

Perspectives on Scientific Inquiry

Causal-comparative research designs

Jason D. Schenker* and Phillip D. Rumrill, Jr.

Kent State University, Department of Educational Foundations and Special Services, 201 Moulton Hall, P.O. Box 5190, Kent, OH 44242, USA

Tel.: +1 330 672 9959; Fax: +1 330 672 5834; E-mail: jschenke@kent.edu

Abstract. This article describes causal-comparative research designs and examines the role these studies play in rehabilitation research. The goals, assumptions, and data analytic strategies that inhere to causal-comparative research are emphasized, illustrated with examples from the contemporary vocational rehabilitation literature.

Keywords: Vocational rehabilitation research, casual-comparative research design

1. Introduction

The purposeful, theory-based nature of the quantitative research paradigm serves to constantly remind researchers that proving or demonstrating something new is a primary objective of scientific inquiry [9]. Undoubtedly, experimental investigations exemplify the spirit of purposeful and active inquiry as they endeavor to draw causal inferences concerning independent and dependent variables [2]. By systematically manipulating the independent variable and randomly assigning participants to treatment and control groups, researchers using experimental techniques claim the strongest warrants for new knowledge, that is, a causal link between the intervention or stimulus and realized outcomes.

In many studies, however, it is not possible (or even desirable) to manipulate the independent variable in an effort to make causal connections. Many studies examine differences between intact groups that are formed on the basis of such characteristics as gender, disability type, or educational attainment – grouping or independent variables that are not amenable to experimental manipulation. These causal-comparative studies examine the magnitude of differences between or among

groups, but no attempt is made to infer causality within an individual study.

In this article, we describe causal-comparative studies. We first describe the goals and assumptions inherent in this non-manipulation approach and then illustrate general points using examples from the contemporary rehabilitation literature.

2. Goals of causal-comparative research

Causal-comparative designs generally involve the use of pre-existing or derived groups to explore differences between or among those groups on outcome or dependent variables. Often, the variables that are examined in causal-comparative studies cannot be experimentally manipulated for practical or ethical reasons. For example, a researcher studying the effects of a particular drug on some disease may be ethically precluded from withholding it from some patients who might be helped by it for the purposes of research. He or she may only be able to compare those who have already been taking the drug to those who have not. Furthermore, participants may belong to any number of groups that may be of interest to the researcher, such as those differentiated by gender, race, or occupation, before a study is conducted. Obviously, membership in such groups cannot be subject to experimental manipu-

*Corresponding author.

lation. Researchers may also compare people from derived groups, where the researcher places participants into groups based on their relative standings on variables of interest. For example, Groomes and Leahy [5] used a measurement instrument to determine rehabilitation clients' dominant coping dispositions, then categorized them into three groups (i.e., problem-, emotion-, or avoidance-oriented) to compare them on their levels of acceptance of disability.

When conducting causal-comparative studies, the researcher must first take into account the types of variables to be used in the study. Causal-comparative studies are similar to experimental designs in that they make use of independent variables that are nominal, or categorical, in nature. Causal-comparative studies also typically make use of continuous dependent variables. Categorical variables include those where the participants are assigned to one of two or more mutually exclusive groups. Continuous variables are those that are measured in terms of amount or degree, with higher scores indicating higher levels of the variable in question. Although a causal-comparative design might involve the use of one or several independent variables, the defining characteristic of causal-comparative research is that the independent variables are (a) categorical and (b) not experimentally manipulated. However, researchers commonly combine independent variables that are experimentally manipulated with those that are not in a single study, such as examining how members of different racial groups are affected by an experimental treatment. A study of this kind would combine causal-comparative and experimental methods.

3. Differences between causal-comparative designs and experimental designs

When experimental studies are conducted, the researcher selects participants and then randomly assigns them to groups. In a simple, two-group experimental design, one group is provided with treatment while no treatment is given to the control group. The two groups are exposed to the same set of procedures, with the exception that the experimental treatment is withheld from the control group. This measure is taken to control for any extraneous variables that could affect expected outcomes. The researcher then compares the two groups on an outcome variable of interest, called the dependent variable, to determine the effect that the treatment had on that variable. However, in some studies, participants may already be grouped by variables

of interest to the researcher before a study is begun. In such circumstances, the researcher cannot manipulate the independent variable or variables. For example, a researcher may want to compare males and females on a theory-driven dependent variable such as level of aggression. Obviously, the researcher cannot manipulate the genders of the research participants. In such a case, a causal-comparative design would be appropriate, wherein the analysis would compare men and women as to their mean levels of aggression (using a t-test in this example). Generally, the independent variables used in causal-comparative designs consist of demographic or status characteristics, such as gender, race, educational level, or income categories.

Because causal-comparative designs lack control of most extraneous variables that may also influence between-group differences, they provide a limited indication of cause and effect relationships. In experimental studies, manipulation of the independent variable, and controlling for extraneous variables through random assignment to groups, allows the researcher to conclude, with some degree of certainty, that the effect the independent variable had on the dependent variable was causative. Without the ability to manipulate the independent variable or randomly assign participants to groups, the causal-comparative researcher cannot conclude with certainty what effect the independent variable had on the dependent variable. The researcher can only conclude that the groups differ with respect to that variable. Using gender again as an example, if the researcher finds that males and females differ on the dependent variable of aggression, he or she cannot conclude that gender "caused" this difference. This limitation by no means implies that causal-comparative designs are not useful; rather, they provide a structure for examining group differences when causal inference is not the primary purpose of the study.

The statistical tests used to determine the significance of the relationships between the independent variable(s) and the dependent variable in causal-comparative research are generally the same as those used in experimental and quasi-experimental designs. Both approaches often involve the use of such statistical tests as analysis of variance and t-tests. However, some experts caution against the use of such tests, especially when multiple independent variables are used [12]. In experimental or quasi-experimental research, participants can be assigned to groups so that the independent variables are truly independent of one another. However, when the groups are pre-existing, independent variables are likely to be correlated so that the indepen-

dent effects of each variable are difficult to determine, as is the meaning of the interaction between or among multiple independent variables. For example, suppose a researcher wants to examine the relationships between (a) race and religion (the independent variables) and (b) socioeconomic status (the dependent variable). Because race and religion are likely correlated (i.e., members of certain races tend to have similar religious orientations), it would be difficult to determine what effect each variable has independently on the dependent variable of socioeconomic status. Furthermore, an interaction between two independent variables is much more complex when the variables are correlated than when they are not correlated. Pedhazur and Schmelkin [12] discussed this issue in greater detail, and they suggest the use of multiple regression along with “dummy” or effect coding.

4. Selection of groups in causal-comparative designs

The most common method of selecting participants for causal-comparative research studies is to choose participants who already belong to the groups that the researcher is interested in studying. For example, if the researcher is interested in studying racial differences in adjustment to disability, he or she might employ stratified random sampling so that an adequate number of members of each racial group is included in the study. As noted previously, other intact grouping variables might include gender, status in the Vocational Rehabilitation (VR) program, residential circumstance, disability type, and level of functional capacity.

However, situations may arise when other group selection methods are more appropriate. Researchers may wish to study individuals from one group who are paired with, or bear some relationship to, members of another group. For example, a rehabilitation researcher may want to examine differences between persons with severe disabilities and their primary caregivers on the dependent variable of quality of life. In such a case, a matched-subjects design could be used. Adcock et al. [1] conducted such a study, where people with acute burn trauma were compared to hospital staff members on ratings of emotional distress. The authors used a paired samples t-test to analyze the data in this study, which compared specific patients with the health care professionals who had worked with them. Hollick et al. [7] compared pairs of monozygotic twins on person-

ality variables after one member of each pair sustained a spinal cord injury.

An additional method of selecting groups for causal-comparative designs is purposive sampling. The researcher may wish to select participants based on their known standing on a continuous variable of interest. The researcher would then select participants who represent extreme scores on this variable. For example, a rehabilitation researcher might wish to compare participants whose disabilities are either very mild or very severe, while excluding those with moderately intrusive disabilities.

5. Internal validity and external validity of causal-comparative designs

Because the independent variables are not manipulated, internal validity (i.e., the extent to which there is a causal link between the independent and dependent variables) of causal-comparative designs cannot be guaranteed. Participants' group membership and levels on other variables exist prior to the study, so the researcher cannot be certain that the independent variable “caused” changes in the dependent variable. For example, if participants were found to differ significantly on acceptance of disability based on type (i.e., people with different types of disability had different levels of acceptability of disability), the researcher could not conclude that disability type “caused” these differences. The question that remains to be answered is why people with disabilities differ with regard to acceptance. Other unidentified variables may help to explain these differences more completely than disability type alone (e.g., pre-disability adjustment, social supports, family constellation, socioeconomic status).

Because internal validity is difficult to verify, establishing the external validity of a causal-comparative study is of increased importance. Although experimental designs have a much stronger claim to internal validity than causal-comparative designs, they may or may not have a stronger claim to external validity, because external validity is established based on the degree to which the sample is representative of the larger population from which that sample was drawn. External validity is best established by randomly selecting participants for the research sample from the larger population and by securing the largest sample possible. If random selection is not possible, the researcher can still enhance external validity by selecting participants so that the research sample is representative of the

population along as many relevant demographic characteristics as possible. Often, however, rehabilitation researchers obtain convenience samples without making reference to the larger population from which these samples are drawn. The results of causal-comparative studies have little meaning if they are not reflective of the broader population from which the participant sample was derived, because, as mentioned previously, in the absence of internal validity, external validity assumes even greater importance.

6. Examples of causal-comparative designs

Wilson [13] used a causal-comparative design to compare acceptance rates for VR services by race. The author compared African Americans ($N = 3,852$) and European Americans ($N = 13,124$) with disabilities based on how frequently they were accepted for or denied VR services. Because both the independent and dependent variables (race and acceptance rate, respectively) were nominal, or grouping variables, a chi-square analysis was conducted. The author found no statistically significant differences between the two racial groups in their acceptance rates for VR services. Wilson et al. [14] conducted a causal-comparative study to replicate Wilson's [13] study with a different sample. The authors also compared African Americans ($N = 1,453$) and European Americans ($N = 3,122$) on acceptance rates for VR services, and they included education level as a control variable. The authors found that African Americans with a high school education were less likely to be accepted services than European Americans with a high school education.

Capella [3] also conducted a study examining the differences in VR acceptance rates between participants of different racial backgrounds. The author examined two samples of 10,000 participants. The first sample included those diagnosed with severe disabilities, and the second included those with non-severe disabilities. Capella conducted a binary logistic regression analysis with race and gender as the independent variables, age and education level as covariates, and acceptance for VR as the dependent variable. Logistic regression was used because the acceptance for VR variable was dichotomously scored (i.e., accepted versus not accepted). The author found that African Americans were significantly less likely to be accepted for VR than European Americans among the severe disability group. However, this result was not found for the non-severe disability group. In addition, the author conducted a

similar analysis with success in obtaining employment and quality of successful closures (i.e., high versus low quality occupations) as dependent variables. Capella found that African Americans and Native Americans were significantly less likely to successfully obtain employment than European Americans. Furthermore, the author found that Hispanic Americans were more likely than European Americans to obtain high quality closures.

Hampton and Marshall [6] employed a causal-comparative design to investigate the differences between American citizens and Chinese citizens with spinal cord injuries on several dependent variables. First, the authors compared American citizens ($N = 133$) and Chinese citizens ($N = 130$) with spinal cord injuries on four cultural values variables: separation from in-group, family integrity, self-reliance, and interdependence. The authors found that American citizens scored significantly higher on separation from in-group but significantly lower on family integrity and self-reliance than Chinese citizens. The groups did not significantly differ on interdependence. Next, the authors included culture (citizenship) and gender as independent variables to examine their relationships to life satisfaction. Cultural values and income were included in the analysis as covariates. Hampton and Marshall found a significant main effect for culture, but no significant main effect for gender. In addition, the authors found a significant culture by gender interaction, with Chinese males scoring significantly lower on life satisfaction than Chinese females and American males and females.

Ochs and Roessler [11] conducted a causal-comparative study to examine the differences between special education ($N = 95$) and general education ($N = 99$) students in their career development levels (i.e., vocational identity, career exploratory intentions, career outcome expectations, career decision making self-efficacy, and academic outcome expectations). The authors utilized a multivariate analysis of variance (MANOVA) with educational placement (special versus general education) and gender as the independent variables and the five career development variables as the dependent variables. The authors found a statistically significant main effect for educational placement overall, but no significant main effect for gender. In addition, the interaction between educational placement and gender was found to be statistically significant. Ochs and Roessler found that special education students scored significantly lower than general education students on four of the five career development

variables: vocational identity, career exploratory intentions, career outcome expectations, and career decision making self-efficacy.

A number of additional examples of causal-comparative research designs are present throughout the recent rehabilitation counseling literature. For example, Groomes and Leahy [5] examined the differentiating impact that type of coping disposition (problem-, emotion-, or avoidance-oriented) had on stress appraisal and acceptance of disability. Chan et al. [4] conducted a causal-comparative study to examine the difference between rehabilitation counseling students and business students in their attitudes toward people with disabilities at the beginning and end of their first year in college. Loo [8] also examined attitudes toward persons with disabilities using a causal-comparative design, comparing management undergraduates grouped into four categories: people with disabilities, those who had a friend or relative with a disability, those who worked with someone with a disability, and those who had no contact with someone with a disability.

7. Conclusion

Causal-comparative investigations make important contributions to the rehabilitation knowledge base. In studies involving intact or derived groups where nominally coded independent variables are neither randomly assigned nor manipulated (the lack of random assignment and non-manipulation of the independent variable chiefly distinguish causal-comparative designs from experiments), researchers utilize causal-comparative methods to examine differences between groups that are formed on the basis of important characteristics such as race, gender, disability type, and educational attainment. Rather than drawing cause-and-effect inferences regarding the relationships between grouping variables (the independent variables) and important rehabilitation outcomes (the dependent variables), causal-comparative studies examine group differences as they occur-without manipulation or intervention. As such, these types of studies have brought to the field

a steadily deepening understanding of the ways in which rehabilitation processes and outcomes may be related to the core attributes of consumers, researchers, and service providers.

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