



## CHAPTER IV

### DATA EXERCISE ON RELIABILITY ASSESSMENT

#### INTRODUCTION

It is important to realize that a questionnaire is simply an instrument, a tool, to be employed in the study of a research problem. (Sheatsey, B.P., 1997) Researchers always try to establish the quality of their research instruments through an assessment of validity and reliability. Validity is defined as the extent to which any measuring instrument measures what it is intended to measure, or the extent to which a tool can reflect the characteristic which we want to measure, nothing else. Reliability is also a major concern in measurement. Reliability depends on how much of the variation in measurement is attributed to random or chance errors.

Reliability test for the questionnaire was conducted as data exercise. This chapter, will focus on the assessment of reliability and the pretest of instrument process. There are six main sections:

- 4.1 Establishing the instrument for data collection
- 4.2 Developing the questionnaire
- 4.3 Reliability assessment

4.4 Pretest procedures

4.5 Assessing the reliability coefficient

4.6 Reliability Analysis

#### **4.1 ESTABLISHING THE INSTRUMENT FOR DATA COLLECTION.**

In order to make a good questionnaire, three basic issues should be addressed; (a) meeting the objectives of the research (b) obtaining the most complete and accurate information possible; and (c) doing this within the limits of available time and resource (Paul B.S., 1983)

The instrument of this study is a set of questions that were applied to patients with hypertension. Four main variables, namely (1) Perceived severity of hypertension complications, (2) Perceived vulnerability of hypertension complications, (3) Perceived self-efficacy of preventive behavior, and (4) Perceived response efficacy of preventive behavior, were measured in the baseline survey phase (pretest) and Evaluation phase (posttest). In addition, the socio-demographic and current self-care practices were assessed.

The questionnaire has been constructed based on literature reviews and previous studies. It consists of five parts: socio demographic data, the patients' perception of threat, perceived self-efficacy, perceived response efficacy of preventive behavior, and self-care practices.

**Part I: Socio Demographic Data:** This part attempts to identify the general characteristics of the respondents. The questions are about age, gender, education, household income, body weight, height, and medical history.

**Part II The Patients' Perception of Threat:** This part provides three rating scales "yes", "no", or "not sure" to find out the patients' perception of threat.

*a) Perceived Severity of Hypertension Complications:* A set of statements in this part aims to measure the understanding of types and consequences of complications. There are ten statements consisting of true and false answers. The questions number 2, 3, 4, 6, 8 and 9 are true, and 1, 5, 7 and 10 are false.

*b) Perceived Vulnerability to Hypertension Complications.* This part consists of 13 statements testing perception of the vulnerability to hypertension complications such as dietary intake, exercise, stress, smoking, drinking alcohol and medication. There are true and false statements. The statements number 1, 2, 3, 4, 7, 8, 9, 10, and 13 are true, and 5, 6, 11 and 12 are false.

According to the questionnaire, there are both positive and negative questions. The questions are used to identify the existing perception of threat appraisal and to test the respondents' attention to the questions. The answers on part a and b are coded into scores by using the following criteria:

<b>True Statement</b>		<b>False Statement</b>	
<b>Answer</b>	<b>Score</b>	<b>Answer</b>	<b>Score</b>
Yes	1	Yes	0
No	0	No	1
Not Sure	0	Not Sure	0

**Part III Perceived Self-efficacy:** A set of statements are designed to assess the respondents' confidence on self-care practices such as controlling dietary intake, reduction on smoking and alcohol consumption, exercising, relaxing and taking medication regularly. Seventeen statements are interpreted by following these criteria:

<b>Answer</b>	<b>Score</b>
Quite a lot of confidence	3
Moderate confidence	2
Very little confidence	1

**Part IV Perceived Response Efficacy of Preventive Behavior:** Eleven statements are based on the consequences of controlled hypertension such as risk reduction of cardiovascular disease, renal disease, retinal arteries, and cerebrovascular disease. The respondents have three choices to answer that are "agree, undecided, and disagree." The answers are coded by using the following criteria:

<b>Answer</b>	<b>Score</b>
Agree	3
Undecided	2
Disagree	1

**Part IV Self-care Practices:** The patients with hypertension will be asked about their current self-care practices such as dietary intake (1-9), relaxation (10-13), exercise (14), smoking (15), alcohol consumption (16), and medication (17-18). There are both positive and negative statements. The statements number 4, 5, 11, 12, and 13 are positive, and 1, 2, 3, 6, 7, 8, 9, and 10 are negative statements.

The answers are coded by using the following criteria:

<b>Positive Statement</b>		<b>Negative Statement</b>	
Never	0	Never	3
1-2 times a week	1	1-2 times a week	2
3-4 times a week	2	3-4 times a week	1
More than 5 times a week	3	More than 5 times a week	0

The answers to questions number 14-17 are coded by using the following criteria:

<b>Questions</b>	<b>Answers</b>	
	<b>Yes</b>	<b>No</b>
Exercising	1	0
Smoking	0	1
Alcohol Consumption	0	1

Questions	Answers	
	Yes	No
Forgetting to take medicine	0	1
Forgetting to see the doctor	0	1

Additional data of each question such as the frequency and duration of exercise, and the total number of cigarettes and alcohol drinks a day are recorded as the baseline data and will be used to evaluate the effectiveness of intervention.

#### 4.2 DEVELOPING THE QUESTIONNAIRE

The health promotion and education experts assisted to develop the questionnaire, to make sure that the questions represent the concept adequately. After consulting the experts, the questions will be reviewed based on the experts' suggestions and recommendations.

#### 4.3 RELIABILITY ASSESSMENT

The reliability of a measurement depends on how much the variation in scores is attributable to random or chance error. There are four basic methods for estimating reliability namely, the *test-retest method*, *inter-rater reliability method*, *alternative form method* and *internal consistency*.

In order to determine which method is most appropriate, focusing on the target group's situation, budget, and time constraints are important. Different methods are also used to estimate reliability in different situations. For example, the internal consistency method requires a single test administration and a unique estimate of the expected correlation of one test with an alternative form containing the same number of items. The test-retest method; however, requires the respondents to respond to same test after a period of time. The alternative-form method needs two forms to display the properties of parallel measurements while inter-rater method needs the respondents to respond two times by different interviewers. In this study, the internal consistency method is the most appropriate method to estimate the reliability.

The internal consistency method is concerned with the homogeneity of items comprising a scale. The measurement theory suggests that the relationships among items are connected to the relationship of the variable. If the items of a scale have a strong relationship to their variable, they will have a strong relationship to each other. Although the linkage between items and variable cannot be observed, the items' correlation with one another can be determined.

### **Internal Consistency Method**

There are two main methods to estimate reliability coefficients, which are referred to as measures of internal consistency:

1. **Cronbach's alpha** is the correlation coefficient used to estimate the degree of equivalence between the answers and sets of questions. It is the most popular method used to estimate reliability. It has been suggested to use if the scale is not dichotomous. The formula for calculated by Cronbach's alpha is:

$$\alpha = \frac{N}{N-1} \left[ 1 - \frac{\sum s_i^2}{s_t^2} \right]$$

Where N is equal to the number of items;  $\sum s_i^2$  is equal to the sum of item variances; and  $s_t^2$  is equal to the variance of the total composite. The equation makes clear that the value of alpha depends on the average inter item correlation and the number of items in the scale. As the average correlation among items increases, the number of items increases as well as the value of alpha. Cronbach's alpha is applied to estimate reliability regarding *Perceived self-efficacy*.

2. **Kuder and Richardson** (1937) have used Cronbach's alpha to estimate the reliability of scales composed of dichotomous score items. Dichotomous items are scored one or zero depending on whether the respondent does or does not possess the particular characteristic under investigation. A score of one is given when subjects answer question correctly, but zero if subjects answer incorrectly. To determine the reliability of scales composed of dichotomous scores, the Kuder Richardson Formula 2) (KR20) is calculated using this formula:



$$r = \frac{N}{N-1} \left[ 1 - \frac{\sum p_i q_i}{\sigma_t^2} \right]$$

Where  $N$  is the number of dichotomous items;  $p_i$  is the proportion responding “positively” to the  $i^{\text{th}}$  item;  $q_i$  is equal to  $1 - p_i$ ; and  $\sigma_t^2$  is equal to the variance of the total composite.

The correlation coefficient, which is calculated from Kuder Richardson formula, is equal to the reliability estimated by Cronbach’s alpha. Since KR20 is simply a special case of alpha, it has the same interpretation as alpha. In addition, it is an estimation of the expected correlation between one test and a hypothetical alternative form containing the same number of items. KR20 is applied to estimate reliability in 3 parts; *Perceived severity*, *perceived vulnerability* and *Perceived response efficacy of preventive behavior*.

The value of alpha is from 0 to 1.0. The negative alpha indicated that something is wrong. Different methodologists and investigators, however, accept different alpha. In general, the minimal acceptable level of Cronbach’s alpha reliability is 0.70. In this study, a value of alpha was 0.7 that was considered as a lower acceptable bound for alpha.

#### **4.4 PRETESTING PROCEDURE**

##### **1) Finding the area for pretest:**

The questionnaire must be pretested with the similar characteristics of the study group. Mae Chan district is located near the study area. The patients with hypertension in this area are assumed that they have the similar characteristics comparing to the study group. Therefore, the patients with hypertension in Mae Chan district were chosen to test for the reliability of the questionnaire.

The smallest number for a normal distribution can use both the t distribution and z distribution is 30. Thus, thirty patients with hypertension in Mae Chan district were asked to respond to the questions.

##### **2) Asking permission:**

The community leader and health staff in Mae Chan district was approached in order to inform the objectives of the study and ask for permission on data collecting. The letter of the College of Public Health, Chulalongkorn University was shown before asking the permission for data collecting. At the health center, the researcher asked for a list of the patients with hypertension in the community.

##### **3) Data collecting:**

After the patients with hypertension allowed the researcher to do the interview, thirty patients with hypertension from the list were selected by simple random sampling. Five patients with hypertension were chosen as reserves when the patients in the first list are not available. The patients were approached one by one.

#### 4) **Data coding and entering into the computer program:**

The data was coded into the numeric as criteria, and entered into the Statistical Package of Social Science Program (SPSS). Then the data was checked using frequency command. After running the statistical program, the data was edited again.

### 4.5 ASSESSING RELIABILITY COEFFICIENTS

After running the statistical analysis to estimate the reliability in each part, the program showed overall scales and the relationships between the individual items and the overall scale. Mean and standard deviations for each item can be obtained. In relation to the Item-total Statistics a number of important columns were shown as below here: (Sheridan, J. C. & Lyndall G. S., 2002, p. 149)

**a) Scale Mean if Item Deleted;** this column tells the average score for the scale if each item is excluded from the scale.

**b) Scale Variance if Item Deleted;** this column tells the scale variance whether the items were eliminated.

**c) Corrected Item-Total Correlation;** this column gives the Pearson correlation coefficient between the scale on the individual item and the sum of the scores on the remaining items.

**d) Alpha if Item Deleted;** this column gives the alpha coefficient that would result if the items were removed from scale.

However, *the Alpha if Item Deleted* column is the most concern, it shows that overall reliability would increase slightly when we remove those items and recalculate the reliability coefficient. To delete an item, which will increase the reliability, need to concern with the objectives, theoretical concept, and content of the main concept. The questionnaire was modified after testing the pretest data and posttest in this study.

#### 4.6 RELIABILITY ANALYSIS

After a researcher pretested the questionnaire in the field, the data were entered into the computer program to estimate the reliability of four variables that are:

##### A) Reliability Analysis for Perceived Severity of Hypertension Complications

Statistics for	Mean	Variance	Std Dev	Variables
SCALE	5.8000	3.6138	1.9010	10

##### Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Alpha if Item Deleted
A1	5.7667	3.4954	.1246	.6104
A2	4.9333	2.9609	.4482	.5503
A3	5.0667	2.6161	.5467	.5101
A4	4.9333	2.9609	.4482	.5503
A5	5.6000	3.4897	-.0272	.6522
A6	5.2333	3.0126	.1984	.6104
A7	5.2000	3.1310	.1330	.6278
A8	4.9667	2.8609	.4751	.5397
A9	5.5333	2.8092	.3995	.5524
A10	4.9667	3.2057	.1948	.6026

## Reliability Coefficients

N of Cases = 30.0                      N of Items = 10

Alpha = .6093

The reliability coefficient for Perceived severity of hypertension complications is 0.6093. If item 5 was deleted and the reliability analysis re-run, then the alpha coefficient would increase to 0.6522. Even though the removal of this item would still increase the alpha coefficient, it was asked to bring out the main consequences of untreated hypertension. Therefore, this item was modified. Besides, the alpha coefficient would increase to 0.6278 if item 7 was removed which asked about the understanding of uncontrolled hypertension. This item might have to be written more clearly.

## B) Reliability Analysis for Perceived vulnerability to Hypertension

### Complications

Statistics for	Mean	Variance	Std Dev	Variables
SCALE	7.7000	7.5276	2.7436	13

### Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	- Corrected Item- Total Correlation	Alpha if Item Deleted
B1	7.0333	6.8609	.1739	.6759
B2	6.8667	6.4644	.4771	.6358
B3	7.3667	5.9644	.5693	.6135
B4	6.8667	6.9471	.2186	.6675
B5	7.1333	5.8437	.5868	.6081

B6	7.1667	6.7644	.1916	.6744
B7	6.8667	6.9471	.2186	.6675
B8	7.4333	6.8057	.2214	.6681
B9	7.2667	7.0989	.0651	.6935
B10	7.0333	6.8609	.1739	.6759
B11	7.1333	5.9816	.5240	.6192
B12	7.1667	6.1437	.4478	.6323
B13	7.0667	6.9609	.1262	.6834

### Reliability Coefficients

N of Cases = 30.0                      N of Items = 13

Alpha = .6746

The reliability coefficient for Perceived vulnerability to hypertension complications is 0.6746. If item 9 were deleted and the reliability analysis re-run, then the alpha coefficient would increase to 0.6935. This item asked about stress, which can measure hours of sleeping, and the item should be reconsidered for revision. Besides, the alpha coefficient would increase to 0.6834 if item 13 was removed which asked about regular visits to the doctor reducing risks to complication.

### C) Reliability Analysis for Perceived Self-efficacy

Statistics for	Mean	Variance	Std Dev	Variables
SCALE	40.3333	40.8506	6.3914	17

#### Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Alpha if Item Deleted
C1	37.9667	35.2747	.7116	.8657
C2	38.1000	37.7483	.3980	.8773

C3	37.7667	35.7023	.5777	.8706
C4	37.8667	36.7402	.4040	.8783
C5	38.1000	38.8517	.2365	.8827
C6	37.8667	35.4989	.7381	.8654
C7	37.8333	36.8333	.5311	.8728
C8	37.9000	36.3690	.4910	.8742
C9	37.6667	36.8506	.4933	.8740
C10	37.7000	37.1828	.4386	.8760
C11	38.0667	35.8575	.5983	.8699
C12	38.1333	35.7057	.5924	.8700
C13	38.4000	36.3862	.5255	.8728
C14	38.2333	35.9092	.5197	.8731
C15	38.1000	34.5069	.6798	.8660
C16	37.9000	36.5069	.4336	.8769
C17	37.7333	37.8575	.3861	.8777

#### Reliability Coefficients

N of Cases = 30.0                      N of Items = 17

Alpha = .8798

The reliability coefficient for Self-Efficacy is 0.8798. No removal of items would enhance this reliability measure. This is expected to be as a well-established scale.

#### D) Reliability Analysis for Perceived Response Efficacy of Preventive Behavior

Statistics for	Mean	Variance	Std Dev	Variables
SCALE	6.8000	12.8552	3.5854	11

#### Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Alpha if Item Deleted
D1	6.0333	10.8609	.6381	.8659
D2	6.3000	10.4241	.6615	.8635

D3	6.1667	10.2126	.7669	.8564
D4	6.1333	10.2575	.7710	.8564
D5	6.2000	10.3034	.7201	.8595
D6	6.1333	11.2920	.4138	.8797
D7	6.3000	10.9759	.4810	.8759
D8	6.0000	11.5172	.4246	.8780
D9	6.2667	11.0299	.4652	.8770
D10	6.2333	11.0126	.4749	.8763
D11	6.2333	10.3920	.6799	.8622

#### Reliability Coefficients

N of Cases = 30.0                      N of Items = 11

Alpha = .8791

The reliability coefficient for Response Efficacy is 0.8791. No removal of items would enhance this reliability measure. It is expected to be a well-established scale.

#### E) Reliability Analysis of 4 variables (Perceived Severity, Vulnerability, Self-Efficacy, and Response Efficacy)

Statistics for	Mean	Variance	Std Dev	Variables
SCALE	60.6333	117.4816	10.8389	51

#### Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Alpha if Item Deleted
A1	60.6000	116.0414	.3577	.8969
A2	59.7667	114.0471	.4489	.8955
A3	59.9000	114.2310	.3171	.8965
A4	59.7667	114.0471	.4489	.8955
A5	60.4333	116.3920	.1053	.8984
A6	60.0667	114.6851	.2355	.8974
A7	60.0333	117.9644	-.0675	.9008
A8	59.8000	112.7862	.5654	.8943



A9	60.3667	114.0333	.3379	.8963
A10	59.8000	115.4759	.2286	.8973
B1	59.9667	111.2747	.5909	.8934
B2	59.8000	114.3034	.3744	.8960
B3	60.3000	111.4586	.5722	.8936
B4	59.8000	115.4759	.2286	.8973
B5	60.0667	109.9264	.6908	.8921
B6	60.1000	114.5069	.2502	.8973
B7	59.8000	114.1655	.3916	.8959
B8	60.3667	116.1713	.1143	.8985
B9	60.2000	117.6138	-.0353	.9005
B10	59.9667	115.3437	.1853	.8979
B11	60.0667	113.6506	.3329	.8963
B12	60.1000	111.6793	.5170	.8941
B13	60.0000	115.7241	.1439	.8984
C1	58.2667	112.6161	.3438	.8963
C2	58.4000	112.3172	.4019	.8955
C3	58.0667	109.0989	.5586	.8931
C4	58.1667	109.3161	.4998	.8940
C5	58.4000	114.3862	.2281	.8977
C6	58.1667	112.2126	.4083	.8954
C7	58.1333	110.2575	.5738	.8932
C8	58.2000	114.1655	.1968	.8987
C9	57.9667	109.9644	.5621	.8932
C10	58.0000	110.0690	.5452	.8934
C11	58.3667	111.4816	.4139	.8953
C12	58.4333	112.3230	.3350	.8965
C13	58.7000	109.9414	.5316	.8936
C14	58.5333	109.0851	.5305	.8935
C15	58.4000	109.3517	.4992	.8940
C16	58.2000	111.4759	.3562	.8964
C17	58.0333	113.3437	.3186	.8965
D1	59.8667	115.1540	.2321	.8973
D2	60.1333	112.1195	.4739	.8946
D3	60.0000	112.8276	.4239	.8953
D4	59.9667	113.6195	.3553	.8960
D5	60.0333	112.1713	.4796	.8946
D6	59.9667	114.8609	.2326	.8974
D7	60.1333	114.1885	.2792	.8969
D8	59.8333	113.0402	.4943	.8948
D9	60.1000	111.5414	.5302	.8940
D10	60.0667	114.2713	.2744	.8970
D.1	60.0667	114.4782	.2549	.8972

## Reliability Coefficients

N of Cases = 30.0

N of Items = 51

Alpha = .8978

The overall reliability of 4 variables is 0.8978, which is acceptable for this study.

## CONCLUSION

In this chapter, the reliability of an instrument was calculated. The reliability of a) Perceived severity of hypertension complication was 0.6093; b) Perceived vulnerability to hypertension complications was 0.6746; c) self-efficacy of preventing behavior was 0.8798; and d) response-efficacy of preventing behavior was 0.8791. After running the data on computer program to estimate all parts of perception, the reliability is 0.8978, which was more than 0.7. Therefore, this questionnaire is acceptable to use in this study.

After asking the respondents, it was found that there were some statements which confused the respondents. Those statements were modified as below:

<b>Before modification</b>	<b>After modification</b>
<i>Perceived Severity</i>	
5. Hypertension can not induce stroke	5. Patients with hypertension are not prone to stroke
7. Hypertension can cause gastritis	7. Patients with hypertension who cannot control blood pressure might develop gastritis
<i>Perceived vulnerability</i>	
9. Blood pressure can be rise if patients	9. If patients with hypertension cannot sleep,

with hypertension cannot sleep

blood pressure can rise

13. Follow up as schedule can reduce risk to heart disease.

13. Patients with hypertension who always see the doctor as scheduled would reduce risk to develop heart disease

## LESSONS LEARNED

1. In order to establish a set of questions to test the concept in the study, we need to understand the concepts clearly so that we will know which we want to measure.
2. It will be easier to pretest questionnaire in the health center at the day of hypertension clinic. Most of the patients with hypertension will visit the doctor at health center. Therefore, Hypertension Clinic day is very useful for interviewing.
3. Household survey is very useful for a researcher as the researcher can observe other factors that might influence self-care practices of patients with hypertension. In addition, the researcher can obtain more information from their relatives.



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