Medical Examination in Nutrition Surveys

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ABSTRACT Pellagra was the most important deficiency disease used as a model for nutrition surveys, because its diagnosis depended on physical signs. By the mid twentieth century, laboratory tests improved the specificity of physical signs in diagnosis of deficiency disease. The author uses his experience in Panama to illustrate how attention to the details of a medical examination can improve accuracy and sensitivity of a nutrition survey. J. Nutr. 135: 1266–1267, 2005.

KEY WORDS: nutrition survey • ICNND • physical signs of nutrition status • beriberi • pellagra

Nutrition surveys are designed to detect malnutrition by a variety of anatomical, chemical, and physiological criteria that are related to estimates of nutrient intakes and assessments of public health. Related information on agriculture, demographic, economics, food technology, etc., is important to the success of the survey. Successful surveys depend on a wide variety of talent and organizational skill. The people surveyed should be a good statistical sample of the population as a whole. The numerous medical nutrition surveys conducted by the Interdepartmental Committee on Nutrition for National Defense (ICNND) addressed the goals of numerous national and international organizations so that conditions leading to malnutrition could be identified along with means of improvement (1).

The ICNND surveys were based on modern nutritional thought that evolved from concepts developed as scurvy (2), beriberi (3), and pellagra (4) were simplified from their seemingly multifactorial origins (5–7). Pellagra probably was most important in the development of the surveys, because it had been an enormous problem in the United States (8–9), and the work leading to the realization that niacin was both curative and preventive was done in the United States (4). In 1917, the death rate for pellagra in some cotton-mill villages in South Carolina was approximately one-half that for ischemic heart disease in the United States in 1975 (10).

Joseph Goldberger, M.D., was a complete epidemiologist and nutritionist although his background was in infectious disease (11). His multifarious talents led him to correct inferences after examining vital statistics and patients at the bedside. He designed community surveys and clinical trials, evaluated sanitary and social conditions, and experimented with animals. Because few involved in medical and nutritional research have either the interest or the ability to do all of these things, surveys rely on many specialists for success.

Reading Goldberger's original articles provides a realization that subtle changes in health and metabolism occur before clinical disease is obvious. He relied on the appearance of skin lesions to corroborate the induction of pellagra by diet at a time when laboratory diagnosis was impossible (12).

Dann and Darby defined 5 zones of nutriture (13,14): 1) saturation, 2) unsaturated but functionally unimpaired, 3) potential deficiency disease, 4) latent deficiency disease, and 5) clinically manifested deficiency disease. Laboratory tests usually are used to assign an individual to one of the zones. If intake of a nutrient is insufficient for a long time, a person will move toward, and may reach, zone 5. When body stores are depleted, biochemical changes occur that lead to changes in physiology and morphology, which can be detected as deficiency disease. Emphasis in surveys is on the latter 3 zones.

The initial phase of a medical examination comprises a history and a physical examination, which may reveal some nonspecific physical signs. Laboratory tests then are used to

1 Presented as part of the symposium “History and Legacy of The Interdepartmental Committee on Nutrition for National Defense (National Development),” given at the 2004 Experimental Biology meeting on April 20, 2004, Washington, DC. The symposium was sponsored by the American Society for Nutritional Sciences. The proceedings are published as a supplement to The Journal of Nutrition. This supplement is the responsibility of the Guest Editors to whom the Editor of The Journal of Nutrition has delegated supervision of both technical conformity to the published regulations of The Journal of Nutrition and general oversight of the scientific merit of each article. The opinions expressed in this publication are those of the authors and are not attributable to the sponsors or the publisher, editor, or editorial board of The Journal of Nutrition. The Guest Editors for the symposium publication are Harold H. Sandstead, The University of Texas Medical Branch, and Gilbert A. Leveille, Cargill Corporation.

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4 Leslie M. Klevay worked as a physician in the survey of the Republic of Panama and co-authored the clinical report with Harold H. Sandstead. He later instructed physicians how to do nutritional examinations in five states of the Ten State Nutrition Survey in the U.S. and advised the National Center for Health Statistics about appropriate laboratory tests for the earliest phases of HANES. Samples for his first paper on copper (28) were collected in Panama; see (29) for a map of survey locations. He is a Fellow of the American Society of Nutritional Sciences and of the American Association for the Advancement of Science.
augment the senses of the physician to obtain a correct diagnosis, to evaluate prognosis in a patient with known disease, to detect early manifestations of disease in an apparently healthy person, to assess therapeutic interventions, and to predict future illness. Good tests are positive in diseased people and are negative in healthy people (15); this statement applies to physical signs as well as to laboratory tests.

Galen and Gambino (15) discuss the impossibility of having laboratory tests that are both highly sensitive and highly specific. They illustrate how a higher hemoglobin value can improve sensitivity in the diagnosis of anemia at the expense of specificity. In the survey of Panama, if we were in doubt that a survey subject had marginal redness of the gums (potentially a sign of scurvy), a pale tongue (potentially a sign of anemia), or dermatitis (potentially a sign of pellagra), etc., we would consult one of the other medical examiners. If 2 examiners agreed that a sign was positive, it was recorded as positive. If there was disagreement between examiners, the sign was recorded as negative. This procedure introduced an intentional bias toward larger lesions that improved sensitivity for the survey as a whole. Because there is a fairly extensive literature on differences between observers in the reading of electrocardiograms and x-rays, etc., it is not surprising that skilled examiners may differ.

Physical signs (16) of malnutrition recorded in the surveys were interpreted later in the light of results of the laboratory tests and other data to improve the overall accuracy of the survey. Sometimes comparison of signs with laboratory data can provide new knowledge (17).

In the context of ICNND and its origins, angular oral fissures were common among Chinese troops in 1945 (18) and Republic of Korea Army troops in 1953 (19) when examined by J. B. Youmans, M.D., and H. R. Sandstead, M.D., respectively. The relation of angular oral fissures to riboflavin deficiency was reported by Sebrell and Butler in 1938 (20). Later, in 1953, Vilter et al. (21) reported an association with pyridoxine deficiency. Angular oral fissures also are found with acrodermatitis from zinc deficiency (22–24). The apparently dissimilar origins of this lesion may be the result of the essentiality of zinc for the activity of flavokinase and pyridoxal kinase (25). The association of one lesion with deficiencies of 3 different nutrients illustrates the lack of specificity of physical signs.

It generally is agreed that accuracy in measurement is desirable. When we were being instructed in survey methods before we approached the equator, Edwin B. Bridgforth, M.S., told us that on a statistical basis, too many blood pressure readings end in the digits 0 or 5, although sphygmomanometers are calibrated in units of 2. He also said that some individual examiners have a statistical tendency, e.g., to record readings that end in 2 or 4, etc., and admonished us to be as accurate as possible.

Accuracy and sensitivity are for naught if people do not come to be surveyed. I remember a town in eastern Panama where we had far more people with angular oral fissures than we anticipated, and the town was so isolated that we could not complete our survey. This led to the development of the Harvard step test (26). In the United States you do not have to travel by DC-3, motorized canoe, or Land Rover to find evidence of malnutrition (26–27), even if you do not count ischemic heart disease, obesity, and osteoporosis as malnutrition.

ACKNOWLEDGMENT

I thank Harold H. Sandstead, M.D. for helpful discussion.

LITERATURE CITED


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