

SEROTYPE FREQUENCIES IN DIFFERENT HUMAN POPULATIONS; RACIAL COMPOSITION OF INDIVIDUALS; STATISTICAL EVALUATION WITH A FREQUENCY MIX

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An individual's serotype has a specific and different frequency in each and every population. A high frequency indicates that the person is "typical" for the population with which he is compared, a low frequency that he is "atypical". These frequencies can be expressed as probabilities; the sum of probabilities for any individual is always 1 (1).

Frequency comparison requires widely differing reference populations, e.g. Caucasian, Negroid, Ameridian, East Asian or Oceanian. The prior weighting is the same for all the frequencies compared. The probabilities obtained from the frequency comparisons tell (in Bayes' terms) how often one would be right if one were to assign the individual concerned to one or other race:

$$W_X = \frac{1}{1 + \frac{f(Y)}{f(X)}} ; W_Y = 1 - W_X.$$

W_X is the relative frequency of a person's serotype in population X, and hence the probability that he/she is a member of this population; W_Y is the relative frequency of that serotype in population Y, and hence the probability that the person belongs to population Y; $f(X)$ is the frequency of the serotype in population X, $f(Y)$ that in population Y. - The following table lists the results of seroanalyses and the physical appearance of 9 non-caucasians:

nationality or origine	f r e q u e n c y a m o n g			appearance
	spaniards	amerindians	black-africans	
1. Bolivia	0.9997	0.0002	0.0001	european
2. Puerto-Rico	0.9920	0.0080	pract.zero	european
3. Angola	0.9774	pract.zero	0.0226	fairly neg- roid
4. Mexico	0.9679	0.0001	0.0320	"
5. Paraguay	0.5690	0.4260	0.0050	european- indian
6. Mexico	0.1600	0.1600	0.6800	"
7. Panama	0.0020	0.9980	pract.zero	indian

nationality or origine	f r e q u e n c y a m o n g			appearance
	dutch	poly-micro- nesians	black-africans	
8. Polynesia	pract.zero	pract.zero	0.9999992	negroid
9. Indonesia	0.6667	0.3333	pract.zero	european- polynesian

We were able to compare physical features of each of the 9 persons - especially skin and hair colour, hair type and facial build - with the results of the seroanalysis. The autopsies bore out the sero-analytical results.

In other cases, usually involving Negroes, there were some discrepancies:

<u>place of origine</u>	<u>black-white ratio</u>		<u>appearance</u>
Gambia	0.7	: 0.3	purely negroid
USA	0.18	: 0.82	" "
USA	0.045	: 0.955	" "
USA	0.005	: 0.995	predominantly negroid
former Fr.Afr.	0.0033	: 0.9967	" "
West Africa	0.0013	: 0.9987	" "
USA	0.0000002	: 0.9999	plainly negroid

Our sample of people of German origin included 5 individuals with a Negroid frequency >0.01 , though the appearance of each was devoid of any negroid features. The black-white ratios were as follows:

0.0187 : 0.9813
0.0197 : 0.9803
0.045 : 0.955
0.19 : 0.81
0.836 : 0.164

A further person from Germany had an American-European ratio of 0.027 : 0.973, though no noticeable American features.

In contrast to these 13 cases in which seroanalytical data and physical appearance did not correlate well, there were 65 cases with a good correlation:

- 32 Germans with a black-white ratio of 1:99 and less, and
- 33 US and African Negroes with a black-white ratio of 99:1 and more.

None of the 65 exhibited Negroid or European features respectively.

There are two possible explanations for the unsatisfactory correlation for the above-mentioned 13:

either there is little correlation between appearance and serotype or the seroanalysis has for some reason produced unrealistic results in a number of the cases;

perhaps the explanation may lie in a combination of both causes.

To study this problem we analyzed 25 black-white married couples and their 27 children (fig.1). In this fig. the 25 families are listed in order of decreasing frequency of the children's serotypes among whites. There does not appear to be any correlation between the children's frequencies and the respective Negroid or European frequencies of the parents. But it is significant that the frequencies of 22 of the 27 children are more typical for Europeans than for Negroes, i.e. appear in serotype to be more European than their actual racial mix warrants. Whatever the explanation, the blood of the white mother seems "dominant" over the blood of the black father. Maybe this would explain the unsatisfactory correlations in cases 1-7^{*)}.

The serotype of the 27 children all lie "between" those of their parents. This would indicate that the method of establishing racial composition by comparing serotype frequencies does not provide "arbitrary" values but values not too far removed from reality. The comparisons between the physical appearance of and the seroanalytical findings for 9 individuals of mixed blood and 65 of pure blood support this conclusion. This should justify the practical application of the method within the serostatistics of cases of disputed parentage.

One possible field of application is cases involving US Negroes as putative fathers. Although gene frequencies for US Negroes are available for most of the common polymorphous blood systems, they are only mean values which, in individual cases, may not apply to the defendant without qualification.

My calculations (2) using frequencies in the literature give the mean portion of white blood in US Negroes as 15 - 20% (the remainder is West African blood). In a seroanalysis of 44 US Negroes

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We lack sufficient data to say whether this applies to cases of a white father and black mother; initial data does suggest so.

(3) about half of the probands had relative black frequencies of over 99% (and possibly 100%). Only 4 (= 10%) had a relative Negroid frequency of below 50%. The mean frequency was 87.2%, i.e. a mean white relative frequency of 12.8%. This agrees well with the "mean value" of 15% based on the literature (2).

Even if one uses frequencies for US Negroes to evaluate cases where the putative father is a US Negro, these will be adequate only in a certain percentage of the cases. Most US Negroes have a far smaller "white portion" than the mean, a minority a larger.

A simple means of taking account of the distribution in individual cases would be to use US Negro frequencies for black frequencies between 80% and 99% (= approx. 35% of all US Negroes), and West African frequencies for black frequencies above 99% (= approx. 50% of all US Negroes). Hence, only in cases where the PV had a black frequency of less than 80% (= approx. 15% of all US Negroes) would it be necessary to construct an appropriate frequency mix to take account of the particular blood composition.

Evaluating the 44 cases with

- a) US Negro frequencies, and
- b) with adequate frequencies

provided an EM difference of ≤ 0.1 in 38 cases and > 0.1 (up to 0.888) in 6 cases. In all the latter 6 cases the black frequency was $\leq 80\%$. A change in the EM value resulted in a change in the verbal predicate in only 2 cases, of 1 grade in one case and of 2 grades in the other.

Fig.2 correlates for individual cases ΔEM and the black frequency of the PV.

If we consider the position of the mean ΔEM values and their scatter we notice that all mean values lie in the "negative" range ($\Delta EM = EM_{USN} - EM_{SWM}$). In addition, the scatter of all the individual values also lies in the negative range. This means that in virtually every single case an evaluation based on US Negro frequencies will produce unduly low W values. The greater the difference between the analytically established black frequency (S) and the "mean" the larger ΔEM . The deviation is least for $S = 80 - 95\%$; the black portion more or less corresponds to that previously obtained from mean frequencies. For $S < 80\%$ as

well as for $S > 95\%$, and especially for $S > 99\%$, ΔEM is too large. The scatter is considerable, as might be expected with limited data. Correspondingly, the difference between the mean values is generally insignificant. Using STUDENT's test the assumption of a real ΔEM difference between groups 1 and 2 is associated with an error of 30%, between groups 2 and 3 of $> 50\%$ and between groups 3 and 4 of 20%. Thus, the ΔEM differences for the groups 1/2, 2/3 and 3/4 are not significant. But the mean values of the groups 2 and 4 ($\overline{\Delta EM}_2 = -0.01138$; $\overline{\Delta EM}_4 = -0.0410$), with an expectation of error of only 0.05%, do differ significantly from one another.

Summary

From these comparative studies we conclude that in cases involving US Negroes it would be useful to seroanalytically determine the relative "blackness" and to use an appropriate frequency mix in the biostatistical evaluation, in particular when black frequencies are $< 80\%$. One should act analogously in respect of members of other mixed populations. This applies, for obvious reasons, particularly to the Americans.

References:

1. Hummel K.: Biostatistical evaluation of blood group findings in cases in which the usual tables based on (Central) European frequencies cannot be applied because one or other of the persons involved is an alien. In: Inclusion probabilities in parentage testing. Am.Ass.Blood Banks. Arlington/Virg. (U.S.A.), 1983, p. 234-237.
2. Hummel, K.: Blutgruppeneigenschaften zur Definition menschlicher Grundrassen und zur Analyse von Mischbevölkerungen. Wienklin.Wschr. 92, 768-774 (1980).
3. Hummel, K.: Sonderfälle strittiger Abstammung aus den letzten 8 Jahren, deren Blutgruppen- und HLA-Befunde im Freiburger Blutgruppen-Institut biostatistisch per Computer ausgewertet wurden. 10.Internat.Kongr.d.Ges.f.forens. Blutgruppenkunde München 1983; Referate p. 295-310.

Legend to the figures:

- Fig.1 25 black-white married couples and their 27 children; relative serotype frequencies among Whites and West Africans on a logarithmic scale (as "probabilities")

Fig.2 Mean ΔEM values and their scatter in four groups displaying relative black frequencies of <80%, 80...95%, 95...99%, and >99%, respectively

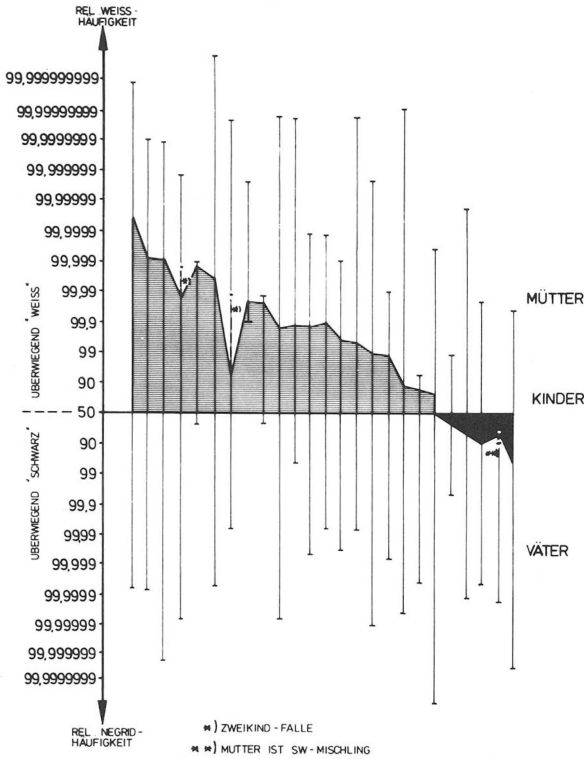


Figure 1

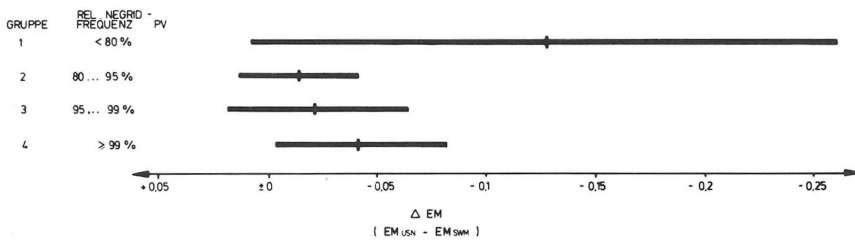


Figure 2