

surveillance for IDDM in Colorado was investigated.

Currently, a total of 560 cases potentially meeting the study criteria have been identified, primarily through a surveillance network of physicians and nurses. Questionnaires detailing patient and parent demographics, health care patterns, postdiagnosis acute complications, and patient and parent perception of the impact of IDDM were sent to all persons identified. Analysis of the data is currently in progress. Preliminary results have indicated that active surveillance of IDDM in Colorado is feasible, and efforts are continuing to register actively all newly diagnosed IDDM case.

MAGDALENA COOK, MS
Colorado Department of Health
Denver

Seizures Apparently Triggered by Video Games

To the Editor.—We would like to add another case to the report of Dahlquist et al (1983;249:776) regarding video game-precipitated epilepsy.

Report of a Case.—An 8-year-old boy traveled overnight with his family to a mountain resort, obtaining little sleep. After skiing for several hours, the patient separated from his family and began playing an arcade video game, where he suffered an unobserved fall. He was unresponsive for several minutes but gradually awoke and regained orientation. He did not recall falling.

He was admitted to a local hospital, where, while sleeping in the early morning, he was observed to have a brief generalized convulsion. He was discharged receiving phenobarbital. An EEG obtained several weeks later demonstrated frequent spontaneous bursts of left focal polyspike and slow wave activity.

The patient's first year of life was remarkable for a probable near-sudden infant death syndrome, from which he was resuscitated by his mother. He also required treatment for Legg-Perthes disease.

Comment.—As judged by this patient's EEG, he was evidently predisposed to the development of a seizure disorder. We believe, however, that the photic stimulation produced by the video screen triggered his first seizure. An additional factor, as noted by Dahlquist et al, was the presence of prior sleep deprivation.

We suspect that the occurrence of seizures while playing video games will become a not uncommonly reported event. Arcades, because they are generally poorly lighted and require players to be close to the screen, probably provide a stronger photic stimulus than does ordinary

television viewing or home video playing. Young video game enthusiasts with light-sensitive epilepsy should be advised to use home sets only, where room lighting and distance from the screen can be increased to limit the intensity of the photic stimulus.

PAUL C. HELFGOTT, MD
JOAN MEISTER, MD
Whittier, Calif

Cost-effective Sampling of Serum Creatine Kinase in Diagnosis of Acute Myocardial Infarction

To the Editor.—Dr Fisher and colleagues (1983;249:393) should be complimented for their interest and effort in promoting cost-effective use of the clinical laboratory. The authors suggest that it is more cost-effective to sample serum creatine kinase (CK) on an every 12-hour (Q12hr) than an every 24-hour (Q24hr) basis in treating patients with suspected acute myocardial infarction (MI). Lest clinicians alter their practices in a manner not intended by the authors, it should be emphasized that the authors' conclusion is valid only if the duration of sampling in the Q12hr strategy is 24 hours, while that in the Q24hr strategy is 48 hours.

Since none of the patients found to have diagnostic CK elevations were missed by either the Q12hr or Q24hr methods, the effectiveness comparison hinges on the frequency with which "clinically important" underestimation (≥ 500 units/L) or peak CK occurs in each strategy. In the study of Fisher and co-workers, four such cases that were detected by the Q12hr method would have been missed by the Q24hr method.

What about costs? As described by the authors, the Q12hr strategy included an admission sample plus an 8 AM/8 PM pair during the first 24 hours (ie, three samples), while the Q24hr strategy included an admission sample plus a daily 8 AM sample for 48 hours (also three samples). Thus, the costs of the two sampling strategies are equal, making the Q12hr strategy more cost-effective (assuming one believes that there is value in not underestimating peak CK by ≥ 500 units/L).

If, on the other hand, both sampling strategies were to last for 48 hours, (ie, five samples in the Q12hr strategy v three samples in the Q24hr strategy), a different conclusion might emerge. Assuming a cost of \$10 per serum enzyme determination (which is reasonable, since determi-

nations of SGOT and lactic dehydrogenase levels are usually obtained along with those of serum CK levels), the marginal cost of applying the Q12hr rather than the Q24hr strategy to the 314 patients in Dr Fisher's study would then be \$6,280, or \$1,570 per case of "clinically important" peak CK underestimation detected. Whether it would be worth spending \$1,570 to obtain the peak CK information then becomes a matter of judgment. (By suggesting that sampling Q12hr is more cost-effective than sampling every four hours [Q4hr], Dr Fisher and co-authors imply that it would not be worth obtaining 1,256 extra CK determinations associated with sampling Q4hr to detect the four cases of "clinically important" CK underestimation missed by employing the Q12hr rather than Q4hr strategy.)

EARL STEINBERG, MD, MPP
Baltimore

In Reply.—I thank Dr Steinberg for his remarks and thoughtful reappraisal of our findings. However, the statement that "determinations of SGOT and lactic dehydrogenase levels are usually obtained along with those of serum CK levels" deserves comment. Although this is still a common practice, the routine use of these additional tests is not appropriate or cost-effective.^{1,2} Costs should be calculated by assuming that CK level determinations are routinely required only for the first 24 hours and need not be accompanied by repetitive analysis of levels of less specific serum enzymes.

MICHAEL L. FISHER, MD
Baltimore

1. Grande P, Christiansen C, Pedersen A, et al: Optimal diagnosis in acute myocardial infarction: A cost-effective study. *Circulation* 1980;61:723-728.

2. Fisher ML, Kelemen MH, Collins D, et al: Routine serum enzyme tests in the diagnosis of acute myocardial infarction: Cost-effectiveness. *Arch Intern Med* 1983; 143:1541-1543.

Reactions to Tetanus Toxoid

To the Editor.—Jacobs and colleagues are to be commended for their review of reactions to tetanus toxoid (1982; 247:40). The authors have demonstrated effectively that a history of reaction to tetanus toxoid correlates poorly with the subsequent reactions to intradermal skin testing with dilute solutions of tetanus toxoid; only 1.4% of such patients had a reaction in their series. However, I question their conclusion that the reactions they observed were caused by tetanus toxoid and not by diphtheria toxoid. In their challenge study,

the authors apparently used DT vaccine, which contains 10 Lime flocculating (LF) units of diphtheria toxoid, rather than Td, which contains 2 units. DT is not recommended for adults, chiefly because of the high incidence of reactions to the full dose; thus, one could ask whether the tetanus component of the combination was, in fact, responsible for the reactions.¹

In 1979, we studied adverse cutaneous reactions to the intradermal injection of diphtheria-tetanus-pertussis (DTP) vaccine.² One hundred one adults were inadvertently immunized with 0.1 mL of DTP instead of PPD during an examination of contacts of a patient with tuberculosis. Severe local reactions at the site of administration of DTP occurred in 90% of recipients. As also found by Jacobs et al, the degree of reaction did not correlate with a prior history of immunization. In fact, some of the most severe reactions were experienced by persons who had had no prior immunization. We showed that the levels of diphtheria and tetanus antitoxins and pertussis antibody were higher in patients who had had a previous immunization than in those who had not had a previous immunization but we could not determine which of the three components caused the inflammation. Jacobs et al described three patients who were challenged with 0.1 mL of full-strength tetanus toxoid (and diphtheria toxoid, I assume from Table 1), and in whom large indurated lesions developed lasting several days. These reactions were apparently similar to the persistent reactions that we noted among our patients who received 0.1 mL of DTP. Were any other patients in their study challenged with the same dose of 0.1 mL?

The authors mentioned that the three patients given the intradermal medication received it "inadvertently." Do they know why this inadvertent administration occurred?

Finally, what syringes and needles were used to give injections of 0.01 mL and 0.02 mL? Precise measurement of such small amounts is extremely difficult with standard medical equipment.

DONALD R. GRAHAM, MD
Springfield Clinic
Springfield, Ill

1. Edsall G, Altman JS, Gaspar AJ: Combined tetanus-diphtheria immunization of adults: Use of small doses of diphtheria toxoid. *Am J Public Health* 1954;44:1537-1545.

2. Graham DR, Dan BB, Bertagnoli P, et al: Cutaneous inflammation caused by inadvertent intradermal administration of DTP instead of PPD. *Am J Public Health* 1981;71:1040-1043.

In Reply.—Dr Graham and associates report a predictable response to an immunizing agent when administered in significant volume and high concentration into the intradermal space. The reactivity may result from release of mediators of inflammation through any or all of a variety of mechanisms, including direct toxicity to local tissue cells, specific humoral (antibody) recognition of antigenic material, and specific cellular (type IV) recognition and response.

As Dr Graham correctly points out, one cannot determine with certainty which immunizing agent, when given in combined form, is responsible for the reactivity that may occur. Clearly in the older child and adult, pertussis immunizations are likely to cause large local reactions as well as constitutional symptoms of fever and malaise.¹ DT (10 LF units of diphtheria), when administered to the adult, is often associated with similar reactions. Td (2 LF units of diphtheria toxoid) is substantially less reactive, and reactions encountered, in general, can be attributed to the tetanus toxoid component.² Fluid tetanus toxoid given as a booster also causes identical local reactions of approximately equal frequency to Td.

In our report, during the testing phase of the patient evaluation, only dilute tetanus toxoid was used, with four of 740 (0.54%) reacting in the immediate time frame, of whom two were subsequently challenged without an adverse response. In the challenge phase of our report, Td (2 LF units of diphtheria) was used. Of the six patients in whom Td caused reactivity during the challenge phase, three were found to have type IV (delayed hypersensitivity) to the mercury-containing preservative thimerosal at a full-strength concentration by both intradermal testing (0.02 mL) and patch testing. This reaction to thimerosal probably will be seen only with use of the jet injector apparatus, since there is invariably some intradermal deposition. When given subcutaneously or intramuscularly, removal is rapid enough to avoid any substantial local cutaneous reactivity. The remaining three patients were given simultaneously 0.1 mL of full-strength Td into the forearm by a physician without clear reason but presumably to avoid adverse reactions possibly related to volume. All, however, suffered severe local reactions. Edema developed in the forearm of one patient, threatening compromise of circulation to the hand and requiring overnight hospitalization for observation. We have seen

other patients challenged by physicians with similar doses and concentrations and similar large reactions. Since testing or challenging intradermally with large volumes and concentrations of Td gives one little useful information and may cause substantial morbidity, it is contraindicated.

A final point raised by Dr Graham concerns equipment and technique. Testing and challenges were carried out using 1.0-mL syringes with 27-gauge needles. Rather than measuring the volume, one measures the wheal. A volume of 0.01 mL causes a wheal size of 4 mm, and 0.02 mL should wheal to 6 mm.

COL ROBERT L. JACOBS, MC, USAF
Wilford Hall USAF Medical Center
Lackland, Tex

1. Centers for Disease Control: Diphtheria, tetanus, and pertussis: Guidelines for vaccine prophylaxis and other preventive measures. *Ann Intern Med* 1981;95:723-728.

2. Levine L, Ipsen J Jr, McComb JA: Adult immunization: Preparation and evaluation of combined fluid tetanus and diphtheria toxoids for adult use. *Am J Hyg* 1961;73:20-35.

CORRECTIONS

Incorrect Price.—An error occurred in the LETTERS section in the March 11 issue of the *THE JOURNAL*. In the Letter to the Editor entitled "Identification of Diabetic Retinopathy" (1983;249:1267), the second sentence in the "Comment" section should have read as follows: "It can be performed by the physician's assistant for about 50 cents."

Incorrect Affiliation.—An error occurred in the LETTERS section in the May 13 issue of *THE JOURNAL* (1983; 249:2460). In the Letter to the Editor entitled "Injuries From Fireworks," the affiliation for Dr Harris should have listed the Centers for Disease Control, Atlanta, in addition to the Washington State Department of Social and Health Services, Seattle.

Incorrect Wording.—An error occurred in the article entitled "Rhesus Diploid Rabies Vaccine (Adsorbed), A New Rabies Vaccine. II. Results of Clinical Studies Simulating Prophylactic Therapy for Rabies Exposure," published in the May 20 issue of *THE JOURNAL* (1983; 249:2663-2665). On page 2665, column 3, the first full sentence in that column should have read as follows: "This new vaccine could also be a reasonable alternative for continuing prophylactic treatment when HRDV is not available. . . ."