ARTICLE

Autism Prevalence and Precipitation Rates in California, Oregon, and Washington Counties

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Objective: To investigate empirically the possibility of an environmental trigger for autism among genetically vulnerable children that is positively associated with precipitation.

Design: We used regression analysis to investigate autism prevalence rates and counts first in relation to mean annual county-level precipitation and then to the amount of precipitation a birth cohort was exposed to when younger than 3 years, controlling for time trend, population size, per capita income, and demographic characteristics. In some models, we included county fixed-effects rather than a full set of covariates.

Setting: Counties in California, Oregon, and Washington.

Participants: Children born in California, Oregon, and Washington between 1987 and 1999.

Main Exposure: County-level precipitation.

Main Outcome Measures: County-level autism prevalence rates and counts.

Results: County-level autism prevalence rates and counts among school-aged children were positively associated with a county's mean annual precipitation. Also, the amount of precipitation a birth cohort was exposed to when younger than 3 years was positively associated with subsequent autism prevalence rates and counts in Oregon counties and California counties with a regional developmental services center.

Conclusions: These results are consistent with the existence of an environmental trigger for autism among genetically vulnerable children that is positively associated with precipitation. Further studies focused on establishing whether such a trigger exists and identifying the specific trigger are warranted.

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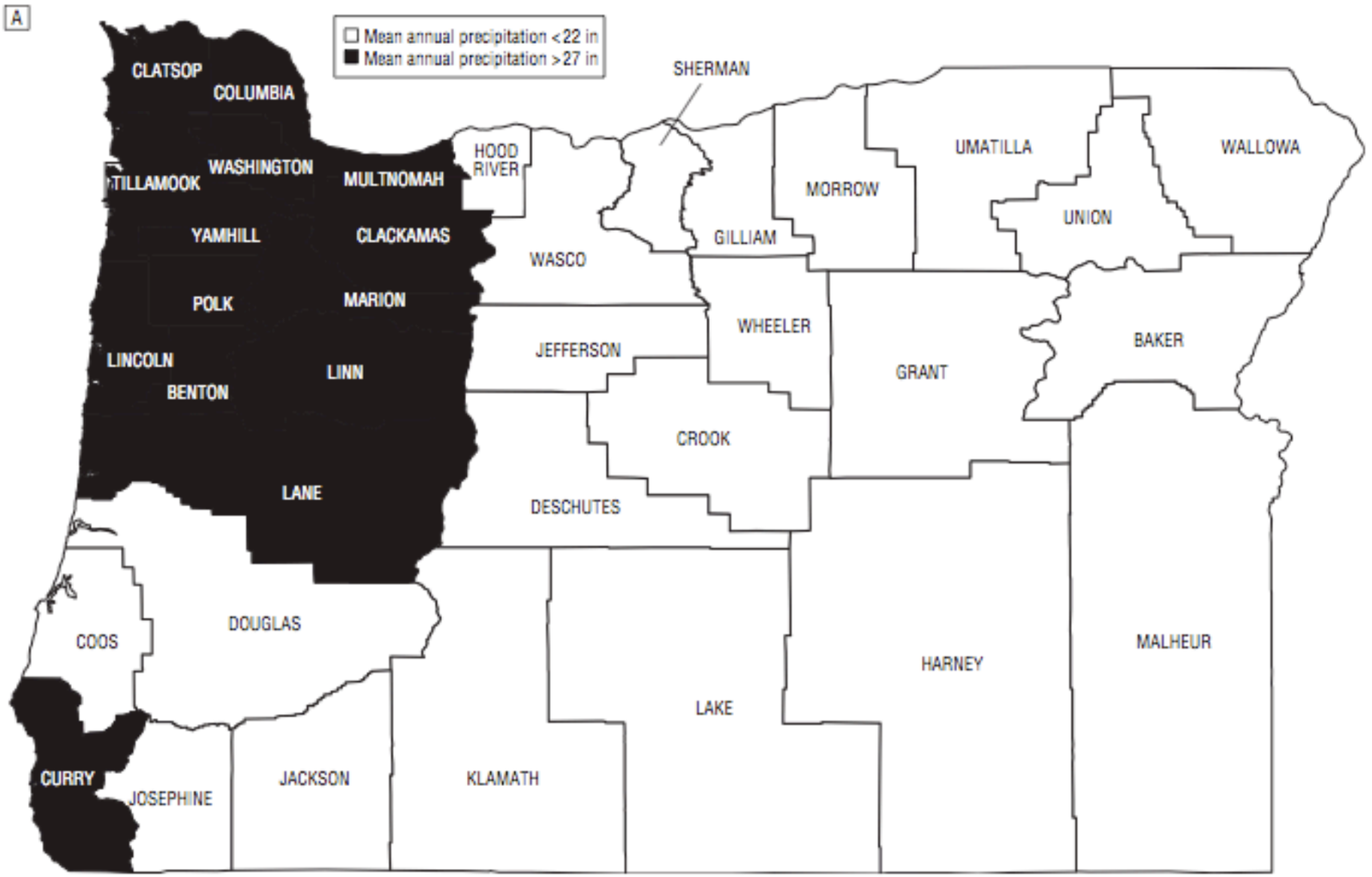
Mean annual precipitation < 22 in
Mean annual precipitation > 27 in
CLATSOP
COLUMBIA
TILLAMOOK
WASHINGTON
MULTNOMAH
YAMHILL
CLACKAMAS
POLK
MARION
LINCOLN
LINN
BENTON
LANE
HOOD RIVER
SHERMAN
GILLIAM
MORROW
UMATILLA
WALLOWA
UNION
WASCO
WHEELER
JEFFERSON
GRANT
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DOUGLAS
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JOSEPHINE
JACKSON
KLAMATH
LAKE
HARNEY
MALHEUR

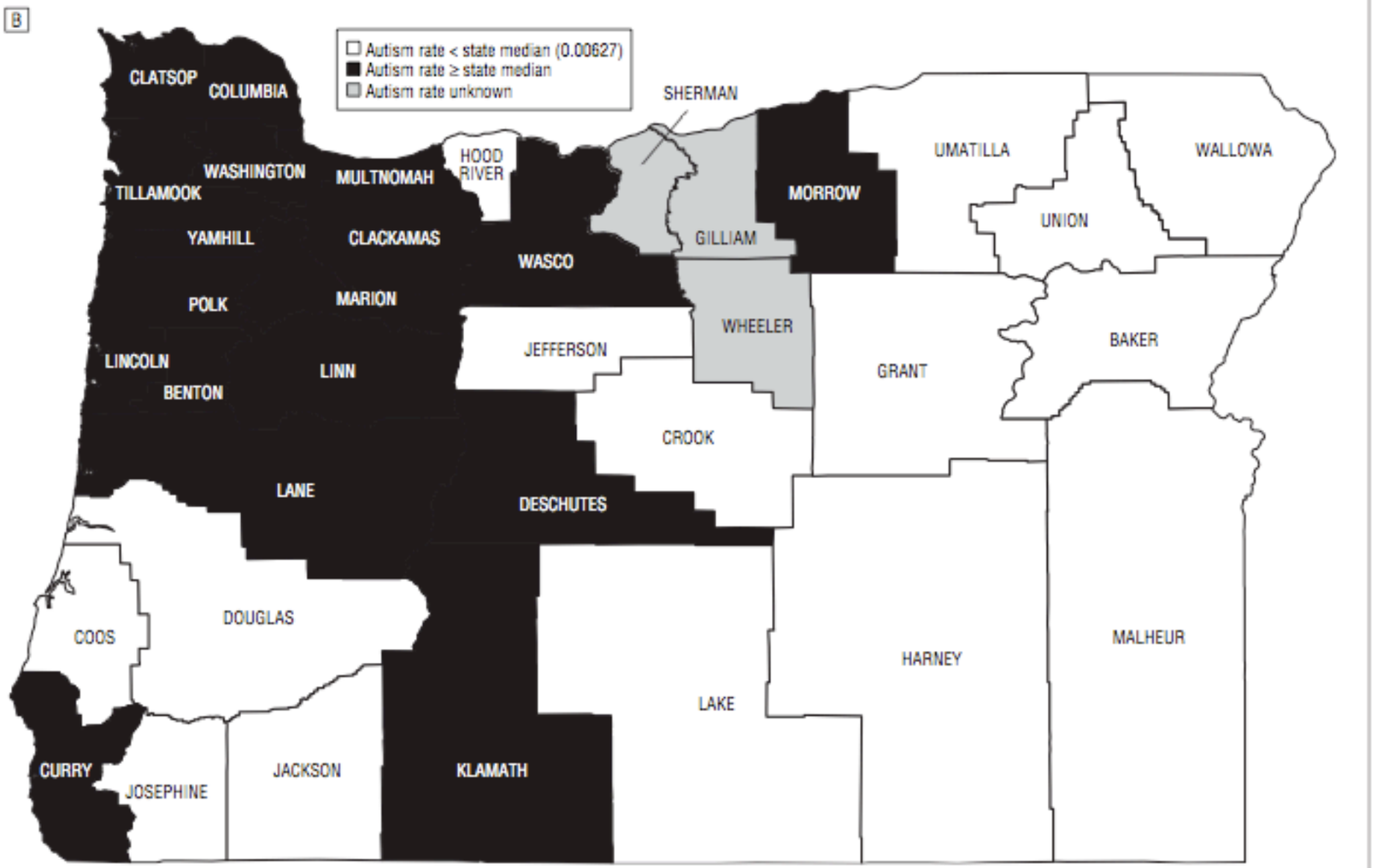

Figure 2. Precipitation (A) (1987-2001) and autism rates (B) (2005) for Oregon counties. Autism prevalence rates are for children aged 6 through 18 years. Precipitation was measured from July 1, 1987, through June 30, 2001.

In an experiment, treatment is imposed.

Caloric restriction improves memory in elderly humans

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Animal studies suggest that diets low in calories and rich in unsaturated fatty acids (UFA) are beneficial for cognitive function in age. Here, we tested in a prospective interventional design whether the same effects can be induced in humans. Fifty healthy, normal- to overweight elderly subjects (29 females, mean age 60.5 years, mean body mass index 28 kg/m^2) were stratified into 3 groups: (*i*) caloric restriction (30% reduction), (*ii*) relative increased intake of UFAs (20% increase, unchanged total fat), and (*iii*) control. Before and after 3 months of intervention, memory performance was assessed under standardized conditions. We found a significant increase in verbal memory scores after caloric restriction (mean increase 20%; $P < 0.001$), which was correlated with decreases in fasting plasma levels of insulin and high sensitive C-reactive protein, most pronounced in subjects with best adherence to the diet (all r values < -0.8; all P values <0.05). Levels of brain-derived neurotrophic factor remained unchanged. No significant memory changes were observed in the other 2 groups. This interventional trial demonstrates beneficial effects of caloric restriction on memory performance in healthy elderly subjects. Mechanisms underlying this improvement might include higher synaptic plasticity and stimulation of neurofacilitatory pathways in the brain because of improved insulin sensitivity and reduced inflammatory activity. Our study may help to generate novel prevention strategies to maintain cognitive functions into old age.

Taken together, potential benefits of specific "brain-healthy diets" have been proposed, but have not been confirmed unequivocally by animal experiments and human epidemiological studies. Evidence drawn from prospective interventional trials in humans is still missing (CR) or scarce (UFA, 28, 29). Therefore, the aim of the present study was to elucidate cognitive effects of a diet low in calories or high in UFAs in healthy elderly individuals (for a flowchart, see Fig. 1). Because memory impairment is an early indication of AD and its precursor, MCI (35), we considered the ability to remember and learn new contents as our primary outcome measure, in accordance with previous studies on lifestyle interventions (36, 37). Moreover, we tried to identify potential mechanisms underlying the positive effects of these dietary interventions. Metabolic factors like insulin-resistance or low-grade inflammation might contribute to age-related cognitive impairments (38, 39), and improvement of metabolic state should result in acute improvement of cognition, in addition to long-term deceleration of cognitive decline. Therefore, we assessed peripheral blood levels for insulin, glucose, and markers of inflammation. Neuronal function may also be enhanced via neurotrophic factors (4), which are suggested to be activated by moderate stressors like CR via adaptive cellular stress response pathways (5). This possibility was tested by assessing neurotrophic levels in peripheral blood.

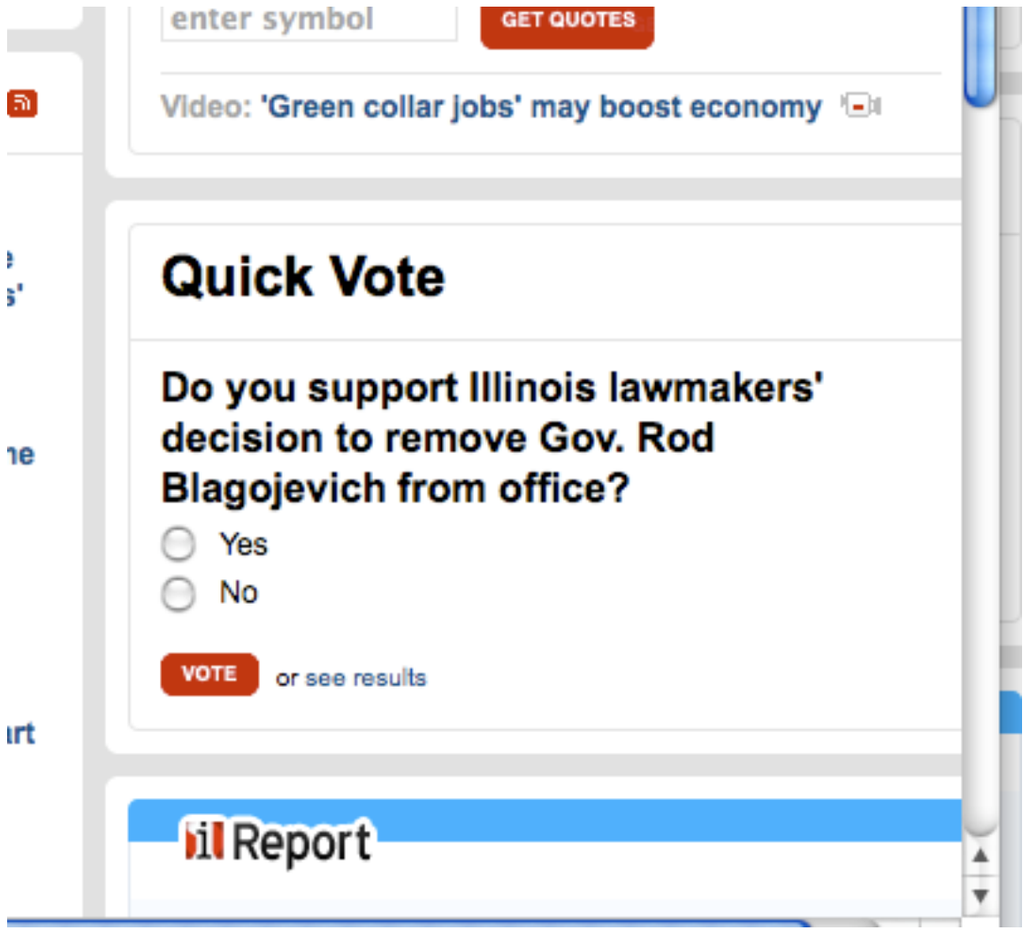
Results

A study is biased if it systematically favors certain outcomes.

Good experiments contain:
A **control group**, so that the experiment itself does not introduce a lurking variable.

Randomize the selection of subjects. This ensures there are no hidden variables accounting for differences in treatment groups.

Populations and Samples



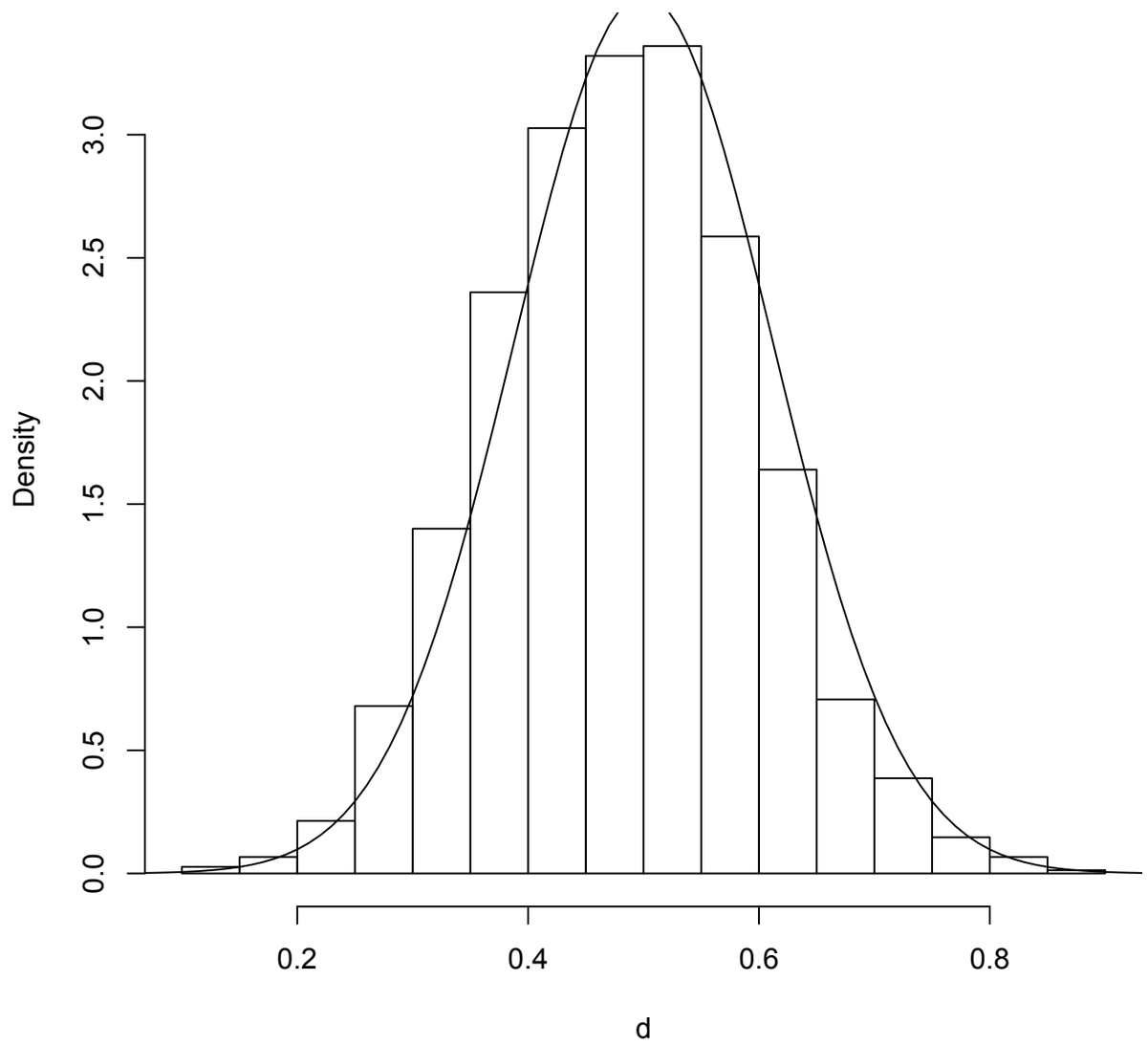
Samples can be biased.

Family size: class sample average: 2.9

US average (total fertility rate) : 2.09

Is this unbiased?

Simple random samples are unbiased.
Each group of n equally likely to be included.


histogram of proportions from 1500 samples of size 20
Density
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0.2
0.4
0.6
0.8
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