PLOS Science Wednesday: Hi reddit, I'm Ronnie Sebro and my study in PLOS Genetics is the first multi-generational analysis of mating patterns in the US – Ask Me Anything!

PLOSScienceWednesday [1] and r/Science AMAs[1]

[1]Affiliation not available

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Abstract

Hi Reddit, My name is Ronnie Sebro and I am an Assistant Professor in Genetics and Radiology at the University of Pennsylvania. As a statistical geneticist and radiologist, my research interests center around genetic analysis of quantitative imaging phenotypes. More recently, I have been exploring the impact of non-random mating on genetic association studies. I recently published a study "Structured mating: Patterns and implications" in PLOS Genetics in conjunction with collaborators at the University of California, San Francisco and Boston University School of Public Health. The aim of the study was to assess how the mating patterns in a European-American population changed over time (over 3 generations, starting in 1948) and to discuss the implication of these findings for current genetic studies. We found there were primarily three clusters of individuals – those with Northern/European ancestry, those with Southern European ancestry and those with Ashkenazi Jewish ancestry. In the first generation, we found that individuals were more likely to choose spouses with similar genetic ancestry (i.e. from the same cluster), however the strength of this association decreased with each successive generation, suggesting gradual intermixing between clusters. Some of the physical and behavioral similarities seen between spouses may be as a result of their similar genetic ancestry. I will be answering your questions at 1pm ET – Ask me Anything!

the WINNOWER

REDDIT

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PLOSSCIENCEWEDNESDAY R/SCIENCE

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Are there any noticeable socioeconomic trends correlating to intermixing of different genetic demographics - such as people of higher or lower economic background showing faster rates of genetic diversification?

vmcreative

We did not look at socioeconomic status/trends, but your question is on my "To do" list.

Hello and thanks for your time. I have two questions.

1. What most stood out in your results as a surprise to you?
2. Regarding the heredity of height, the verbiage muddies my understanding and makes it sound like there were mitigating factors or inaccuracies to be compensated for. Could you ELI5 the methodology in investigating the SNPs considered relevant?

amillionsame

Perhaps the most striking finding was that apart from age, genetic ancestry was the most significant factor related to spouse-choice. The magnitude and the strength of the association was surprising. We also inferred that the association would have been even stronger in the parents of the first generation. Lango-Allen et al in 2010 published a list of SNPs that were associated with height and provided estimates of how much each SNP contributed to overall height. We used a "composite" of the estimates of some of these SNPs.

The study sure is interesting. However, it speaks with respect to a restricted location within a closed sect.

Any plans on conducting a similar study, but with people from different or multiple ethnicity? Because I believe it just tells a few lines of the story, not tale instead.

kvn95

Agreed. The findings pertain to a restricted location. However, the goal was to show the implications of ancestry-related assortative mating in what has been described as a relatively homogeneous population.

Simple question, what does this mean for cultural diversity over the next 100 years? My take from your statement is that slowly but surely, the melting pot of the United States is turning into its own "race" made up of others. Sorry, stuffing my face with a chicken biscuit whole stumbling around on Reddit this morning. This study is awesome though! Thanks.

mtdew2litre

The United States is a nation with a substantial proportion of immigrants (from various time periods) of many different ethnicities, races and cultures. I define the word "culture" here as "social behavior". I think you have touched on an important point that culture has the ability to influence genetics (Cavall-Sforza & Feldman, 1981). Extrapolation is difficult, but I suspect there would be increased genetic intermixing in the next 100 years. I think some cultures will continue, others will not, and there will be new cultures/fusion cultures that develop.

Can anything be said regarding the 'health' of the offspring of those who inter-mingle? I.E is there a higher rate of birth-defects among offspring that come from parents who have fewer ancestral similarities? Cheers

jimdalyxoxo

We did not study the health of the offspring with regard to the genetic similarity/dissimilarity of their parents. I do not believe that the degree of ancestry-related assortative mating noted affects offspring health.

Do you believe that genetics are more influential than environmental and pharmacological imperatives? Especially in the case of addiction. What can we achieve if able to manipulate our inherited genealogy?

unknown_baby_daddy

Both genetics and environment influence diseases/traits. The relative contributions of each depend on

the underlying disease/trait in question. There is active research on the genetics of addiction but I think we haven't fully understood this trait/disease.

Were any groups more likely to mix with another particular group, or was the mixing more random?

I would imagine that the European Americans were more likely to mix with other white people than with traditional minorities.

YoCuzin

The analysis was restricted to individuals of European-American ancestry (all white). The data suggest that there was relatively increased intermixing between individuals with Northwestern European and the Southern European ancestry compared to the intermixing between either cluster and individuals with Ashkenazi ancestry. We also noted a higher rate of unions between men with Southern European ancestry and women with Northwestern European ancestry than the opposite.

I'm not familiar with genome-wide association. Is it some sort of high dimensional distance measure of similarity between two subjects? Anything else I should know about it to understand the paper? Wikipedia has been unhelpful.

jjelin

Risch and Merikangas Science 1996 suggested that instead of looking at linkage studies (shared genetic segments that are transmitted in families to all affected individuals) that we could find disease genes by looking at genetic variants (e.g. SNPs) that are physically near to the actual disease causing variant. We could then do a Chi-squared test comparing the frequency of a genetic variant in cases to that of controls to find disease causing variants.

By people of European *ancestry* do you mean these were Americans? Are the first generation then immigrants and the third generation more Americanized? How did you control for cultural influences apart from genetics?

samesamesameme2

These participants are all white Americans of European ancestry from the same geographic location - Framingham, MA. We did not know the immigration status of the first generation, but it is possible/likely that this cohort may have had more recent immigrants. The third generation are the grandchildren of the first generation cohort. Spouse-choice is likely influenced by change in culture.

Really interesting study. Were there noticeable differences in terms of distance between each cluster (i.e. did each group live in ancestrally-homogenous neighborhoods)? And if so, did this change between generations?

drakesghostwriterr

The town of Framingham is approximately 25 square miles. We hypothesized that the impact of geography (neighborhood) on spouse choice would be relatively small given the size of the town. However, it is possible that there may be microneighborhoods within the town that are ancestrally-homogeneous and influence our results. We did not track where participants lived (at the level of the street/block) and how this influenced their spouse choice.

This is a really neat study and thanks for publishing it. Do you think similar patterns would be found among non-white families? How applicable are the methods you used to time periods before 1954? Do you believe this study can be cited or built upon to make the point that our concept of race is extremely limited by a short-sighted view of time?

Tigaj

Yes. The findings will most likely be stronger in non-white families. Risch et al. Genome Biology 2009 performed a similar analysis looking at Latino populations and found very strong evidence of ancestry-related assortative mating. The methods used can be used for time periods before 1948 if good DNA is available from spouse-pairs from that period. I think that race is largely a social construct. Prior to modern transportation, mate choice was largely influenced by geography - so populations were isolated by mountains, rivers, seas etc. These somewhat isolated populations accrued differing frequencies of genetic variants by genetic drift and in some cases new genetic variants. We use these genetic variants to detect "genetic ancestry" and "continental ancestry". The majority of these genetic variants have no clinical significance, but there are a few variants that are clinically relevant.

Would you consider doing a similar study in Brazil?

mikebrown33

I would. I think Brazil is a fantastic country with racial, ethnic and cultural diversity. It would be interesting to see how the findings in Brazil vary across Brazil and it would be interesting to compare to the United States!

What do you think will be the long term effects of Tinder/Bumble?

It seems that more and more women are chasing after the same 10% of men. I know a dozen Professional women in their late 30s that kept chasing the bigger better deal and now most likely won't have children.

Will the future be dominated by the less educated that had more kids?

What did you think about Idiocracy?

ImmodestPolitician

I think online dating is an example of a cultural shift that may influence genetics and the genetic landscape of the United States and the world. I'd like to point out educated is correlated with but not synonymous with intelligence. The future is difficult to predict but I think our social behaviors - what we encourage and reward as a society will be a major factor in determining what the future looks like.

Is there such thing as an 'average' white American? Do regional differences between the 'average' southerners, northerners, midwesternerns, and westerners actually have genetics underlying them or is it just cultural? Is there a more or less genetic blending in different areas of the US?

WtfIsevenasnoo

I suspect that there are regional genetic differences across the United States. For example, in Louisiana, there is a substantial proportion of individuals of French ancestry, whereas in the midwest

(e.g. Minnesota) German ancestry is more common, and in the North East (e.g. Boston) there are individuals with substantial Irish and Italian ancestry. I suspect there is genetic intermixing across the US, but it varies by geographic locale.

Can you assign a rate and is it a constant?

paretooptimum

We did not calculate rates of intermixing within generations/cohorts, however I suspect that these rates would vary between generations.

First of all thank you for doing this AMA.

This looks like an interesting study and study area. I have actually been thinking lately of searching for something to read into the area of contemporary mating patterns. So thank you for bringing this to my attention.

What motivated you to go into this area of study? What is your plan now after having published this study? Will you focus on expanding upon it or go into a new direction?

arcademan2

While I was at Harvard working on my PhD thesis, my advisor asked me to work on statistics around the transmission disequilibrium test (TDT). The TDT compares the rate of transmission of a genetic variant from a heterozygous parent to offspring. I noticed that whenever there was population stratification (a study population comprised multiple subpopulations where there is random mating within but not between subpopulations) there was a decrease in the number of heterozygous parents. I also noticed that there was ancestry-related assortative mating. Dr. Dupuis, Dr. Risch, Dr. Peloso and I decided to show this and dedicated this paper to Dr. David Siegmund at Stanford, for his festschrift.

I have some ideas and will continue working in this area... I find it fascinating!