Overall Comparison Between Two Groups Using Effect Sizes

G Singh

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Abstract

In controlled clinical trial, comparing trial drug (Group-I) with standard drug (Group-II), it is often seen that both groups result statistically significant on a number of variables and not statistically significant on some variables when compared within the group using (say) paired t-test. Similarly, between the groups comparison using unpaired t-test based on difference of means of pre and post measurements results significant on some variables and not significant on a number of variables. This suggests that both the groups (drugs) have similar effect (comparable) on variables resulting not significant whereas, groups differ on variables that resulted significant. Then a need may arise to decide which group may be considered to have performed better based on all comparisons together. Apart from clinical decision, there can be some objective criteria for such decision-making. If a set of variables are such that, decrease (or increase) after treatment shows improvement (cure) then a useful method may be comparison of cumulative effect size based on all the variables of the set together. For example, in a study (say) 'k' items (variables) are measured before treatment (BT) and after treatment (AT) in both the groups. Let the k variables like cholesterol, triglycerides, creatinine etc. are such that decrease in values after treatment show improvement or cure. Let the study results significant or not significant in a manner as shown in Table1.

Figure 1

Variables	Within the group comparison (BT-AT), Paired t-test Result		Effect Size (Mean of difference divided by SD of difference)		Between the group comparison on difference, Unpaired t test Result
	Group-I (Trial Drug)	Group-II (Standard Drug)	Group-I (Trial Drug)	Group-II (Standard Drug)	
1 (Cholesterol)	S	S	e_1	e'_1	NS
2 (Triglycerides)	S	S	e_2	e'_2	NS
3 (Creatinine)	S	NS	e_3	e'_3	S
4	NS	NS	e_4	e'_4	NS
. .	. .	. .	. .	. .	. .
i	S	NS	e_i	e'_i	S
. .	. .	. .	. .	. .	. .
K	S	S	e_k	e'_k	NS
			Σe_i	$\Sigma e'_i$	

S = Statistically Significant,
NS = Not Statistically Significant

It is evident from the table that both groups may be regarded as comparable on items showing inter-group comparison not statistically significant whereas, the groups differ on items showing significant. The question now is to choose a group that may be considered better on overall comparison based on all items. In such situation, some norms may be set-up based on clinical perspective and prognostic factors that may be more a subjective criteria considerably varying across studies.

An alternative method for overall comparison between the groups considering such k-variables at a time may be cumulative effect size comparison. Comparing effect size instead of p-values is usually a better approach1. The effect size in paired t-test is equal to the mean of difference (BT-AT) divided by standard deviation of difference. The effect size calculated for all variables may be added group-wise to get cumulative effect size. If this sum for (say) trial group ($?e_i$) comes greater than the sum for standard drug ($?e'_i$) then,

trial drug may be considered to have been observed better than standard drug. It is worth mentioning here that this method may prove to be an alternative for such decision making in the absence of other appropriate clinical criterion. It may also be used in addition to any suitable relevant criterion. Further, the method can also be extended taking weighted sum of effect sizes by suitably choosing the weights preferably based on clinical significance of the variables.

CORRESPONDENCE TO

Dr. Girish Singh 6, Ganga Bagh Colony, Lanka Varanasi – 221005 India Phone: 0091-0542-2367304 e-mail: drgirishsingh@yahoo.com

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Author Information

Girish Singh
Biostatistics Unit, Department of Basic Principles, Institute of Medical Sciences, Banaras Hindu University