillance Systems for 2004 through 2008, they investigated spatial correlations for specific years. Over that time span, the pattern of the spreading of the epidemic, which has Greene County, Ala., as its epicenter, has shown that two clusters spanning distances of 1,000 kilometers have emerged; one along the Appalachian Mountains, the second in the lower Mississippi River valley.

The spatial map of obesity prevalence in the United States shows that neighboring areas tend to have similar percentages of their populations considered obese, i.e. have a body mass index greater than or equal to 30. Such areas are considered obesity clusters, and their spread can be seen in the maps from 2004 to 2008.

To assess the properties of these spatial arrangements, the researchers calculated an equal-time, two-point correlation function that measured the influence of a set of characteristics in one county on another county at a given distance. The characteristics studied were population density, prevalence of adult obesity and diabetes, cancer mortality rates and economic activity.

The researchers said the form of the correlations in obesity were reminiscent of those in physical systems at a critical point of second-order phase transition. Such systems are uncorrelated and characterized by short-range vanishing fluctuations when they are not at a critical stage.

However, at critical points long-range correlations appear, and these may signal the emergence of strong critical fluctuations in the spreading of obesity and diabetes. Consequently, they concluded the clustering patterns found in obesity were the result of ñcollective behavior, which may not merely be the consequence of fluctuations in individual habits.ò

Professor Makse and his colleagues believe the correlations of fluctuations in the prevalence of obesity may be linked to demographic and economic variables. To test this hypothesis, they compared the spatial characteristics of industries associated with food production and sales, e.g. supermarkets, food and beverage stores, restaurants and bars, to other sectors of the economy.

Their analysis of spatial fluctuations in food economic activity gave rise to the same anomalous values as obesity and diabetes. Areas with above-average concentrations of food-related businesses had high-than-normal prevalence of obesity and diabetes.

In future studies, Professor Makse plans to apply physics concepts to measure the spread of cancer and diabetes. ñThe basic idea is that if a non-communicable disease is spreading like a virus, then environmental factors have to be at work,ò he said. ñIf only genetics determined obesity, we wouldnôt have seen the correlations.ò

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Web version of the release at: https://www.ccny.cuny.edu/news/Environmental-Factors-Spread-Obesity