I HAVE STATED MY HYPOTHESES NOW WHAT DO I DO WITH THEM—PART II

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Hypothesis

"WHY do I need to worry how many variables I have? All that I have to do is to describe them."

In many countries, little research has been published or described in writing for others to study. Unless and until people are willing to share their exploratory or descriptive observations with others, the basic elements or variables which are important in a situation cannot be identified.

But let us say that you are in a country which has some basic knowledge of the issues related to a particular problem. Perhaps the problem has been known for sometime. Then further **description** of the issue is redudant; what is needed now are educated guesses, built on previous research, which have emerged from the literature and the experience of many researchers.

"You mean that these "educated guesses" have some foundation in fact or opinion."

Right. And, it's a very good idea to state, in writing, why you guessed what you did, hat is, the basis for your rationale and your perception of the problem.

"Well, I see many research studies that do not elaborate on this rationale. In fact, some studies do not even state what their guesses are?"

That's right, in writing research, these "educated guesses" or hunches are formally termed **hypotheses.** And you undertake the study in order to come to some conclusion about each hypothesis you have stated. That is, after studying the problem and testing your hunches or hypotheses you either accept them or reject them. Now if your hypothesis is poorly stated, or when you can take no action on your hypotheses, this is poor planning. If hypotheses are clear, specific, and consist of only one research prediction, and, if research is designed in such a way that each hypothesis is testable, then the researcher will always be able to come to a definite conclusion on each one. If he cannot, then you can be certain that there was something wrong either in the statement of the hypothesis or the design of the research.[1]

"This explanation seems clear enough, but can you give an example?"

Alright. A good example can be found in India where concern had been expressed about the reluctance of nurses to work in the rural areas.[2] Authorities believed that once the students experienced urban life and the busy hospital setting, the attractiveness of their own rural settings were quickly forgotten. This dearth was compounded by the move toward primary care coupled by the emerging patterns of health care delivery and newer more contemporary health care models. The trend was fairly well established to the extent that revised models did not even mention a position for the professional nurse in the rural areas.[3] Also noted was the strategies adopted by other countries to alter this trend. That is, community based nursing education programmes were created, providing students clinical experience not in hospitals, but in rural settings.

This picture was provided, at least in part, to create a level of comfort for working in the rural setting. And it was reasoned that if one's training is primarily rural in nature, one's job preference upon graduation would also be rural.

"So some methods had been proposed to solve the problem which was to educate nurses directly in the village setting."

That is right. And experience as well as the literature documented that the problem existed, and persisted.

After reading the literature, however, a group of nurse researchers in India had some doubts about the factors which had to do with job preference after graduation. Further, they, as nursing faculty, had taught and counseled many graduating nurses. That is, they had had direct on hands, experience with the issues related to this problem. They believed that other factors, in addition to setting of educational experiences, had to do with ultimate preferences.

"I am beginning to see the difference now between the descriptive study and the study where hypotheses are tested. This group with their experience and availability of literature had some definite ideas about specific factors and perhaps the relationships those factors had to job preferences."

That is correct. And the researchers were able to state some tentative statements about those relationships.

Then, in your hypothesis statement you have variables specified. Also needed is the population of reference group about or upon whom these variables are to be measured. In our earlier example "rural health settings" suggest from where or from whom we are to get the data. Further you need to state the question to be answered or statement to be addressed. In the above example the hypothesis is stated in statement form which gives a direction to the problem solution. In our question, "What factors influence the implementation of primary health care in rural village settings?", the question you post is to the question of finding out which factors have a bearing on a phenomenon, in this case, implementation of primary care.

Be careful that when stating your hypotheses that you do not ask questions which cannot be answered. Questions which are moral, religious or ethical in nature are simply not fare for the researcher. For example, asking if one caste in India is better than another renders an untestable hypothesis. But you could ask if one caste is more effective than another in carrying out some activity. Then you would define "effective" in some way. Also, you should note that a hypothesis tests only one idea at a time. For example, the following hypothesis is not testable for it carries more than one prediction.

"The level of medical expertise and extent of financial support were related to decreases in infant morbidity and reduction in maternal infection."

This hypothesis would have to be altered because if the data support one prediction and not the other you would have the problem of "partial support" for the hypothesis a position in which the research should avoid.

Let us look at our previous example of traditional birth attendants:

"Traditional birth attendants who are exposed to 10 hours of training will effect significantly lower rates than traditional birth attendants who have not had 10 hours of training."

Research Hypothesis and the Null Hypothesis

Well, what you have is a statement of your **research hypothesis**, and we will later interpret your data only in terms of this hypothesis and these variables. But before you do that, we must discuss the way the research hypothesis is stated. The usual procedure is to put the research hypotheses (Hi) as Hi in its **null form**, or to state the null hypothesis, or (Ho). This is necessary in order to develop a decision procedure for accepting or rejecting a single hypothesis.

"The important points are that there must be only two hypotheses, and they must be mutually

exclusive and exhaustive. This permits rejection of one to imply acceptance of the other."[4]

Thus, in order to be tested, our hypotheses about birth attendants would change from:

"Traditional birth attendants who are exposed to 10 hours of training will demonstrate significantly lower infant mortality rates than traditional birth attendants who have not had 10 hours of training."

would be changed to:

"A significant difference in the infant mortality rates will be demonstrated for traditional birth attendants exposed to 10 hours of training and those not exposed to 10 hours of training."

Research dictates that a null hypothesis be formed so that a sample can be provided in order to decide to either reject or not reject the null hypothesis. If you can reject the **null** hypothesis, then you accept the **statistical hypothesis.** Thus, you do not **prove** anything in research, you only **test** your hypothesis. As a researcher, you hope the null hypothesis is faulty as it can be rejected in favour of the alternative or research hypothesis.

"Why must the hypothesis be in null form?"

Because the sampling distribution and the statistic can only be computed when the hypothesis is in null form.

The null hypothesis states that all samples are random samples from a single population. And you are attempting to negate that statement. Put another way, you are asking, "do the two samples from the same population?"

In our example, we have randomly selected two groups of traditional birth attendants from the same population. We put one through our 10 hours of X special classes, and the other one gets no classes. Then after 10 hours, we compare their mean scores. Now, we want to know whether or not the two are **still** random samples from the same population. We hope they are not, if they are, the group exposed to our teaching has not changed. And there will be no significant difference between the two groups. Thus, we cannot reject the null hypothesis. And, we cannot accept research hypothesis.

Levels of Significance

In our example, let us say that the group with the training scores 90 and the group without the training scored 80. The question is, is the difference significant? So we do a statistical test appropriate for our data sample? size and number of groups. The results are that indeed our difference of 10 points **is** significant.

"Well, may be you just happended, by chance, to select a bright group of attendants. May be you were lucky."

Good observation. To address that question, conventional **levels of significance** have been created to tell us the extent to which this sampling error has occurred.

"What are they?"

Generally, we want to know how seldom must the results be obtained before we are willing to say that they did not occur by chance? The level of significance is your statement of the **point** at which the significance probability is so large that you say it was chance rather than your teaching method. In behavioral research we select two levels, the .05 and 01 levels. "Five per cent means that if a study were done 20 times, in one of those 20 (5%) a spurious conclusion could be drawn. For the level of significance also may be seen as the maximum risk of error the researcher is willing to run when he rejects the null hypothesis and concludes that a difference is **not** attributable to chance."[5] Can you say what .01 level would imply?

Let's see, using your example, I would say that is a study were done 100 times, in one of those 100 times (1%) a spurious conclusion could be drawn

Right. Then researcher states the research hypothesis, states the null hypothesis, hen sets the level of significance. Once it is set, it is not changed. And generally, .05 and .01 levels are the levels used. Occassionally, where less precision is expected, we have seen 10 set. This means that these researchers were willing to

run a 10% error when he/she rejected the null hypothesis. After the level of significance is set, the statistical test is compared, and a result obtained. Then the number obtained is checked against a table designed for that test. The number in that table (for the researcher's "n" or sample size, or "df" (degree of freedom) is compared with the statistical test results, **for the level of** significance previously determined by the researcher (either .05 or .01).

Usually if the test result falls **above** the number listed in the table, the null hypothesis can be rejected, and the research hypothesis accepted. If the number falls **below,** the null hypothesis cannot be rejected and you cannot, therefore, accept the research hypothesis.

"Does this mean that we have stated the hypothesis without sufficient evidence? that is, our educated guess was wrong?"

Not necessarily so. We fall to reject null hypothesis when the statistical result is not significant. This is probably due to a sampling error or chance occurrence. There can be two types of errors in rejecting or not rejecting the null hypothesis. When we fail to reject a null hypothesis of no difference when in actuality the difference does exist this is called a **Type II or Beta** (β) error.

When we take a problem where there are number of independent variables that cannot be controlled or held constant we need to choose a liberal level of significance (say, 0.1). This will avoid a Type II error. Let us look at this example. In a study of the patients undergoing major abdominal surgery, the subjects of an experimental group went through an organized exercise programme pre-operatively. The patients of the control group received the routine instruction and did not go through the organized programme. Respiratory functions were assessed pre and post operatively for both groups. Althoug the extraneous variables, such as smoking habits, administration of antibiotics etc., and intervening variables as pre-operative anxiety, pain etc. were identified, the researcher could not hold this constant because of the non-availability of a large sample. The researcher set the level of confidence as 0.1. This error can occur the other way round. That is, we reject a null hypothesis of no difference to conclude that a difference does exist whereas in actuality no difference exists. This is called Type I or Alpha ( ) error.

"How can this be?"

Similarly, we need to use a fine screen or high level of significance to avoid a type I error where the study is set up in a more controlled situation, such as a study to access the complications of a new drug. Often we are faced with a small size sample when we do an experimental study because of the problem of considering the extraneous variables. Small sample size tend to yield error in statistics; hence to avoid the chance for error we need to increase the size of sample.

One-tailed and Two-tailed Tests

"I noticed that when I looked up the tests in the Appendix, I was not sure what table to look under, for some of the tables said "one tailed test" and some said "two-tailed test". What does that mean?"

Good question. If you remember earlier we said that there are only two hypotheses, the one you reject in order to imply acceptance of the other. Now, there are two ways of starting the null hypotheses. One way is to state a hypothesis of no difference.

"There will be no difference in incidence of **infection of two groups** receiving two different concentrations of the X vaccine."

Here we have not predicted the **direction** of the difference. When we predict no directionality, that is, if we have no reason to expect a difference to one direction rather than the other, then we use the **two-tailed test.**

When you suspect or have reason to think there will be direction, then you say so.

Yes. When we can make a prediction, in advance, then we are justified in using a one-tailed test. As example of a hypothesis using a one-tailed test would be:

"The group exposed to vaccine A concentration will demonstrate a significantly lower incidence of infection than the group expected to vaccine B concentration."

Here we are predicting a direction—that Group A will score lower than Group B.

"But then how do you state the null hypothesis?"

Simple. You could say—"The group exposed to vaccine A concentration will not demonstrate a significant lower incidence of infection than the group exposed to vaccine B concentration."

Again, you: 1) state the hypothesis, 2) state it in its null form; 3) run the appropriate statistical test and 4) compare your answer with the answer in the Table. But you are to be sure to look under the correct label, that is for the one-tailed test or for the two-tailed test.

Remember, "since the probability of a difference in one specified direction is just half that of the same amount of difference in either direction, the one-tailed test is twice as sensitive as the one we would be obliged to use if we were merely exploring; a difference half as large will qualify at whatever level of confidence we have prescribed."[6]

References

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