General Nutrition Management in Patients Infected with Human Immunodeficiency Virus

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Nutritional management is integral to the care of all patients infected with human immunodeficiency virus (HIV). HIV infection results in complicated nutritional issues for patients, and there is growing evidence that nutritional interventions influence health outcomes in HIV-infected patients. We define levels of nutritional care, and we discuss when patients should be referred to providers (i.e., registered dietitians) with nutritional and HIV expertise.

Nutritional management is integral to the care of all HIV-infected patients. Approximately 920,000 Americans (36 million people worldwide) are estimated to be infected with the HIV, with ~40,000 new infections in the United States per year [1, 2]. During the course of HIV infection, several nutritional issues are likely to arise, including the need for education about the following:

- Healthful dietary principles.
- Maintenance of lean body mass and normal growth in children, and the treatment of wasting.
- Management of metabolic complications due to drug therapies.
- Management of drug and food or nutrient interactions.
- Management of gastrointestinal symptoms that may influence the types and amount of food ingested.
- Appropriate use of herbal and/or nutritional supplements.
- Cultural and ethnic beliefs related to diet and food [3, 4].

- Role of exercise.
- Relationship between substance abuse and nutrition.
- Food safety.
- Nutrition during pregnancy.
- Access to infant formula and food as an alternative to breast-feeding.

HIV-infected patients may be at nutritional risk at any point in their illness [5–8]. Severe malnutrition and weight loss, particularly loss of lean tissue, and delayed weight gain and height velocity in children, can affect morbidity and mortality [9–21]. Fear of developing fat-redistribution syndrome, with central obesity and loss of subcutaneous fat, may prevent patients from beginning or continuing potent antiretroviral therapies [22–26]. Development of hyperglycemia and lipid abnormalities may increase the risk of diabetes, heart disease, and stroke [27–31]. The appearance of these metabolic changes may induce patients to cease HAART or to change to less effective antiretroviral regimens.

Food and drug interactions are an important issue for effectiveness and tolerability of HAART regimens. The presence of food in the gastrointestinal tract can influence the absorption of several HIV medications such as didanosine, indinavir, saquinavir, and nelfinavir. Drug-food interactions can influence serum drug concentrations, thus increasing the likelihood of side effects when serum concentrations are too high and increasing

the risk for viral resistance and loss of durable viral suppression when serum concentrations are too low. In addition, complicated medical and food schedules as well as side effects of the medications can compromise adherence to and tolerability of the regimen. Table 1 summarizes the drug-food interactions with antiretroviral medications [32–34]. It is important for health care professionals to be knowledgeable about these interactions so they can help patients with timing of their antiretroviral regimens with regard to food.

Anorexia and oral/gastrointestinal symptoms such as pain, nausea, vomiting, malabsorption [35–37], and diarrhea may arise from HIV infection, secondary infections, encephalopathy [38], or drug therapies. Inability to eat food secondary to complicated medical regimens or fatigue adds to the nutritional risk. Opportunistic infections [39] are associated with increased resting energy expenditure, and HAART may be associated with increased [40] or decreased [41, 42] resting energy expenditure. Clinically, these symptoms may prevent adequate nutritional intake [8, 43–46], resulting in continued weight and lean tissue loss [39, 41], vitamin or mineral deficiencies [47–58], and poor nutritional status [59, 60]. Chemical dependency and socioeconomic factors can limit access to proper food and nutrition [61–63]. The malnutrition that results can itself contribute to an increased immunocompromised state [64–68].

WHAT EVIDENCE IS THERE THAT NUTRITIONAL INTERVENTION INFLUENCES OUTCOME?

Nutritional counseling has been shown to be effective; it has also been shown to influence health outcomes in HIV infection [69–71]. When dietary counseling is combined with oral nutritional supplements, there is additional evidence for its value [72–76]. Nutritional counseling also facilitates access to adequate dietary intake.

A regular resistance exercise program has been shown to improve lean body mass and strength in HIV-infected patients [77]; such exercise reduces serum triglyceride levels with [78] and without [79, 80] anabolic therapies. Promoting regular fitness may minimize muscle wasting [81] and normalize blood lipids without requiring the addition of pharmacologic therapies to patients already receiving complicated medical regimens.

Several studies have documented marginal-to-deficient vitamin and mineral status associated with adverse outcomes [5, 6, 50–59]. However, there is little documentation in the literature that supplementation beyond what is recommended has had any impact on clinical outcome. If a patient's vitamin or mineral status is deficient, supplementation is clearly necessary.

Few studies have looked at enteral and parenteral feedings in HIV-infected patients. In general, patients who have gastrointestinal disease, including malabsorption, benefit from enteral or parenteral feedings [82–94]. Despite the small number of studies, the benefit of enteral and parenteral feedings was demonstrated for patients who were not receiving active antiretroviral therapy. This benefit was also demonstrated to extend to life expectancy.

Various pharmacological therapies have been used to maintain or increase body weight in patients who experience wasting. Studies vary in design from open-label to placebo-controlled trials. Appetite stimulants such as megestrol acetate [95–97] and dronabinol [98, 99] improve appetite and body weight. Anabolic therapies such as growth hormone [100–103], oxandrolone [104, 105], nandrolone decanoate [80, 106, 107], and combinations thereof [108, 109] can help maintain or increase lean body mass, even in those patients who require physiologic testosterone replacement [110–114]. Anticytokine therapies such as thalidomide [115] and pentoxifylline [116] have been used to attenuate the catabolic response to inflammation. Other agents have been used to treat the signs and symptoms of the metabolic complications associated with HAART, including antilipemic medications such as statins, fibrates, fish oil, and niacin and antiglycemic medications such as metformin and the glitazones. Therapies for symptomatic relief such as antidiarrheals, antiemetics, and analgesics can also help reduce a patient's nutritional risk.

Since the era of HAART, incidence of wasting has been reduced [117], which is perhaps the result of the prevention of disease progression and opportunistic infections. However, it is not clear that HAART results in improved body weight [118]. If weight does increase while the patient receives antiretroviral therapy, the gain appears to be mostly fat rather than lean body mass [119]. In children, catch-up growth has been reported after initiation of HAART [120, 121].

WHAT ARE THE LEVELS OF NUTRITION CARE?

Because of the rapidly changing picture of HIV disease, the CDC classification by CD4 count and clinical signs and symptoms may not be appropriate for nutritional complications or referrals. Rather, defining levels of risk for nutritional compromise as the trigger for nutrition referral and intervention may be more practical, given current resources. Ideally, all patients infected with HIV should have access to a registered dietitian (RD). Nutritional and medical assessments are needed for optimal individualized care [70, 122].

The initial visit of a new HIV-positive patient should include screening for nutritional risk. A validated screening tool is needed to assess the degree of nutritional risk. The purpose of screening is to categorize a patient's nutritional needs as low, moderate, or high risk for nutritional compromise. If indicated, referral to an RD for nutrition assessment and development of an individualized care plan should be made. Follow-up visits of stable HIV-positive patients should include an annual screen-

Table 1. HIV medication and food interactions.

Antiretroviral medication and usual adult daily dosage	Food effect	Dietary recommendation	Dosage form
	NRTI		
Zidovudine (Retrovir-AZT-ZDV), Glaxo Wellcome, 300 mg b.i.d.	Administration of zidovudine capsules with food decreased peak plasma concentration by >50%; however, AUC may not be affected; or AUC decreased by 25% after meal. Avoid alcohol.	Take on empty stomach, if possible. If this is not possible because of GI side effects, recommend taking with low-fat meal.	300 mg tablet; 100 mg capsule; 50 mg/5 mL syrup
Lamivudine (epivir-3TC), Glaxo Wellcome, 150 mg b.i.d. or 300 mg q.d.	Food has little effect on the extent of absorption. Avoid alcohol.	Can be taken without regard to meals. If taken with meals, may decrease GI side effects.	150 mg tablet; 10 mg/mL oral solution
Zidovudine- lamivudine (Combivir, AZT-3TC), Glaxo Wellcome, 1 tablet b.i.d.	Administration of zidovudine capsules with food decreased peak plasma concentration by >50%; however, AUC may not be affected; or AUC decreased by 25% after meal. Avoid alcohol.	Take on empty stomach, if possible. If this is not possible because of GI side effects, recommend taking with low-fat meal.	300 mg AZT and 150 mg 3TC per tablet
Abacavir (Ziagen-ABC), Glaxo Wellcome, 300 mg b.i.d.	There was no significant difference in systemic exposure (AUC) in the fed and fasted states. Alcohol increased AUC by 41%. Avoid alcohol.	Can be taken without regard to meals.	300 mg tablet; 20 mg/mL oral solution
Zidovudine-lamivudine-abacavir (Trizivir,AZT-3TC-ABC), Glaxo Wellcome, 1 tablet b.i.d.	Administration of zidovudine capsules with food decreased peak plasma concentration by >50%; however, AUC may not be affected; or AUC decreased by 25% after meal. Alcohol increased AUC of ABC by 41%.	Take on empty stomach, if possible. If this is not possible because of GI side effects, recommend taking with low-fat meal. Avoid alcohol.	300 mg AZT and 150 mg 3TC and 300 mg ABC per tablet
Didanosine (Videx EC-ddl), Bristol Myers–Squibb, 400 mg tablets q.d. for >60 kg and 250 mg tablets q.d. for <60 kg	Food decreases absorption. Administration with food results in approximately 55% decrease in AUC. Avoid alcohol as it exacerbates toxicity. Avoid antacids containing magnesium and aluminum.	Take on empty stomach, at least 30 min before or 2 h after a meal. Take only with water.	25, 50, 100, 150, 200 mg chewable/buffered tablets; 100,167, 250 mg/packet buffered powder for oral solution; 2 or 4 g/bottle of pediatric powder or oral solution; 125, 200, 250, 400 mg enteric-coated ddl
Stavudine (zerit-d4T), Bristol Myers–Squibb, 40 mg b.i.d. for >60 kg 30 mg b.i.d. for <60 kg	Food has little effect on absorption. Avoid alcohol.	Can be taken without regard to meals.	15, 20, 30, 40 mg capsule, 1 mg/mL oral solution
Tenofovir (Viread), Gilead Sciences, 300 mg qd	Administration with high-fat meal increased AUC by 40%. If taking didanosine, must take tenofovir 2 h before or 1 h after didanosine.	Take with food.	300 mg tablets
Zalcitabine (Hivid-ddC), Roche Laboratories, 0.75 mg q8h	Administration with food decreases AUC by 14% (not clinically significant). Do not take antacids containing magnesium and aluminum at the same time as medication. Avoid alcohol. Do not take with metoclopramide (decreases AUC by 10%).	Can be taken without regard to meals.	0.375, 0.750 mg tablets
	NNRTI		
Delavirdine (Rescriptor-DLV), Pharmacia and Upjohn, 400 mg t.i.d.	Concentrations similar in fasting and fed states in steady-state dosing. Medications such as antacids containing aluminum and magnesium and didanosine should be taken at least 1 h after, they can decrease absorption. Avoid St. John's wort (Hypericum perforatum), alcohol.	Can be taken without regard to meals.	100, 200 mg tablets
Efavirenz (Sustiva-EFV), Dupont Merck, 600 mg/d	Low-fat meal improves tolerability. High-fat meal increased bioavailability by 50%. Take in the evening or bedtime to minimize side effects. Alcohol may increase side effects. Avoid St. John's wort.	Can be taken without regard to meals; however, avoid high-fat meal.	50, 100, 200 mg capsules; 600 mg tablets

Drug	Pharmacology notes	Meal recommendations	Formulations
Nevirapine (Viramune-NVP), Roxane, 200 mg/d for 14 d, then 200 mg b.i.d.	Absorption not affected by food, antacids, or didanosine. Avoid St. John's wort, alcohol.	Can be taken without regard to meals.	200 mg tablet, 50 mg/teaspoon oral suspension
		Protease inhibitor	
Amprenavir (Agenerase-APV), Glaxo Wellcome, 1200 mg b.i.d.	Take with or without food. If taken with food, avoid high-fat meal (>67 g fat), as high-fat decreases absorption (decreases C_{max} and AUC). Avoid grapefruit juice. Increase fluid intake. Avoid extra vitamin E supplements (872 IU vitamin E /1200 mg amprenavir). Avoid St. John's wort. Do not take antacids within 1 h of this medicine.	Can be taken without regard to meals; however, avoid high-fat meal.	50, 150 mg soft-gel capsules (109 IU vitamin E/150 mg capsule),[a] 15 mg/mL oral solution (14% less bioavailable than capsules, thus doses not equivalent to capsules)
Indinavir (Crixivan-IDV), Merck, 800 mg q8h	Administration with high-fat, high-protein meal decreased serum concentrations by 84% and decreased AUC by 77%. It can be taken with a nonfat snack. Avoid grapefruit juice. Drink an additional 48 ounces of liquid daily to avoid kidney problems. Avoid St. John's wort. Ritonavir-indinavir combination (400 mg q12h each) significantly increases the drug level of indinavir and eliminates the need to fast.	Take on empty stomach at least 1 h before or 2 h after a meal or with a low/non-fat meal (juice, skim milk, etc.). Take 1 h before or after ddI as buffer impairs IDV absorption.	200, 333, 400 mg capsules
Saquinavir (soft-gel capsule) (Fortovase-SQVsgc), Roche Laboratories, 1200 mg t.i.d.	Administration with food (i.e., fatty meal) increases AUC 670%. Store capsules in refrigerator. Avoid alcohol, St. John's wort.	Take with meal or up to 2 h after a full meal.	200 mg soft-gel capsule
Saquinavir (hard-gel capsule) (Invirase-SQV), Roche Laboratories, 600 mg t.i.d.	Administration with food (i.e., fatty meal) increases AUC 200%. Taking with grapefruit juice will also increase absorption by 40%–100% as a result of inhibition of gut CYP3A4. Avoid alcohol, St. John's wort.	Take with meal or up to 2 h after a full meal with high calories and high-fat foods for better absorption.	200 mg hard-gel capsules
Lopinavir-ritonavir(Kaletra, LPV-RTV), Abbott, 3 capsules b.i.d.	Take with high-fat food for better absorption. Store the capsules in the refrigerator. Avoid St. John's wort.	Take with meals, especially with high fat content.	133.3 mg LPV and 33.3 mg RTV per soft-gel capsule, 80 mg LPV and 20 mg RTV per mL oral solution
Ritonavir (Norvir-RTV), Abbott, 600 mg b.i.d.	Extent of absorption of ritonavir from the soft-gel capsule formulation was 13%–15% higher when administered with a meal. Store capsules in refrigerator. Avoid St. John's wort.	Take with meals if possible. Mix oral solution with chocolate milk or oral supplements to improve taste.	100 mg soft-gel capsules, 80 mg/mL oral solution
Nelfinavir (Viracept-NLF), Agouron, 750 mg t.i.d. or 1250 mg b.i.d.	Plasma concentrations and AUC were 2–3-fold higher under fed versus fasting conditions. Increase fluid intake. Lactose-free dairy products or lactase may be needed to minimize diarrhea. Avoid acidic food or liquid. Avoid St. John's wort.	Take with a meal or light snack that includes a high-protein food to increase absorption and to decrease GI side effects.	250 mg tablet, 50 mg/g (1 level scoop) oral powder (or 200 mg per teaspoon of powder. Note: Oral powder contains aspartame, not for children with phenylketonuria.

NOTE. From [32–34]. AUC, area under the concentration-time curve (the total amount of drug absorbed is reduced when the AUC is decreased); GI, gastrointestinal; NNRTI, nonnucleoside reverse transcriptase inhibitor; NRTI, nucleoside reverse transcriptase inhibitor. Dosages for protease inhibitors are listed at nonboosted amounts. Ritonavir is often given in combination with other protease inhibitors, and the dosages are different. Refer to a physician with HIV expertise.

[a] Recommended daily intake for adults for vitamin E is 30 IU.

ing for nutritional risk. Follow-up visits for those with greater risk for nutritional problems should be referred to an RD in a timely manner on the basis of the urgency of the problem. Referrals to RDs are recommended on the basis of these priorities. The timing for the referral to an RD is made on the basis of these guidelines and expert opinion. In general, they apply to all age groups and both sexes.

Levels of nutritional risk are categorized as low, moderate, and high risk for nutritional compromise. The risk reflects consideration of multiple factors that may lead to nutritional compromise. The spectrum of nutritional intervention includes ensuring basic education on healthy diets, identifying common practices and diseases that traditionally require nutrition counseling or intervention, and assessing conditions that are specifically seen in HIV disease that are known to affect morbidity and mortality if nutritional intervention does not occur. Many of these factors span the spectrum of HIV disease; therefore, individualized assessment, rather than triage by stage of HIV disease, is recommended.

The following categories are based on those published by the American Dietetic Association [122, 123] and the Los Angeles County Commission on HIV Health Services [124]. The priority timeline for referral for patients categorized by nutritional risk is as follows: (1) *high risk,* to be seen by an RD within 1 week; (2) *moderate risk,* to be seen by an RD within 1 month; and (3) *low risk,* to be seen by an RD as needed. Detailed decriptions of the categories appear below:

I.   High risk (see RD within 1 week).
   A. Poorly controlled diabetes mellitus.
   B. Pregnancy (mother's nutrition; infant: artificial infant formula).
   C. Poor growth, lack of weight gain, or failure to thrive in pediatric patients.
   D. >10% unintentional weight loss over 4–6 months.
   E. >5% unintentional weight loss within 4 weeks or in conjunction with
      1. Chronic oral [or esophageal] thrush.
      2. Dental problems.
      3. Dysphagia.
      4. Chronic nausea or vomiting.
      5. Chronic diarrhea.
      6. CNS disease.
      7. Intercurrent illness or active opportunistic infection.
   F. Severe dysphagia.
   G. Enteral or parenteral feedings.
   H. Two or more medical comorbidities, or dialysis.
   I. Complicated food-drug-nutrient interactions.
   J. Severely dysfunctional psychosocial situation (especially in children).
II. Moderate risk (see RD within 1 month).
   A. Obesity.
   B. Evidence for body fat redistribution.
   C. Elevated cholesterol (>200 mg/dL) or triglycerides (>250 mg/dL), or cholesterol <100mg/dL.
   D. Osteoporosis.
   E. Diabetes mellitus, controlled or new diagnosis.
   F. Hypertension.
   G. Evidence for hypervitaminoses or excessive supplement intake.
   H. Inappropriate use of diet pills, laxatives, or other over-the-counter medications.
   I. Substance abuse in the recovery phase.
   J. Possible food-drug-nutrient interactions.
   K. Food allergies and intolerance.
   L. Single medical comorbidity.
   M. Oral thrush.
   N. Dental problems.
   O. Chronic nausea or vomiting.
   P. Chronic diarrhea.
   Q. CNS disease resulting in a decrease in functional capacity.
   R. Chronic pain other than oral/gastrointestinal tract source.
   S. Eating disorder.
   T. Evidence for sedentary lifestyle or excessive exercise regimen.
   U. Unstable psychosocial situation (especially in children).
III. Low risk (see RD as needed).
   A. Stable weight.
   B. Appropriate weight gain, growth, and weight-for-height in pediatric patients.
   C. Adequate and balanced diet.
   D. Normal levels of cholesterol, triglycerides, albumin, and glucose.
   E. Stable HIV disease (with no active intercurrent infections).
   F. Regular exercise regimen.
   G. Normal hepatic and renal function.
   H. Psychosocial issues stable (especially in children).

All patients of all levels of risk should be educated about healthy, balanced diets for their given lifestyle and physiologic requirements. Medical nutrition therapy should take into account the patient's age, sex, and physiological state, with special attention paid to pediatric growth and development, pregnancy, obesity, quality of dentition, and exercise practices. During nutrition assessment, family and medical history should be considered, particularly regarding diabetes, coronary artery disease, hypertension, and other cardiac risk factors. Recommendations (individualized care plans) should be adapted to stage of HIV progression, from asymptomatic to advanced stages with active

secondary infections. Socioeconomic, cultural, and ethnic background should be considered, including a history of mental health disorders or substance abuse as well as literacy level and financial status. Nutritional counseling or medical nutrition therapy should also be tailored to make the most of available access to care.

WHO SHOULD BE DOING THE NUTRITION ASSESSMENTS?

HIV medical nutrition therapy requires specialized knowledge of nutrition, especially in relation to HIV disease, medications, complications, and sensitivity to the infected and affected populations served. The number of qualified medical nutrition therapy providers is inadequate, and there are scant opportunities for training. HIV medical nutrition therapy providers can do the following:

- Work in concert with the HIV medical team.
- Receive continuing education each year, to include HIV medical, pharmacological, and nutritional updates as well as updates in any other relevant area.
- Be targeted for education and ongoing training through the Ryan White CARE Act, AIDS Education and Training Centers, or other comparable systems. The education and training of other health care professionals should include at least basic nutrition for patients with HIV.

The Food and Nutrition Board and Institute of Medicine (IOM) Committee on Nutrition Services for Medicare Beneficiaries issued a report in December 1999 evaluating the benefits and costs of the provision of nutrition services, including the services of an RD, to Medicare beneficiaries [125]. The IOM report found that the RDs are currently the single identifiable group of health care professionals with standardized education, clinical training, continuing education, and national credentialing requirements necessary to be directly reimbursed as a provider of nutrition therapy. The committee also recognized that other health care professionals could in the future submit evidence to be evaluated by the Centers for Medicare and Medicaid Services for consideration as reimbursable providers.

The Medicare Medical Nutrition Therapy Act of 1999 [126] defines medical nutrition therapy, requires a physician's referral, and identifies and defines the qualifications of the provider. The Medical Wellness Act of 2000 [127], introduced on 9 March 2000, would provide preventive screening and counseling benefits to the Medicare program. This includes screening for hypertension and cholesterol and coverage for medical nutrition therapy by RDs for diabetes and for cardiovascular and kidney disease.

It is recommended that nutritional evaluations be performed by an RD [122, 123, 126, 128, 129] with experience in HIV nutrition, or an RD without such experience who consults with an HIV-experienced RD. In pediatric situations, an RD with pediatric experience and HIV knowledge is ideal. Otherwise, an RD who consults with a pediatric HIV-experienced RD is acceptable. The scope of practice laws in each state should be checked; they specify who may legally provide nutrition assessment, medical nutrition therapy, and basic nutrition information.

SCREENING TOOLS VALIDATED FOR HIV NUTRITION PROBLEMS

Several screening tools are used for assessment of risk for nutritional problems. After a review of the literature for nutrition screening of HIV-infected individuals, the following tools were identified. Only the Revised Subjective Global Assessment [130, 131] has been studied and reported for use in HIV-infected populations. The others, however, have been adopted and adapted for use in the screening of HIV/AIDS patients. They are as follows (descriptions follow):

- Scored Patient-Generated Subjective Global Assessment.
- Revised Subjective Global Assessment for HIV-Infected Individuals.
- Quick Nutrition Screen.
- Nutrition Referral Criteria for Adults and for Pediatrics.
- Nutrition Screening Initiative.
- HIV/AIDS Medical Nutrition Therapy Protocol.

Scored Patient-Generated Subjective Global Assessment. The Scored Patient-Generated Subjective Global Assessment (PG-SGA) [132] is validated for use in oncology patients. It is a widely used screening form that can also be used in the context of a comprehensive assessment. There are 2 sections to the PG-SGA. The first is generated by the patient and includes components of patient history with an assigned prognostic value, history of weight status, list of food intake, a checklist of symptoms that impede food intake, and a measure of functional capacity. The remainder of the form is generated by the health care provider and includes diagnosis, stress level, physical findings, and a score based on comprehensive review of the information. The form was designed to be administered by RDs, registered nurses, physician assistants, physicians, and other medical providers.

The form is based on the validated SGA of nutritional status developed by Detsky and associates [133–135]. The American Dietetics Association uses the PG-SGA as the standard in clinical pathways for oncology patients [136]. The original version was based on the premise that complications associated with malnutrition are minimized or reversible with refeeding.

Revised SGA for HIV-Infected Individuals.　Bowers and

Dols [130] revised the SGA and used it to evaluate the nutritional status of 36 HIV-positive patients. The revised SGA is an effective evaluation tool for stratifying patients into categories according to their nutritional status. Weight loss history, dietary intake, wasting, functional impairment, and gastrointestinal symptoms identified through the revised SGA relate directly to malnutrition. It can be used in a variety of settings, including homes, hospitals, home-care settings, doctors' offices, and nurse-run clinics.

Quick Nutrition Screen. The Quick Nutrition Screen [137] was published in the Health Care and HIV Nutrition Guide for Providers and Clients by the Bureau of Primary Health Care and distributed for the use by its Ryan White CARE Act grantees. It was developed and reviewed by HIV nutrition, nursing, and other health care professionals and community representatives from both nongovernment and government agencies. Completed by clients, this screening tool has been adopted and adapted in numerous agencies across the country. As published in 1996, it requires updating. It has not been validated.

Nutrition Referral Criteria for Adults (18 or more years) with HIV/AIDS and Nutrition Referral Criteria for Pediatrics (<18 years) with HIV/AIDS. Nutrition Referral Criteria for Adults (18 or more years) with HIV/AIDS [122] and Nutrition Referral Criteria for Pediatrics (<18 years) with HIV/AIDS [123] were screening tools originally developed in 1997 by Dietitians in AIDS Care, a networking group in Los Angeles, as part of the nutrition standards of care, approved by the Los Angeles County Commission on HIV Health Services [124], a Title I EMA planning council. It had been reviewed by the multidisciplinary Standards of Care Committee of the Commission and subsequently adapted by agencies within Los Angeles County and throughout the country. It contains both time and symptoms and conditions that trigger nutrition referral to an RD. It has not been validated.

Public Awareness Checklist of the Nutrition Screening Initiative. The Nutrition Screening Initiative [138], formed in 1990, is a broad, multidisciplinary effort led by the American Academy of Family Physicians, the American Dietetic Association, the National Council on the Aging, and a coalition of >25 national health, aging, and medical associations. The Nutrition Screening Initiative developed the Public Awareness Checklist, a series of screening tools (Level I and Level II), along with a manual for professionals. This simple test was intended to increase the nutrition awareness of elderly people and not to diagnose malnutrition. The initiative validated the usefulness of the checklist as a public awareness tool. The Public Awareness Checklist, however, is the basis of nutrition screening tools developed for HIV and other disease conditions. *A Clinician's Guide to Nutrition in HIV and AIDS* adapted both

Nutrition Screening Initiative Levels I and II screening tools as its recommended screening tool for identifying persons at risk for nutritional problems [139]. There has been no report of its validation in HIV.

HIV/AIDS Medical Nutrition Therapy protocols. The purpose of HIV/AIDS Medical Nutrition Therapy protocols [122, 123] is to clearly define the level, content, and frequency of nutrition care needed in HIV disease. Originally developed and reviewed by members of HIV/AIDS and Pediatric Dietetic Practice Groups and the American Dietetic Association, it was published in 1996 and revised in 1998.

The screening criteria for nutrition referral are based on the following:

I. Time considerations, starting with a nutrition assessment at baseline and thereafter according to the individual's level of care, defined in the protocol.
   A. For adults:
      1. Asymptomatic HIV infection: 1–2 times a year.
      2. HIV/AIDS symptomatic but stable: 2–6 times a year.
      3. HIV/AIDS acute: 2–6 times a year.
      4. Palliative: 2–6 times a year.
   B. For children/adolescents:
      1. No signs/symptoms or mild signs/symptoms: 1–4 times a year.
      2. Moderate signs/symptoms: 4–12 times per year
      3. Severe signs/symptoms: 6–12 times a year.
II. New or ongoing clinical conditions, and
III. The individual's ability to understand and incorporate nutrition management skills.

Although the protocol does not list specific screening conditions, it assumes that the health care team will base referrals on assessment factors spelled out in the protocols.

To date, no validation studies of the Medical Nutrition Therapy protocols have been reported. The Nutrition Guidelines for Agencies Providing Food to People with HIV/AIDS [140] refers to the protocols given above as the guide RDs should follow to provide medical nutrition therapy to persons with HIV/AIDS.

Of note, Heller et al. [141] have recently reported on an instrument to assess nutritional risk in HIV-infected children. Fifteen providers evaluated 39 children. Information collected included medical history and sociodemographic, dietary, anthropometric, and biochemical data. Medical, dietary, and anthropometric data were found to be good predictors of nutritional risk. In spite of the small sample size, the instrument was found to be valid and a good predictor of nutritional risk in HIV-infected children.

RECOMMENDATIONS

It is important to the health of persons with HIV/AIDS to have access to the services of an RD whose knowledge in the area of nutrition for HIV/AIDS is current. We recommend that each program have an RD in some capacity: full time, part time, or in consultation. The RD should provide a nutrition assessment, provide appropriate nutrition intervention counseling with appropriate educational materials, and participate in case conferences as part of the medical team.

References

1. Centers for Disease Control and Prevention. HIV/AIDS—United States, 1981–2000. MMWR Morb Mortal Wkly Rep **2001**;50:430–4.
2. Centers for Disease Control and Prevention. The Global HIV/AIDS epidemic, 2001. MMWR Morb Mortal Wkly Rep **2001**;50:434–9.
3. Kraak V, Stricker JD, Utermohlen V, et al. Determining the nutrition needs of an ethnically diverse urban population with HIV/AIDS [abstract no. PB0916]. In: Program and abstracts of the International Conference on AIDS, Stockholm, Sweden, 7–12 Aug **1994**;10:226.
4. Torres S. Cultural sensitivity: a must for today's primary care provider. Adv Nurs Prac **1993**;1:16–8.
5. Baum M, Cassetti L, Bonhevi P, et al. Inadequate dietary intake and altered nutrition status in early HIV infection. Nutrition **1994**;10:16–20.
6. Baum MK, Shor Posner G, Zhang G, et al. HIV-1 infection in women is associated with severe nutritional deficiencies. J Acquir Immune Defic Syndr Hum Retrovirol **1997**;16:272–8.
7. Zuin G, Comi D, Fontana M, et al. Energy and nutrient intakes in HIV-infected children: pediatric AIDS and HIV infection—fetus to adolescent. Am J Gastroenterol **1994**;5:159–61.
8. Johann-Liang R, O'Neill L, Cervia J, et al. Energy balance, viral burden, insulin-like growth factor-1, interleukin-6 and growth impairment in children infected with human immunodeficiency virus. AIDS **2000**;14:683–90.
9. Kotler DP, Wang J, Pierson RN, et al. Body composition studies in patients with the acquired immunodeficiency syndrome. Am J Clin Nutr **1985**;42:1255–65.
10. Kotler DP, Tierney AR, Wang J, et al. Magnitude of body mass depletion and the timing of death from wasting in AIDS. Am J Clin Nutr **1989**;50:444–7.
11. Chlebowski RT, Grosvenor MB, Bernhard NH, et al. Nutritional status, gastrointestinal dysfunction, and survival in patients with AIDS. Am J Gastroenterol **1989**;4:1288–92.
12. Guenter P, Muurahainen N, Simons G, et al. Relationships among nutritional status disease progression, and survival in HIV infection. J Acquir Immune Defic Syndr **1993**;6:1130–8.
13. Palenicek JP, Graham NH, He YD, et al. Weight loss prior to clinical AIDS as a predictor of survival . J Acquir Immune Defic Syndr Hum Retrovirol **1995**;10:366–73.
14. Grinspoon S, Corcoran C, Lee K, et al. Loss of lean body and muscle mass correlates with androgen levels in hypogonadal men with acquired immunodeficiency syndrome and wasting. J Clin Endocrinol Metab **1996**;81:4051–8.
15. Suttmann U, Ockenga J, Selberg O, et al. Incidence and prognostic value of malnutrition and wasting in human immunodeficiency virus–infected patients. J Acquir Immune Defic Syndr Hum Retrovirol **1995**;8:239–46.
16. Ott M, Fischer H, Polat H, et al. Bioelectrical impedance analysis as a predictor of survival in patients with human immunodeficiency virus infection. J Acquir Immune Defic Syndr Hum Retrovirol **1995**;9:20–5.
17. Carey VJ, Yong FH, Frenkel LM, et al. Pediatric AIDS prognosis using somatic growth velocity. AIDS **1998**;12:1361–9.
18. Berhane R, Bagenda D, Marum L, et al. Growth failure as a prognostic indicator of mortality in pediatric HIV infection. Pediatrics **1997**;100:E7.
19. Brettler DB, Forsberg A, Bolivar E, et al. Growth failure as a prognostic indicator for progression to acquired immunodeficiency syndrome in children with hemophilia. J Pediatr **1990**;117:584–8.
20. Towo PA, de Martino M, Gabiano C, et al. Prognostic factors and survival with perinatal infection: the Italian Register for HIV Infections in Children. Lancet **1992**;339:1249–53.
21. Fontana M, Zuin G, Plebani A, et al. Body composition in HIV-infected children: relation with disease progression and survival. Am J Clin Nutr **1999**;69:1282–6.
22. Lo JC, Mulligan K, Tai VW, et al. "Buffalo hump" in men with HIV-1 infection. Lancet **1998**;351:867–70.
23. Walli R, Herfort O, Michl GM, et al. Treatment with protease inhibitors associated with peripheral insulin resistance and impaired oral glucose tolerance in HIV-1 infected patients. AIDS **1998**;12:F167–73.
24. Babl FE, Regan AM, Pelton SI. Abnormal body-fat distribution in HIV-1–infected children on antiretrovirals. Lancet **1999**;353:1243–4.
25. Jaquet D, Levine M, Ortega-Rodriguez E, et al. Clinical and metabolic presentation of the lipodystrophic syndrome in HIV-infected children. AIDS **2000**;29:2123–8.
26. Arpadi SM, Cuff PA, Horlick M, Kotler DP. Visceral obesity, hypertriglyceridemia and hypercortisolism in a boy with perinatally acquired HIV infection receiving protease inhibitor–containing antiviral treatment. AIDS **1999**;13:2312–3.
27. Health advisory for newest class of AIDS drugs. FDA talk paper. Washington, DC: US Food and Drug Administration, 11 June **1997**.
28. Carr A, Samaras K, Chisolm DJ, et al. Pathogenesis of HIV-1 protease inhibitor associated peripheral lipodystrophy, hyperlipidaemia and insulin resistance. Lancet **1998**;351:1881–3.
29. Henry K, Melrose H, Huebsch J, et al. Severe premature coronary artery disease with protease inhibitors. Lancet **1998**;351:1328.
30. Vigouroux C, Gharakhanian S, Salhi Y, et al. Diabetes, insulin resistance and dyslipidaemia in lipodystrophic HIV-infected patients on highly active antiretroviral therapy (HAART). Diabetes Metab **1999**;25:225–32.
31. Melvin A, Lennon S, Mohan K, et al. Blood lipid levels and body composition in HIV-infected children treated with protease inhibitors [abstract 66]. In: Program and abstracts of the 7th Conference on Retroviruses and Opportunistic Infections (San Francisco, California). Foundation for Retrovirology and Human Health, CDC, NIAID, **2000**.
32. Garey KW, Rodwald KA. Antiretroviral Agents and Food Interactions. Infections Med **1998**;15:836–9, 873.
33. Package inserts from all FDA-approved antiretroviral agents: zidovudine, lamivudine, didanosine, stavudine, zalcitabine, abacavir, delavirdine, efavirenz, nevirapine, amprenavir, lopinavir/ritonavir, ritonavir, indinavir, saquinavir (soft and hard gel capsules), nelfinavir, tenofovir.
34. Office of Special Health Issues and Division of Antiviral Drug Products. Nucleoside reverse transcriptase inhibitor (NRTI) and non-nucleoside reverse transcriptase inhibitor (NNRTI) drug interactions. Washington, DC: US Food and Drug Administration, **2001**.
35. Howell RB, Jandinski JJ, Palumbo P, et al. Dental caries in HIV-infected children. Pediatr Dent **1992**;14:370–1.
36. Jandinski JJ, Catalanetto F, Murray P, et al. Oral pathology and pain in pediatric AIDS. J Dent Res **1995**;74:137.
37. Jimenez-Exposito MJ, Garcia-Lorda P, Alonso-Villaverde C, et al. Effect of malabsorption on nutritional status and resting energy expenditure in HIV-infected patients. AIDS **1998**;12:1965–72.

38. Mintz M. Neurological and development problems in pediatric HIV infection. J Nutr **1996**; 126:2663S–73S.

39. Grunfeld C, Pang M, Shimizu L, et al. Resting energy expenditure, calorie intake and short-term weight change in human immunodeficiency virus infection and the acquired immunodeficiency syndrome. Am J Clin Nutr **1992**; 55:455–60.

40. Shevitz AH, Knox T, Spiegelman D, et al. Elevated resting energy expenditure among HIV-seropositive persons receiving highly active antiretroviral therapy. AIDS **1999**; 13:1351–7.

41. Pernerstorfer-Schoen H, Schindler K, Parschalk B, et al. Beneficial effects of protease inhibitors on body composition and energy expenditure: a comparison between HIV-infected and AIDS patients. AIDS **1999**; 13:2389–96.

42. Macallan DC, Noble C, Baldwin C, et al. Energy expenditure and wasting in human immunodeficiency virus infection. N Engl J Med **1995**; 333:83–8.

43. Beaugerie L, Carbonnel F, Carrat F, et al. Factors of weight loss in patients with HIV and chronic diarrhea. J Acquir Immune Defic Syndr Hum Retrovirol **1998**; 19:34–9.

44. Baum MK, Cassetti L, Bonhevi P, et al. Inadequate dietary intake and altered nutrition status in early HIV-1 infection. Nutrition **1994**; 10: 16—20.

45. Arpadi SM, Horlick MN, Wang J, et al. Body composition in prepubertal children with human immunodeficiency virus type 1 infection. Arch Pediatr Adolesc Med **1998**; 152:688–93.

46. Varille V, Faye A, Levine M, et al. Resting energy expenditure (REE) and growth velocity (GV) in HIV-infected children [abstract 0-28]. In: Program and abstracts of the International Conference on Nutrition and HIV Infection, Cannes, France, **1997**; 13:274.

47. Baum MK, Shor-Posner G, Lee Y, et al. Micronutrients and HIV-1 disease progression. AIDS **1995**; 9:1051–6.

48. Skurnick JH, Bogden JD, Baker H, et al. Micronutrient profiles in HIV-1 infected heterosexual adults. J Acquir Immune Defic Syndr Hum Retrovirol **1996**; 12:75–83.

49. Beach RS, Mantino-Atienza E, Shor-Posner G, et al. Specific nutrient abnormalities in asymptomatic HIV infection. AIDS **1992**; 6:701.

50. Dworkin BM, Antonecchia PD, Smith F, et al. Reduced cardiac selenium content in the acquired immunodeficiency syndrome. J Parenter Enteral Nutr **1989**; 13:644–7.

51. Baum MK, Shor-Posner G. Micronutrient status in relationship to mortality in HIV-1 disease. Nutr Rev **1998**; 56(1 Pt 2):S135–9.

52. Baum MK, Shor-Posner G, Campa A. Zinc status in human immunodeficiency virus infection. J Nutr **2000**; 130(Suppl):1421S–3S.

53. Baum MK, Shor-Posner G, Lai S, et al. High risk of HIV-related mortality is associated with selenium deficiency. J Acquir Immune Defic Syndr Hum Retrovirol **1997**; 15:370–4.

54. Campa A, Shor-Posner G, Indacochea F, et al. Mortality risk in selenium-deficient HIV-positive children. J Acquir Immune Defic Syndr Hum Retrovirol **1999**; 20:508–13.

55. Semba RD, Caiaffa WT, Graham NM, et al. Vitamin A deficiency and wasting as predictors of mortality in human immunodeficiency virus–infected injection drug users. J Infect Dis **1995**; 171:1196–202.

56. Tang AM, Graham NM, Chandra RK, et al. Low serum vitamin B-12 concentrations are associated with faster human immunodeficiency virus type 1 (HIV-1) disease progression. J Nutr **1997**; 127:345–51.

57. Tang AM, Graham NM, Saah AJ. Effects of micronutrient intake on survival in human immunodeficiency virus type 1 infection. Am J Epidemiol **1996**; 143:1244–56.

58. Coodley GO, Coodley MK, Nelson HD, et al. Micronutrient concentrations in the HIV wasting syndrome. AIDS **1993**; 7:1595–600.

59. Melchior JC, Niyongabo T, Henzel D, et al. Malnutrition and wasting, immunodepression, and chronic inflammation as independent predictors of survival in HIV-infected patients. Nutrition **1999**; 15:865–9.

60. Gorbach SL, Knox TA, Roubenoff R. Interaction between nutrition and infection with human immunodeficiency virus. Nutr Rev **1993**; 51:226–34.

61. Smit E, Graham NM, Tang A, et al. Dietary intake of community-based HIV-1 seropositive and seronegative injecting drug users. Nutrition **1996**; 12:496–501.

62. Fahs MC, Waite D, Sesholtz M, et al. Results of the ASCUS for pediatric AIDS patients: utilization of services, functional status, and social severity. Acta Paediatr Suppl **1994**; 400:106–10.

63. Blank A, Mofenson LM, Willoughby A, et al. Maternal and pediatrics AIDS in the United States: the current situation and future research directions. Health Serv Res **1994**; 29:549–68.

64. Hecker LM, Kotler DP. Malnutrition in patients with AIDS. Nutr Rev **1990**; 48:393–401.

65. Moseson M, Zeleniuch-Jacquotte A, Belsito DV, et al. The potential role of nutritional factors in the induction of immunologic abnormalities in HIV-positive homosexual men. J Acquir Immune Defic Syndr Hum Retrovirol **1989**; 2:235–47.

66. Keys A, Brozek J, Henschel A, et al, eds. The biology of human starvation. Minneapolis, MN: University of Minnesota Press, **1950**.

67. Brozek J, Wells S, Keys A. Medical aspects of semi-starvation in Leningrad (siege 1941–1942). Am Rev Soviet Med **1946**; 4:70.

68. Winick M. Hunger disease: studies by Jewish physicians in the Warsaw ghetto. New York: Wiley, **1979**.

69. Rabeneck L, Palmer A, Knowles JB, et al. A randomized controlled trial evaluating nutrition counseling with and without oral supplementations in malnourished HIV-infected patients. J Am Diet Assoc **1998**; 98:434–8.

70. McKinley MJ, Goodman-Block J, Lesser ML, et al. Improved body weight status as a result of nutrition interventions in adult HIV-positive patients. J Am Diet Assoc **1994**; 94:1014.

71. Klein S, Kinney J, Jeejeebhoy K, et al. Nutrition support in clinical practice: review of published data and recommendations for future research directions. Am J Clin Nutr **1997**; 66:683–706.

72. Burger B. Schwenk A, Junger H, et al. Oral supplements in HIV-infected patients with chronic wasting: a prospective trial. Med Klin **1994**; 89:579–81, 633.

73. Shabert JK, Winslow C, Lacey JM, et al. Glutamine-antioxidant supplementation increases body cell mass in AIDS patients with weight loss: a randomized, double-blind controlled trial. Nutrition **1999**; 15: 860–4.

74. Berneis K, Battegay M, Bassetti R, et al. Nutritional supplements combined with dietary counseling diminish whole body protein catabolism in HIV-infected patients. Eur J Clin Invest **2000**; 30:87–94.

75. Stack JA, Bell SJ, Burke PA, et al. High-energy, high-protein, oral, liquid, nutrition supplementation in patients with HIV infection: effect on weight status in relation to incidence of secondary infection. J Am Diet Assoc **1996**; 96:337–41.

76. Rothpletz-Puglia P, Oleske J, Boland M, et al. Preliminary results of a retrospective study of nutrition intervention strategies for HIV infected infants and children [abstract 42344]. In: Program and abstracts of the 12th International Conference on AIDS (Geneva, Switzerland). Stockholm, Sweden: International AIDS Society. **1998**; 12:843.

77. Roubenoff R, McDermott A, Weiss L, et al. Short-term progressive resistance training increases strength and lean body mass in adults infected with human immunodeficiency virus. AIDS **1999**; 13:231–9.

78. Yarasheski KE, Tebas P, Stanerson B, et al. Resistance exercise training reduces hypertriglyceridemia in HIV-infected men treated with antiviral therapy. J Appl Physiol **2001**; 90:133–8.

79. Wagner G, Rabkin J, Rabkin R. Exercise as a mediator of psychological and nutritional effects of testosterone therapy in HIV-positive men. Med Sci Sports Exerc **1998**; 30:811–7.

80. Sattler FR, Jacque SV, Schroder ET, et al. Effects of pharmacologic doses of nandrolone decanoate and progressive resistance training in immunodeficient patients infected with human immunodeficiency virus. J Clin Endocrinol Metab **1999**; 84:1268–76.

81. Evans WJ, Roubenoff R, Shevitz A. Exercise and the treatment of wasting. Aging and human immunodeficiency virus infection. Semin Oncol **1998**; 2(S6):112–22.

82. Gaare J, Singer P, Katz D, et al. Enteral supplementation in AIDS: an open trial. FASEB J **1991**; 5:A1688.

83. Kotler D, Tierney AR, Ferraro R, et al. Enteral alimentation and repletion of body cell mass in malnourished patients with acquired immunodeficiency syndrome. Am J Clin Nutr **1991**; 53:149.

84. Kotler D, Tierney AR, Culpepper-Morgan JA, et al. Effect of home total parenteral nutrition on body composition in patients with acquired immunodeficiency syndrome. J Parenter Enteral Nutr **1990**; 14:454.

85. Howard L, Heaphey L, Fleming CR, et al. Four years of North American registry home parenteral nutrition outcome data and their implication for patient management. J Parenter Enteral Nutr **1991**; 15: 384.

86. Singer P, Rothkoopf MM, Kvetan V, et al. Risks and benefits of home parenteral nutrition in the acquired immunodeficiency syndrome. J Parenter Enteral Nutr **1991**; 15:75.

87. Singer P, Rubinstein A, Askanazi J, et al. Clinical and immunologic effects of lipid-based parenteral nutrition in AIDS. J Parenter Enteral Nutr **1992**; 16:165.

88. Ireton-Jones CS, Stiller DL. Evaluation of outcomes for patients with AIDS receiving home total parenteral nutrition. Nutrition **1998**; 14;731–5.

89. Kotler D, Fogleman L, Tierney AR. Comparison of total parenteral nutrition and an oral, semielemental diet on body composition, physical function, and nutrition-related costs in patients with malabsorption due to acquired immunodeficiency syndrome. J Parenter Enteral Nutr **1998**; 22:120–6.

90. Ockenga J, Suttmann U, Selberg O, et al. Percutaneous endoscopic gastrostomy in AIDS and control patients: risks and other outcomes. Am J Gastroenterol **1996**; 91:1817–22.

91. Melchior JC, Chastang C, Gelas P, et al. Efficacy of 2-month total parenteral nutrition in AIDS patients: a controlled randomized prospective trial. The French Multicenter Total Parenteral Nutrition Cooperative Group Study. AIDS **1996**; 10:379–84.

92. Henderson RA, Saavedra JM, Perman JA, et al. Effect of enteral tube feeding on growth of children with symptomatic human immunodeficiency virus infection. J Pediatr Gastroenterol Nutr **1994**; 18: 429–34.

93. Miller TL, Awnetwant EL, Evans S, et al. Gastrostomy tube supplementation for HIV-infected children. Pediatrics **1995**; 96:696–702.

94. Dabbas-Tyan M, Goulet O, Colomb V, et al. Home parenteral nutrition in human immunodeficiency virus infected children [abstract P-37]. Nutrition **1997**; 13:289.

95. Von Roenn JH, Armstrong D, Kotler DP, et al. Megestrol acetate in patients with AIDS-related cachexia. Ann Intern Med **1994**; 121: 393–9.

96. Oster MH, Enders SR, Samuels SJ, et al. Megestrol acetate in patients with AIDS and cachexia. Ann Intern Med **1994**; 121:400–8.

97. Brady MT, Koranyi KI, Hunkler JA. Megestrol acetate for treatment of anorexia associated with human immunodeficiency virus infections in children. Pediatr Infect Dis J **1994**; 13:754–5.

98. Struwe M, Kaempfer SH, Geiger CJ, et al. Effect of dronabinol on nutritional status in HIV infection. Ann Pharmacother **1993**; 27: 827–31.

99. Gorter R, Selfried M, Volberding. Dronabinol effects on weight in patients with HIV infection. AIDS **1992**; 6:127.

100. Mulligan K, Grunfeld C, Hellerstein MK, et al. Anabolic effects of recombinant human growth hormone on patients with wasting associated with human immunodeficiency virus infection. J Clin Endocrinol Metab **1993**; 77:956–62.

101. Schambelan M, Mulligan K, Grunfeld C, et al. Recombinant human growth factor in patients with HIV-associated wasting: a randomized, placebo-controlled trial. Ann Intern Med **1996**; 125:873–82.

102. Waters D, Dansha J, Hurdy K, et al. Recombinant human growth hormone, insulin-like growth factor 1, and combination therapy in AIDS-associated wasting. Ann Intern Med **1996**; 125:865–72.

103. Lee PD, Pivarnik JM, Bukar JG, et al. A randomized, placebo-controlled trial of combined insulin-like growth factor and low dose growth hormone for wasting associated with human immunodeficiency virus infection. J Clin Endocrinol Metab **1996**; 81:2968–75.

104. Berger JR, Pall L, Hall CD, et al. Oxandrolone in AIDS-wasting myopathy. AIDS **1996**; 10:745–52.

105. Fox-Wheeler S, Heller L, Salata CM, et al. Evaluation of the effects of oxandrolone on malnourished HIV-positive pediatric patients. Pediatrics **1999**; 104–e73.

106. Strawford A, Babieri T, Neese R, et al. Effects of nandrolone decanoate therapy in borderline hypogonadal men with HIV-associated weight loss. J Acquir Immune Defic Syndr Human Retrovirol **1999**; 20: 137–46.

107. Gold J, High HA, Li Y, et al. Safety and efficacy of nandrolone decanoate for treatment of wasting in patients with HIV infection. AIDS **1996**; 10:7445–52.

108. Strawford A, Barbereri T, Van Loan M, et al. Resistance exercise and supraphysiologic androgen therapy in eugonadal men with HIV-related weight loss: a randomized controlled trial. JAMA **1999**; 281: 1282–90.

109. Wanke C. Single agent/combination therapy of human immunodeficiency virus–related wasting. Semin Oncol **1998**; 25(S6):98–103.

110. Wagner G, Rabkin J, Rabkin R. Exercise as a mediator of psychological and nutritional effects of testosterone therapy in HIV-positive men. Med Sci Sports Exerc **1998**; 30:811–7.

111. Dobs AS. Androgen therapy in AIDS wasting. Ballieres Clin Endocrinol Metab **1998**; 12:379–90.

112. Engelson E, Rabkin JG, Rabkin R, et al. Effects of testosterone on body composition. J Acquir Immune Defic Syndr Hum Retrovirol **1996**; 11:510.

113. Miller K, Corcoran C, Armstrong C, et al. Transdermal testosterone administration in women with acquired immunodeficiency syndrome wasting: a pilot study. J Clin Endocrinol Metab **1998**; 83:2717–25.

114. Grinspoon S, Corcoran C, Stanley T, et al. Effects of androgen administration on the growth hormone-insulin-like growth factor I axis in men with acquired immunodeficiency syndrome wasting. J Clin Endocrinol Metab **1998**; 83:4251–6.

115. Reyes-Teren G, Sierra-Madero JG, Martinez del Cerro v, et al. Effects of thalidomide on HIV-associated wasting syndrome: a randomized, double-blind, placebo-controlled clinical trial. AIDS **1996**; 10:1501–7.

116. Haslett PA. Anticytokine approaches to the treatment of anorexia and cachexia. Semin Oncol **1998**; 25(S6):53–7.

117. Centers for Disease Control and Prevention. Surveillance for AIDS-defining opportunistic illnesses, 1992–1997. MMWR Morb Mortal Wkly Rep **1999**; 48(SS-2):1–22.

118. Schwenk A, Kremer G, Cornely O, et al. Body weight changes with protease inhibitor treatment in undernourished HIV-infected patients. Nutrition **1999**; 15:453–7.

119. Silva M, Skolnik PR, Gorbach SL, et al, The effect of protease inhibitors on weight and body composition in HIV-infected patients. AIDS **1998**; 12:1645–51.

120. Miller TL, Mawn BE, Orav EJ, et al. The effect of protease inhibitor therapy on growth and body composition in human immunodeficiency virus type 1–infected children. Pediatrics **2001**; 107 E77.

121. Dreimane D, Nielsen K, Deveikis A, et al. Effect of protease inhibitors combined with standard antiretroviral therapy on linear growth and weight gain in human immunodeficiency virus type 1–infected children. Pediatr Infect Dis J **2001**; 20:315–6.

122. Fenton M, Silverman E, Vazzo L. HIV/AIDS adult Medical Nutrition Therapy protocol. In: Gilbreath J, Inman-Felton AE, Johnson EQ, Robinson G, Smith K, eds. Medical nutrition therapy across the continuum of care. Chicago, IL: American Dietetic Association and Morrison Health Care, **1998**:1–16.

123. Heller L, Rothpletz-Puglia P, Morris V, et al. HIV/AIDS children/adolescents Medical Nutrition Therapy protocol. In: Gilbreath J, Inman-Felton AE, Johnson EQ, Robinson G, Smith K, eds. Medical

nutrition therapy across the continuum of care. Chicago, IL: American Dietetic Association and Morrison Health Care, 1998:1–16.

124. Los Angeles County Commission on HIV Health Services. Guidelines for implementing HIV/AIDS Medical Nutrition Therapy protocols. Los Angeles, CA: Los Angeles County Commission on HIV Health Services, 1999.

125. Committee on Nutrition Services for Medicare Beneficiaries. The role of nutrition in maintaining health in the nations elderly: evaluating coverage of nutrition services for the medicare population. Washington, DC: Food and Nutrition Board, Institute of Medicine; December 1999.

126. Medicare Medical Nutrition Therapy Act of 1999 (HR 1187/S 660).

127. Medical Wellness Act of 2000 (SS.2232/HR3887).

128. The cost of covering medical nutrition therapy services under TRI-CARE: benefits, costs, cost avoidance and savings. Final report prepared by the Lewin Group Inc for Department of Defense Health Affairs. J Am Dietetic Assoc 1999; 99:428–35.

129. California Medi-Cal Managed Care, RFA section 14, p. 4, glossary definition 5, addendum 6; February 1995.

130. Bowers JM, Dols CL. Subjective global assessment in HIV infected patients. J Assoc Nurses AIDS Care 1996; 7:83–9.

131. Niyongabo T, Melchior JC, Henzel D, et al. Comparison of methods for assessing nutritional status in HIV-infected adults. Nutrition 1999; 15:740–3.

132. McMahon K, Decker G, Ottery FD. Integrating proactive nutritional assessment in clinical practices to prevent complications and cost. Semin Oncol 1998; 25(2 Suppl 6):20–7.

133. Detsky AS, McLaughlin JR, Baker FP, et al. What is the subjective global assessment of nutritional status? J Parenter Enteral Nutr 1987; 118–3.

134. Detsky AS, Baker FP, Mendelson RH, et al. Evaluating the accuracy of nutritional assessment techniques applied to hospitalized patients methodology and comparisons. J Parenter Enteral Nutr 1984; 8:153–9.

135. Hirsh S, deObaldia N, Petermann M, et al. Subjective global assessment of nutritional status: further validation. Nutrition 1991; 7:35–8.

136. Gilbreath J, Inman-Felton AE, Johnson EQ, et al. Cancer Medical Nutrition Therapy protocol. In: Gilbreath J, Inman-Felton AE, Johnson EQ, Robinson G, Smith K, eds. Medical nutrition therapy across the continuum of care. Chicago, IL: American Dietetic Association and Morrison Health Care, 1998.

137. Quick Nutrition Screen. In: Health care and HIV: nutritional guide for providers and clients. Washington, DC: Bureau of Primary Health Care, HRSA, DHHS, June 2002:p. 2-5.

138. Nutrition Screening Initiative Public Awareness checklist of the nutrition screening initiative, 1990. Available at: http://www.aafp.org/nsi/index.html. Accessed 26 February 2003.

139. Fields-Gardner C, Thompson C, Rhodes SS. A clinicians' guide to nutrition in HIV and AIDS. Chicago, IL: American Dietetic Association, 1997.

140. Association of Nutrition Services Agencies. Nutrition guidelines for agencies providing food to people living with HIV disease, 2nd ed. Washington, DC: ANSA; 2002. Available at: http://www.aidsnutrition.org/Guidelines.aspx. Accessed 4 March 2003.

141. Heller L, Fox S, Hell KJ, et al. Development of an instrument to assess nutritional risk factors for children infected with human immunodeficiency virus. J Am Diet Assoc 2000; 100:323–9.