

Department of Epidemiology
School of Public Health
University of North Carolina

EPID 160

Principles of Epidemiology

Fall 1967

REHABILITATION AND VALIDITY

Laboratory Exercise V

<u>Subject</u>	<u>Systolic / Diastolic</u>
Practice Subject*	/
1	/
2	/
3	/
4	/
5	/
6	/
7	/
8	/
9	/
10	/
11	/
12	/
13	/
14	/

* This blood pressure reading is not to be included in your analysis.

<u>Subject</u>	<u>Systolic</u>	<u>/</u>	<u>Diastolic</u>
Practice Subject*		/	
1		/	
2		/	
3		/	
4		/	
5		/	
6		/	
7		/	
8		/	
9		/	
10		/	
11		/	
12		/	
13		/	
14		/	

* This blood pressure reading is not to be included in your analysis.

I. Validity-Continuous Analysis

Given a set of blood pressure readings which have been accepted as the standard or validation source, a study of the validity of your readings from the film can be performed.

The standard readings for systolic blood pressure and diastolic blood pressure by a judge to be used in this exercise are as follows:

<u>Subjects</u>	<u>Systolic Blood Pressure</u>	<u>Diastolic Blood Pressure</u>
1	100	70
2	140	40
3	150	90
4	220	110
5	180	70
6	120	70
7	150	90
8	120	70
9	100	70
10	270	160
11	130	70
12	140	40
13	220	110
14	270	160

1. Compare your readings with the standard reading and calculate the millimeter difference between your reading and the judge's reading in each instance.
2. Plot a graph showing the amount of agreement.

Vg.

II. Validity-Categorical Analysis

In the previous test of validity, you compared each of your readings with actual readings accepted as the standard or the assumed "correct" reading by a judge or judges. These standard readings can be grouped into broad intervals or categories such as subjects with hypertension and subjects without hypertension. Using these groupings, a categorical analysis of validity can be done.

For this test, the following standard has been accepted for the definition of hypertension:

Systolic Blood Pressure greater than 150

or

Diastolic Blood Pressure greater than 90

1. Classify the subjects according to your own readings and according to the standard or judge's readings as having hypertension or not having hypertension.
2. Construct a table showing the comparison of the subjects classified according to your readings and according to the standard or judge's readings.
3. Calculate the sensitivity and specificity rates.

III. Reliability-Intraobserver (continuous data)

Assume that the 14 blood pressure readings represent two readings for only seven different subjects. This would result in the following seven pairs of recordings.

Subjects Numbered

1 and 9
2 and 12
3 and 7
4 and 13
5 and 11
6 and 8
10 and 14

1. Compare your two readings for each of the seven different subjects. Make a graphical representation of amount of agreement.

IV. Reliability-Intraobserver (categorical analysis)

1. Using the criteria given for categorizing subjects as having hypertension and not having hypertension given in Section II, page 2, classify each of the two blood pressure readings for the seven subjects defined in Section III.
2. Compare the classifications of the two readings for each subject.

V. Reliability-Interobserver

1. Obtain the blood pressure readings recorded by one other student in the class. In this case, interpret the readings as single readings for fourteen different subjects.
2. Compare your readings with the other students in terms of:
 - a. actual readings (continuous data)
Plot on a graph your reading against the other students reading.
 - b. classification of subjects with and without hypertension (categorical data).

Make a table which shows the classification of your data compared to the other student.

RELIABILITY AND VALIDITY

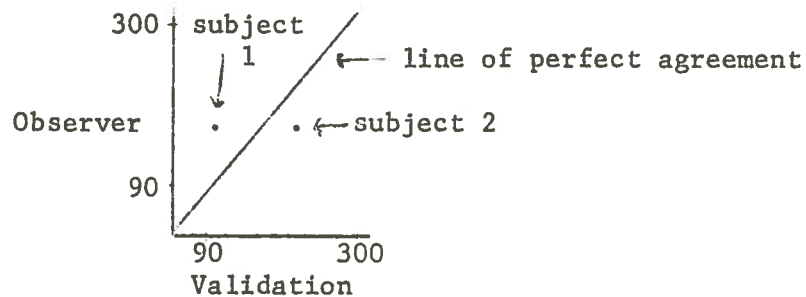
Faculty Guide to Laboratory Exercise V

This exercise is designed to demonstrate the computations of measures of validity and reliability, treating blood pressure as both a continuous and a categorical variable.

I. Validity-Continuous Analysis

Continuous analysis: For systolic BP and diastolic BP, separately, a graphic representation should be constructed; each point represents the joint measurement of each subject by the judge and by the observer, e.g.:

Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Validation	100	140	150	220	180	120	150	120	100	270	180	140	220	270
Observer	108	132	180	200	180	126	170	114	90	272	184	140	224	268
	+8	-8	+30	-20	0	+6	+20	-6	-10	+2	+4	0	+4	-2



Discuss the range of differences for each student and how often a student was higher or lower than the judge (that is consistently high or low).

II. Validity-Categorical Analysis

Given a judge's standard reading for each subject, the observer's reading can be classified as true or false, positive or negative. We shall call either systolic blood pressure greater than 150 mm or diastolic blood pressure greater than 90 "hypertension."

Subject	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Validation	$\frac{100}{70}$	$\frac{140}{40}$	$\frac{150}{90}$	$\frac{220}{110}$	$\frac{180}{70}$	$\frac{120}{70}$	$\frac{150}{90}$	$\frac{120}{70}$	$\frac{100}{70}$	$\frac{270}{160}$	$\frac{180}{70}$	$\frac{140}{40}$	$\frac{220}{110}$	$\frac{270}{160}$
True Classification	N	N	N	HYP	HYP	N	N	N	N	HYP	HYP	N	HYP	HYP

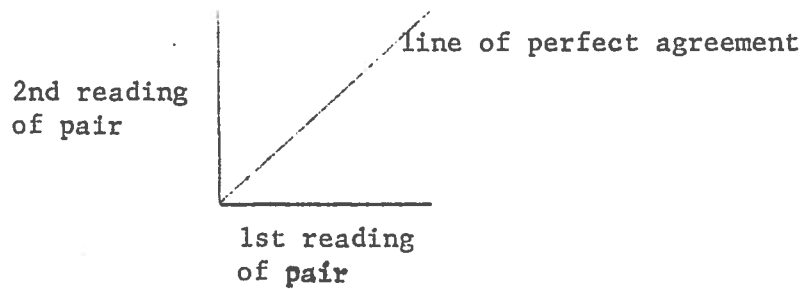
Each observer should classify each of his 14 observations as either N or HYP and then by comparison with our validation table classify each of his judgements as either true or false, positive or negative - summing and entering them in a table as below, permitting computation of sensitivity and specificity of each observer.

		Validation		
		HYP	NORM.	
Observer	HYP	TP	FP	Sensitivity = $\frac{TP}{6}$
	NORM.	FN	TN	Specificity = $\frac{TN}{8}$
		6	8	14

Note: Sensitivity approaches 100% as FN approaches 0.
 Specificity approaches 100% as FP approaches 0.
 (The marginals may be quite similar with very poor sensitivity and specificity.)

III. Reliability-Intraobserver

Continuous treatment of blood pressure: The comparison in units of BP between the two readings for the pairs as itemized below constitutes the measure of reliability. This can be expressed as units of deviation one measure from the other and the distribution of deviations for the entire set studied (with only 7 pairs frequency distributions of "deltas" have little meaning, perhaps graphic representation would be more convincing).



IV. Reliability-Intraobserver

Categorical treatment of blood pressure: There are seven identical pairs of blood pressure recordings in the following patterns.

- 1- 9
- 2-12
- 3- 7
- 4-13
- 5-11
- 6- 8
- 10-14

After each subject has been coded as either N or HYP, the agreement between these two readings for the pairs listed above constitutes the intraobserver reliability.

V. Reliability-Interobserver

Class members can pair off in teams and repeat the arguments as detailed for III and IV, using all 14 observations and measuring agreements for both categorical and continuous treatment between the two observers.

- VI. Observer contrasted with all others in his lab section, or the entire class: We can collect all observations and do frequency distributions of multiple observers for the same subject. I do not think time would permit this during the lab session. If the faculty thinks it worth the effort, it could be done by our staff and returned to the class next week--this would permit computations of full frequency distributions and probable demonstration of the "curve of errors," i.e., the normal distribution.