

Department of Epidemiology and Biostatistics

513-607A Inferential Statistics

Final Examination: In-class portion

1981

1. Gonadotrophin and the human secondary sex ratio

A recent article has reviewed some ten studies which reported on the outcome of pregnancies after induction of ovulation, looking in particular at the sex of the infants born of such pregnancies (although there were many multiple births, they were almost always multizygotic, so that the sexes of the infants in such multiple births may be assumed to be roughly independent). The following data resulted:

Sexes of infants after induction of ovulation

- With clomiphene (compiled from 3 separate studies): 96 males and 120 females
 - With gonadotrophin (compiled from 7 separate studies): 133 males and 179 females
- (i) Are the results with the two separate “agents” comparable? (i.e. can they be pooled?)
 - (ii) Do the results provide strong evidence that there is an “unusual” sex ratio in births after induction of ovulation?
 - (iii) If they do, what probability (or range of probabilities) would you give for the sex of an infant born of this kind of pregnancy?

2. Birth Month and Asthma and Respiratory Symptoms

There is some evidence that environmental factors in infancy may influence the subsequent occurrence of respiratory diseases such as asthma. Two studies that investigated this further are reported in part below:

Study 1:
Hospital admissions for asthma, South West Thames region of England 1970-1977; children aged 5-14 years at time of admission

Study 2:
Percentage of 12 year old children reported by parents to have ever had a history of asthma or wheezing (A/W). Croydon Primary School questionnaire study 1978.

Month of Birth	Number of Admissions	Number of Children	% ever had A/W
		Jan. 303	16.5
January	287	Feb. 286	21.3
February	228	March 342	19.9
March	243	April 344	17.4
April	202	May 294	17.7
May	306	June 310	12.9
June	318	July 324	22.5
July	259	Aug. 332	19.0
August	298	Sept. 299	22.4
September	287	Oct. 295	16.9
November	298	Nov. 274	21.9
December	223	Dec. 273	17.2
Total	3272	Total 3676	18.8

2. (cont'd)

- (i) Is there sufficient data in Study 1 to test for a possible variation in the risk of asthma according to when during the year a child is born (and presumably exposed to different environmental and other agents, diseases, infections etc)? Indicate how you would go about getting any additional data and how you would carry out the statistical test.
- (ii) Likewise for Study 2.
- (iii) Assuming you had access to all the data, and not just the 60 sample cases you worked with during the course, how would you use SPSS to get corresponding data from the "3-cities" pollution study?
- (iv) If you found significant variation in asthma problems according to the month of the year the child was born in each of the three studies, how would you then judge whether the effect was a genuine one, or whether it was simply an artifact of having studied large samples (where significance is often easier to achieve)?

3. Right-Handedness: A consequence of Infant Supine Head-Orientation Preference?

Most newborn infants orient their heads towards their right sides while supine. This right bias has been thought to contribute to the development of right bias in handedness by producing lateral symmetries in visual experience of the hands and differences between the hands in neuromotor activity. In a study to investigate this theory, some 150 neonates were assessed in the 16 to 48 hours after birth, resulting in the following distribution of neonatal head-orientation preference leading the author to conclude that the distribution was "significantly biased to the right".

<u>Definitely Right</u>	<u>Right Tendency</u>	<u>Mixed</u>	<u>Left Tendency</u>	<u>Definitely Left</u>	<u>Total</u>
73	24	31	13	9	150

Twenty neonates with consistent head-orientation preferences were selected from the original 150 (10 from each extreme) and tested at 22 weeks for hand use preference, giving the following results: (R = Right; L = Left)

	Neonatal	Hand-Use Preference at 22 Weeks	
	<u>Head-Orientation</u>	<u>Initial Reach</u>	<u>Frequency Score</u>
10 infants who consistently oriented head to right	R	R	1.0
	R	R	0.4
	R	R	2.0
	R	R	1.2
	R	*	0.2
	R	L	-2.5
	R	R	1.5
	R	R	1.3
	R	R	1.9
	R	R	1.9

10 who consistently oriented head to left	L	L	-2.3
	L	L	-2.3
	L	*	0.0
	L	L	-1.4
	L	R	1.3
	L	L	-1.9
	L	L	-2.3
	L	L	-1.0
	L	L	-1.0
	L	R	1.8

* Each hand was used for initial reaching in half the testing conditions

- (i) Do you agree that the distribution of head-orientation preferences is "significantly biased to the right"? How would you put it to a statistical test?
- (ii) Does the direction of neonatal head orientation significantly predict which hand is used initially in a 3-minute test? To think about this, it might help to imagine trying to predict hand preference from whether the baby was born on an even or odd day of the month.
- (iii) What about its ability to predict teaching frequency preference? (a positive frequency score means the infant reached more often with the right hand during the full 3-minute test; a negative score means he/she reached more often with the left.)
- (iv) The author claims that "infants with consistent preferences to turn their heads to the right show a significant right-hand bias (as judged by positive frequency scores) at 22 weeks (binomial sign test, $p = 0.0215$, two-sided). Explain how this p-value was obtained; what was the null hypothesis? How would you obtain a p-value to judge whether infants with a left head orientation preference are similarly biased towards left-handedness?