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Some considerations in the interpretation of psychological data as they related to the effects of malnutrition [1, 2]

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SUMMARY

In general, in complicated scientific problems the interpretation of data requires careful estimation of the multiple sources of variance. Such is the case with the psychological data collected from studies relating to nutrition and mental development. Additional concerns, such as the cultural appropriateness both of psychological tests used and the interpretation of test results, make the study of malnutrition and mental development an extremely complicated research topic. In the present article a critical analysis is offered pointing out some of these concerns, emphasizing the precautions which should be taken to arrive at an adequate experimental design.

INTRODUCTION

The study of malnutrition and its relationship to mental development is complicated both by difficulties in specifying and measuring theoretically important variables, and by the

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complexity of the interrelationships among these variables (1-3). However, with specific reference to the interpretation of psychological data in studies of malnutrition and mental development one encounters two major areas of difficulty. The first of these difficulties arises from the fact that there exists a group of variables which, although not directly psychological in nature, either confound interpretation or dramatically raise the variability of outcome measurements. Confounding does not, however, represent all the analytic difficulties. The second major difficulty in the interpretation of psychological data is that of accurately inferring psychological structure and function in the specific cultural context where the study is conducted. In the ensuing discussion, data are presented in an exemplary fashion as they serve to illuminate the points being discussed. For the most part, these exemplary data were generated in a longitudinal study of malnution and mental development being conducted by the "Instituto de Nutrición de Centro América y Panamá" in Central América and are being reported in more detail elsewhere.[5]

EXOGENOUS VARIABLES

The necessity of coping with extraneous sources of variation and confounding is a well recognized problem. It becomes a particularly difficult problem in studies of the effects of malnutrition on mental development because mental development is a plastic and multi-determined phenomena. Without attempting an exhaustive discussion, we shall illustrate the problem of extraneous variability with some examples.

In many investigations of the topic discussed here, social-structural position —that is, the position and role of the family in the community and society— is given the logical status of a blocking variable. Thus, for purposes of analysis, families are frequently divided into different social-structural groups because, although the mediating mechanisms themselves are unknown, investigators have noticed that psychological performance frequently varies strongly across levels of social

5 The discussion focusses on children with mild-to-moderate protein-calorie malnutrition in their natural surroundings, rather than severely malnourished children in institutional settings. However, in the case of mild-to-moderate malnutrition we do not find the apathetic, isolated pehavior patterns, which are so common in severely malnourished institutionalized children.

strata. At best, this would be unwanted variance which is controlled for by grouping their subjects by "social class". But more serious is the fact that descriptive social variables such as social-structural position are not usually independent of nutrition and thus experimental control is required to avoid confounding (4).

Hypotheses which attempt to relate social-structural position to psychological performance generally do so in terms of patterns and styles of child-rearing, at one level, and to environmental levels of sensory stimulation and the opportunity to operate on a variety of stimuli at a still more discrete level. However, considerable variability in child rearing styles exists even within social strata (5) and the investigador looses precision in his measures if he elects simply to block on gross social-structural categories. Moreover, detrimental effects of malnutrition may be in part ameliorated by optimal levels of environmental stimulation and opportunities for early learning. If this is so, discrete measures of the social environment are crucial to understanding the relationship between malnutrition and mental development.

Another serious source of variation occurs in studies of children hospitalized as a result of their nutritional condition. Hospitalization (or institutionalization in general) can powerfully affect the intellectual and social development of children (6, 7). In spite of this fact, only one published study has attempted to estimate or to eliminate effects of institutionalization on psychological development (8).

In addition to the sociocultural and environmental factors which affect the course of intellectual development, there is also a group of biomedical variables which, if allowed to vary indiscriminately, make psychological test results difficult to interpret. As with sociocultural factors, there are essentially two concerns: variability and confounding. Intrauterine infection and perinatal anoxia are examples of troublesome sources of variability. Since these factors are rarely measured at birth, they usually remain hidden and thus make interpretation of psychological data particularly difficult. When the groups of subjects under study are small, and/or when the hypotheses governing statistical procedures are not rigorously examined, the presence of a few of these subjects as outliers in the distribution may be sufficient to generate statistically

significant group differences. Possibly, these are some of the differences which find their way into published literature.

In summary, there are both social and biomedical variables, apart from the nutritional variables under study, which may contribute a troublesome degree of variance to psychological test performance and behavior and thus render difficult the interpretation of results of psychological tests. Only through carefully implemented experimental designs can the investigator be in a position to eliminate alternative explanations of his findings.

INTERNAL COHERENCE

Successful resolution of the question: "How does malnutrition affect psychological performance?" will rest on the systematic use of models in the conceptualization and operationalization of notions about psychological performance. Thus, a first crucial step facing the investigator in the planning of such research is the careful operationalization of the constructs he will measure. For without a sufficiently ample conception of psychological development, the investigator runs the risk of misinterpreting his findings because he has not sampled a sufficiently broad spectrum of psychological function. Many published studies of the effects of malnutrition on psychological performance are flawed by the application of one test as a single index of a particular psychological construct with insufficient concern of its theoretical adequacy. Specifically, the danger here is the misinterpretation of the meaning of a response and the attribution of poor performance to a psychological function which the test presumably measures, where in fact, an intervening construct may more accurately account for the observed behavior. An example of such a case is presented by Kagan & Kogan (9) in which six-year-old children were administered the following class inclusion problem: "There are 13 boys and 10 girls in a class. Are there more boys or more children?" When the problem was presented orally, only 10% answered correctly "children". When the problem was presented in written form so that the child had continual access to all elements of the problem 70% of the children answered correctly "more children". In this case, it is more parsimonious to postulate memory deficits

related to the mode of presentation of the problem rather than to assert that six-year olds cannot solve class inclusion problems.

Cultural appropriateness, both of the psychological tests used and of the interpretation of test performance, is an equally sensitive problem. Unambiguous interpretation of psychological performance requires that the investigator has mapped the domain of psychological behavior with sufficient precision that he can make sense of children's behavior in the context of the social requirements levied against the children in a particular culture.

We find, for example, upon interviewing adults in rural Guatemalan villages, that an admired characteristic of young children is that they be generally quiet and non-intrusive in adults' affairs. We are currently exploring the possibility that this generalized adult orientation toward suppressing unnecessary verbal behavior is related to the retardation in verbal ability which we find in our sample. Should this be the case, it may be impossible to demonstrate any effect of nutrition on psychological development, using verbal behavior as an index, even if such an effect exists, since a higher level of environmental press for linguistic performance may be required for an improvement to occur. Obviously, the situation is complicated and requires careful analysis of context: children should be active and responsive, but not in the affairs of adults!

Another example of the complications resulting from the interaction between cultural expectations and environmental factors is seen in the case of response impulsivity. It has been demonstrated that for psychological tests in which the subject must analyze several possibly correct answers before responding, the tendency to respond impulsively results in poor performance (10). But in has also been suggested that one of the behavioral correlates of mild malnutrition may be response impulsivity[6] or a generally heightened level of activity (3). Moreover, hyper-activity is also a frequently encountered behavioral characteristic among children with minimal brain damage (9). Thus, we have two possible factors, malnutrition

6 Impulsivity is specifically defined in the context of the test and refers to the child's response rhythm (i. e., a tendency to respond rapidly on a complicated problem); it is independent of his general activity level as measured in free play situations.

on the one hand and minimal brain damage, perhaps not due to malnutrition, on the other which may incline children to behave impulsively on tests wherein impulsive responses will prejudice their performance. To further complicate the picture, interviews conducted with parents of preschool children in our Guatemalan sample reveal that physically active and quick moving children are judged smarter or more intelligent. Since parents place value on smartness or intelligence, we suspect that they also reinforce and put high premium on this kind of behavior. Thus, children who are seen by their parents to be performing adequately would also be predicted to be relatively impulsive. These speculations about the causes of response impulsivity highlight the type of interpretative problems to be encountered in the evaluation of psychological performance in studies of malnutrition and mental development.

Test validity is an additional complication which must be faced, and the validation of an investigator's notions about culturally relevant dimensions of psychological performance are not easily obtained. An example of such an attempt comes from a small study conducted by a member of our group investigating social competence in preschool children. Fifty parents of preschool children were interviewed with respect to what they considered to be the behavioral characteristics of smart children. In addition to collection of interview data, 35 adults were asked to rank 10 children in terms of "smartness". Two aspects of the results of this study are of interest here. The first, mentioned earlier, is that children who move quickly and impulsively are considered smart. The second point of interest is that the adults could rate with high levels of agreement among themselves, which were the smartest children. Moreover, significant correlations were found between adult's rating of children's "smartness" and the children's performance on test of perception, memory, and verbal analogies. Thus, for these intellectual tasks, there was good correspondence between the adult's judgment and the children's performance, suggesting that these psychological tests are tapping culturally relevant intellectual skills.

The adequacy of control groups presents a final problem of interpretation. Without some type of nutrition intervention, it is essentially impossible to obtain an adequately nourished group which is at the same time comparable to a mal-

nourished group in terms of the bio-social factors discussed earlier (1). However, the very process of nutritional intervention may affect psychological development by providing dimensions of social stimulation not normally available. The design of the study being carried on by the Division of Human Development for example, involves daily attendance at nutritional supplementation centers to insure adequate nutritional status among preschool children in two villages. The possibilities for changes in psychological test performance due to increased social stimulation obliged us to develop similar centers for the two control villages in our study to insure parallel social experience. Without such a control it would be difficult to interpret group differences in psychological performance.

RESUMEN

Algunas consideraciones para la interpretación de datos psicológicos en función de los efectos de la desnutrición

En general, cuando se trata de investigaciones científicas complejas, la interpretación de datos requiere una estimación cuidadosa de las múltiples fuentes de variabilidad. Esto sucede en el caso de datos psicológicos obtenidos en el curso de estudios que persiguen determinar la relación entre nutrición y desarrollo mental. Otros factores, tales como la adecuación cultural tanto de las pruebas psicológicas utilizadas, como la interpretación de los resultados de esas pruebas, hacen del estudio de la desnutrición y del desarrollo mental un tema de investigación sumamente complicado. En este trabajo se presenta el análisis crítico de algunos de estos factores haciendo énfasis sobre las precauciones que deben adoptarse para lograr un diseño experimental adecuado.

BIBLIOGRAPHY

(1) Klein, R. E., O. Gilbert, C. Canosa & R. De León.—Performance of malnourished in comparison with adequately nourished children on selected cognitive tasks (Guatemala). Paper presented at the Annual Meetings of the American Association for the Advancement of Science, Boston, December, 1969.

(2) Klein, R. E.—Some considerations in the measurement of the effects of food supplementation on intellectual development and social adequacy. In: Proceedings of the International Conference on Amino Acid Fortification of Protein Foods. N. S. Scrimshaw & J. E. Gordon, Eds. Cambridge, MIT Press, in press.

(3) Klein, R. E., J. P. Habicht & C. Yarbrough.—Effect of protein-calorie malnutrition on mental development. **Advances Pediat., 18:** in press.

(4) Méndez, A.—Método para medir la situación sociocultural de las familias rurales centroamericanas y su aplicación a los programas de salud. **Arch. Latinoamer. Nutr.**, 20: 281-291, 1970.
(5) Steckler, G.—Personal communication.
(6) Spitz, R. A.—Hospitalism: an inquiry in to the genesis of psychiatric conditions in early childhood. **In:** The psychoanalytic study of the child, Vol. I. New York, International University Press, 1958.
(7) Yarrow, L. J.—Separation from parents during early childhood. **In:** Review of child development research, Vol. I. M. L. Huffman & L. W. Huffman, Eds. New York, Russell Sage Foundation, 1964.
(8) Chase, H. P. & H. P. Martin.—Undernutrition and child revelopment, **New Eng. J. Med.**, 282: 933, 1970.
(9) Kagan, J. & N. Kogan.—Individual variation in cognitive processes. In: Carmichael's manual of child psychology, Vol. I, P. H. Mussen, Ed. New Kork, John Wiley & Sons, 1970. p. 1273-1365.
(10) Kagan, J.—Reflection-impulsivity: the generality and dynamics of conceptual tempo. **J. Abnorm. Psychol.**, 71: 17-24, 1966.