langmuir

ALEXANDER D. LANGMUIR, M.D.
RFD ABEL'S HILL
CHILMARK, MA. 02535
TELEPHONE 645-2624

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Dear Matthew,

Here's an issue of Science News with a squib on anthrax that perhaps you have not seen.

Also you might enjoy the "Final Problem." — not really an examination but given to my students in my advanced course at the Hopkins entitled "Epidemiological Inference."

You and Jeanne might find this worthy of your analytical talents some balmy spring evening at Woods Hole when you have nothing else to do!

I've used this many times since 1946 — perhaps 100×. By far the best submission came from a Harvard Senior (undergraduate) who was allowed to take my course with the Harvard-MIT joint medical program in 1973. Cheers Alex

THE JOHNS HOPKINS UNIVERSITY SCHOOL OF HYGIENE
AND PUBLIC HEALTH

DEPARTMENT OF EPIDEMIOLOGY

FOURTH QUARTER COURSE 1988 EPIDEMIOLOGICAL INFERENCE

FINAL PROBLEM

Obscure Disease
Studied by Means of an Epidemiological Survey

The following exercise is based upon a large epidemiological survey conducted some years ago by a highly competent group of epidemiologists. The data presented are derived from the published report. The identity of The Disease is being withheld in order to focus on the epidemiological characteristics that have been recorded. You are asked to accept assurance that The Disease in question can be recognized with reasonable accuracy by experienced physicians and that in this study strict and consistent diagnostic criteria were followed throughout.

The object of the exercise is not to determine the diagnosis of The Disease, but, rather to test the degree to which you have developed your judgement and skill in summarizing, graphically presenting, and evaluating epidemiological data.

The exercise may be considered as a completely open book examination without even the normal restrictions of the so-called honor system. You may read anywhere. You are encouraged to discuss any aspect of the problem with anyone, fellow students, faculty, wives, or others. You may work jointly with others in the preparation of graphs and discussing which epidemiological points may be important or trivial. If you become confident of the diagnosis or discover documentary proof of it in the medical literature, you are free to tell others or not as you wish. Thus, there are no restrictions or inhibitions; you cannot cheat.

You are asked to submit a written "critique", or more precisely an analysis on the morning of May 19 before the final seminar. During the seminar you may make notes on your paper if you wish. Hand it in at the end of the seminar. Marks in the course will be pass, fail or incomplete. The faculty will read each report and make written comments which will be our personal evaluation of your whole participation in the course. Attach a self addressed manilla envelope for us to mail back your paper.

Final Problem-2

Read the text with care, study the tables in detail, and organize your thoughts for some time before you start to write. Reasonable brevity is commendable but do not feel restricted in commenting on any aspect that you consider pertinent or interesting.

Background Information

At the time the survey to be described was conducted, the etiology, pathogenesis, mode of spread, the role of immunity and of social and environmental factors in the occurrence of the disease were obscure and subject to controversy. Many theories about the nature of the disease were considered. Among these were: (1) infectious theory; (2) hereditary susceptibility theory; (3) intoxication theory; and (4) metabolic disturbance theory, including a nutritional deficiency of some vague and poorly understood nature.

The Survey: In order to collect quantitative data in defined populations regarding this disease, the U. S. Public Health Service undertook an extended survey of the disease over a five and one-half year period from 1916 to 1921. The data presented in this exercise were collected in 1917. A team of investigators consisting of medical field workers, sanitary engineers, statisticians, a social economist, and trained non-medical interviewers, was organized. A series of 24 cotton-mill towns in the Piedmont area of South Carolina was chosen for the survey because of a persistently high endemic incidence over a period of years, ready accessibility for study and unique environmental circumstances which made possible the testing of several important hypotheses.

These villages varied widely in their sanitary status. Some had public water supplies, some had sewerage systems, some had both, some had neither. These extreme variations in sanitation were not related to the income or economic status of the population, but rather to the paternalistic attitudes of the mill owners. The population consisted of white persons primarily wage earners and their families. All could be classified in the low income group.

In each village studied, bi-weekly visits were made to each household over a period of one year. The name, age, sex, and marital status of each member was recorded. The occurrence of the disease was determined by history and examination. The primary diagnostic criterion was the appearance of a characteristic symmetrical rash on the backs of the hands, although a wide variety of other symptoms, including rash elsewhere on the body, sore mouth, diarrhea, weakness and loss of weight were common. Questionable cases were referred to one of the directors of the study with long experience in the diagnosis of the disease. The medical field workers were further checked at repeated intervals for the consistency of their case identification.

Sanitary surveys were made. Each village, as a unit, was rated For quality of general cleanliness, excreta disposal, and water supply. The incidence of typhoid fever was recorded as a further index of sanitation. Careful records were collected of household income, including wages, rent from boarders, and estimated income from farming. The economic status of each family was graded in relation to the gross income corrected to family size and for the age and sex of the family members.

Summary of data

Table 1 presents the monthly incidence of "The Disease".

Table 2 presents the incidence in each village along with the composite sanitary rating and the incidence of typhoid fever.

Table 3 presents the age and sex specific incidence rates.

Table 4 presents the incidence by economic status.

Procedure

1. Study each table and:
   a. List in simple outline form, the salient epidemiological characteristics of The Disease indicated by the data. (Economy of words in this outline is important.)

   b. Prepare simple graphs to illustrate these characteristics if you believe they help in focusing on important aspects of the data. (The choice of graphic methods, reasonable neatness, clarity, and accuracy of labeling coordinates are important.)

   c. Develop one or more hypotheses concerning the nature of The Disease that are compatible with all the evidence presented.

   d. List one or more additional specific investigations, inquiries, or control measures you would recommend to test your hypothesis, or hypotheses.

Table 1

Cases of The Disease by Month of Onset in 24 Villages Surveyed for One Year (Population 22,653)

Month	Number of Cases	Rate per 1000[1]
January	—	—
February	4	0.2
March	28	1.2
April	120	5.5
May	310	13.7
June	432	19.7
July	154	6.8
August	57	2.5
September	28	1.3
October	14	0.6
November	—	—
December	—	—

[1]Adjusted to 31-day month.

Note: In individual villages peaks of incidence occurred in different months as follows:

May 4; May-June 3; June 16; July 1.

Table 2

Incidence of The Disease and Typhoid Fever

in 24 Villages in Relation to Sanitary Rating

Village	Population	Sanitary Rating [1]	Typhoid Fever		The Disease	
			Cases	Rate [2]	Cases	Rate [2]
All villages	22,653	-	89	3.9	1,010	44.6
Aa.	513	40.85	5	9.7	19	37.0
At.	452	35.20	1	2.2	32	70.8
Bt.	726	24.55	1	1.4	25	34.4
Dn.	731	27.43	12	16.4	17	23.3
Dun	1,372	80.24	1	.7	57	41.5
Fn.	284	40.70	-	-	13	45.8
Ge.	669	39.57	1	1.5	30	44.8
Gy.	998	82.24	3	3.0	33	33.1
Gr.	664	50.58	6	9.0	12	18.1
In.	803	26.46	20	24.9	69	85.9
Jn.	1,241	61.89	-	-	35	28.2
Lt.	1,109	65.51	-	-	25	22.5
Mh.	1,247	39.44	5	4.0	79	63.4
Ny.	840	51.01	-	-	20	23.8
Ola	1,569	48.76	3	1.9	81	51.6
Pt.	1,520	73.33	2	1.3	103	67.8
Rc.	1,346	85.62	2	1.5	90	66.9
Sn.	638	44.46	6	9.4	15	23.5
Sa.	395	54.36	-	-	13	32.9
Spn	1,411	71.15	3	2.1	58	41.1
Tu.	977	36.33	4	4.1	43	44.0
Un.	1,165	44.95	2	1.7	67	57.5
Vr.	1,314	28.40	12	9.1	39	29.7
Wy.	669	25.06	-	-	35	52.3

1. Sanitary rating represents the sum of the weighted ratings of the individual factors or groups of factors (including those for excreta disposal and water supply)--that is the general quality of the sanitation. The higher the rating, the better the sanitation.

2. Rate per 1,000 per year.

Table 3

Incidence of The Disease by Age and Sex
in 24 VillagesSurveyed for One Year

Age Group	Males			Females		
	Popula-tion[1]	Cases	Rates Per 1000	Popula-tion[1]	Cases	Rates Per 1000
Under 1	327	0	—	365	0	—
1	233	2	8.6	205	1	4.9
2	408	30	73.5	365	16	43.8
3	368	26	70.7	331	28	84.6
4	348	33	94.8	321	32	99.7
5 - 9	1,574	193	122.6	1,531	174	113.7
10 - 14	1,329	131	98.6	1,276	95	74.5
15 - 19	1,212	4	3.3	1,510	17	11.3
20 - 24	1,055	1	.9	1,280	51	39.8
25 - 29	882	1	1.1	997	75	75.2
30 - 34	779	4	5.1	720	47	65.3
35 - 39	639	4	6.3	646	51	78.9
40 - 44	469	10	21.3	485	34	70.1
45 - 49	372	7	18.8	343	18	52.5
50 - 54	263	13	49.4	263	12	45.6
55 - 59	200	5	25.0	228	6	26.3
60 - 64	164	9	53.6	153	3	19.6
65 - 69	106	4	37.7	105	2	19.1
70 & over	80	6	75.0	114	2	17.5
Total	10,812	483	44.7	11,238	664	59.1

[1]As enumerated between May 1 and July 15.

Table 4

Incidence of The Disease by Economic Status
in 24 Villages[1] Surveyed for One Year

Weekly Family Income Per Ammain[2]	Population	Cases	Rate per 1000
Under $2.50	796	99	124.4
$2.50 to $3.49	2,888	240	83.1
$3.50 to $4.49	4,868	260	53.4
$4.50 to $5.49	5,035	177	35.2
$5.50 to $7.49	5,549	132	23.8
$7.50 to $9.49	1,832	23	12.6
$9.50 and over	769	2	2.6
Total	21,737	933	42.9

[1]Restricted to cases developing after 30 days residence.

[2]The "ammain" is a socioeconomic unit for measuring the variation in the "gross demand for articles of consumption" among individuals of different ages and sex. By studying a large number of families in the survey area, the consumption of all types of goods, services, and food was estimated for each family member. The adult male age 25 was found to consume the most. Adult females consumed somewhat less. Children and older adults also consumed less. The amount of consumption by the 25 year old male was arbitrarily chosen as one unit or one ammain. Individuals of other ages and sex were assigned weightings (i.e. fractions of an ammain) in relation to their consumption.

By means of this unit it was possible to scale the families in the survey by economic status, correcting gross family income to family size. For example, a family of 2 parents and 2 small children with a weekly income of $20.00 would be relatively well off in this particular area, but a family of 10 persons with the same gross income would be much poorer.