Diet may play a significant role in cancer prevention, disease progression, and treatment tolerance. An in-depth search of the literature revealed limited information geared toward nurses about diet assessment methods used in research. The purpose of this review is to synthesize the evidence regarding diet assessment methods important in oncology studies. The method used varied based on the study size, duration, and research question. For example, studies focusing on mean nutrient intake of a group used a 24-hour dietary recall, estimated food diary or dietary record, or food frequency questionnaire. Studies investigating usual nutrient intake predominately used multiple 24-hour dietary recalls, dietary records, biomarkers, or food frequency questionnaires. Measuring dietary intake accurately in a cost-effective manner is a difficult task. Selection of the appropriate assessment tool is critical for the generation of quality data. Oncology nurses are increasing their involvement in nutrition research, and the findings from this review may promote a better understanding of the published and ongoing research in this important field of study.
Diet Assessment Methods

Importance of Selecting an Appropriate Method

Measuring dietary intake accurately in a cost-effective manner with minimal patient burden is a difficult task. The accuracy of a measurement method is known as the validity, which is assessed when the results of the study are compared to a “gold standard” or alternate instrument with known validity (Burrows, Warren, Colyvas, Garg, & Collins, 2008). In nutrition research, the comparison may be an alternative diet assessment method, closely monitored weighed food records, or an appropriate biomarker. The use of complementary assessment methods can enhance the reliability of the results (Fowles et al., 2007).

Several factors have been shown to affect the validity of a measurement method. Validity is “the ability of a dietary assessment tool to measure food consumption data that represents the true dietary intake of an individual” (Burrows, Martin, & Collins, 2010, p. 1501). Factors that alter the validity of the assessment method may include recall bias or reliance on participants’ memory, “history” or events such as specific food safety concerns (e.g., peanut butter contamination, spinach package recalls), or the participant recruitment strategy. Many diet assessment methods rely on self-reported intake from a survey respondent or patient. Therefore, psychological factors are important, as body weight, health, serving proportions, and types of foods all have an emotional aspect that is influenced by society, geography, and ethnicity. For example, overweight parents and/or overweight children may under-report foods considered unhealthy and overweight and over-report healthy foods (Burrows et al., 2008). Participants may alter the types of foods or simplify the number of foods that they eat to decrease the respondent burden or the perceived difficulty that they associate with the assessment method (Fowles et al., 2007). The day of the week that data is collected also is an important consideration, as weekend intake generally is higher than weekday intake (Beaton et al., 1979; Haines, Hama, Guillek, & Popkin, 2003).

Diet assessment of specific nutrients should address participants’ use of dietary supplements. The use of a multivitamin supplement is increasing in popularity and has a strong impact on the prevalence of nutrient adequacy (Murphy, White, Park, & Sharma, 2007). For example, the serum level of a specific nutrient may reflect the daily multivitamin more than the actual intake via food. In addition, the formulation and dosages of multivitamins and dietary supplements can vary a great deal and may complicate nutritional assessment (Thompson & Newton, 2005).

The design of the diet assessment method, whether prospective or retrospective, short or long, simple or intensive, containing open-ended questions or a predetermined food list, will affect the method’s vulnerability to the idiosyncrasies in the sample study population. Regardless of the method used, investigators need to be sure quality control is in place to minimize error and increase the reliability of interviewing and coding. With quality control, researchers will review the data for accuracy or possibly validate a subset of values with an alternate assessment method.

Several popular methods exist for dietary intake measurement. This review is limited to the diet assessment strategies that have been used in large population-based studies. However, a few emerging studies used electronic means of tracking dietary patterns, including multiple dietary recalls administered via the Internet, audio recordings, or food images taken before and after consumption using cell phones with camera capability (Thompson, Subar, Loria, Reedy, & Baranowski, 2010). Those methods currently are under development, but may improve the convenience and accuracy of diet assessment.
The most frequently used dietary assessment approaches include weighed food records (in a community setting or in a closely monitored nutrition laboratory), estimated dietary records or food diaries, a single 24-hour dietary recall, multiple 24-hour dietary recalls, food frequency questionnaires (FFQs), and biomarkers such as urinary nitrogen, serum nutrient levels, or doubly labeled water. Each method has its own unique set of advantages and limitations (see Table 1).

**Weighed Food Records**

Weighed food records can be a very precise form of dietary measurement. All foods and beverages are weighed and the preparation method, brand names, and ingredients are recorded. Historically, the method has been used for seven days, but it also is used frequently for three or four days (Tucker, 2007). Ideally, respondents are motivated, literate, and do not alter their habitual food intake (Gibson, 2005). Unfortunately, that is not always the case. With the weighed record or the food diary, participants may avoid complex dishes or eating away from home, such as at a restaurant where the ingredients may be unfamiliar (Tucker, 2007; Wylie-Rosett, Wassertheil-Smoller, & Elmer, 1990).

Energy intake (calories consumed) is calculated by identifying the ingredients (e.g., protein, fat, carbohydrate) in each dish and calculating the chemical energy that can be metabolized. Livingstone et al. (1990) compared energy intake as measured by seven-day weighed dietary records to the energy expenditure estimated by the doubly labeled water biomarker in 31 healthy adults and found that the average recorded energy intake was significantly lower than the measured energy expenditure. Under-reporting may be from the lengthy study duration, participant motivation, or insufficient respondent training. Livingstone et al. (1990) used a relatively small sample size but demonstrated that weighed food records do not always accurately reflect usual intake.

**Table 1. Advantages and Disadvantages of Dietary Assessment Methods**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>DESCRIPTION</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighed food records</td>
<td>A detailed record is kept of the weights of ingredients, final cooked food, and leftovers.</td>
<td>Considered the most precise method of dietary intake assessment</td>
<td>High respondent burden may impact foods or quantities that are selected.</td>
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<tr>
<td></td>
<td></td>
<td>May be used to correlate precise intake with biomarker levels</td>
<td>May accurately reflect intake during the study period but not habitual food intake or selection</td>
</tr>
<tr>
<td>Food diary or dietary records</td>
<td>Participants are asked to record the intake of food and beverages as they consume them for a number of days (usually 3–7 days).</td>
<td>May be more accurate for culture-specific foods, unique foods or dishes, or foods that are consumed very rarely</td>
<td>Relatively high respondent burden may affect foods or quantities that are selected. Patients tend to record less diligently as the duration increases.</td>
</tr>
<tr>
<td>24-hour dietary recall</td>
<td>Trained interviewer elicits list of foods consumed over the previous 24 hours, quantity, brand names, and preparation. Data usually are entered into a food analysis program.</td>
<td>Can be completed by a face-to-face interview or by telephone</td>
<td>Requires a skilled interviewer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can be used with literate or illiterate populations</td>
<td>Requires sufficient memory skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reflects intake of previous day, so participants are less likely to alter eating behaviors</td>
<td>Can be affected by inadvertent or intentional reporting errors, seasonal variations, and day of the week</td>
</tr>
<tr>
<td>Multiple 24-hour dietary recalls</td>
<td>Participants are interviewed multiple times for a 24-hour dietary recall. Nonconsecutive days are preferred to decrease impact of previous day’s intake and household food availability.</td>
<td>Increases the ability of the results to reflect usual eating patterns compared to a single 24-hour dietary recall</td>
<td>Requires skilled interviewer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can be completed by a face-to-face interview or by telephone</td>
<td>Multiple recalls increase respondent and researcher burden.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreased impact of seasonal variation or day of the week</td>
<td>Can be time-consuming to input and analyze data</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Susceptible to under-reporting</td>
</tr>
<tr>
<td>Food frequency questionnaire</td>
<td>Participants are given a list of foods (may be short list or a long list of more than 200 items) and they are asked to rate how frequently the foods are consumed (i.e., daily, once per week, once per month). May obtain portion size information and use; household measures or portions are reported as small, medium, or large.</td>
<td>Relatively easy and inexpensive to administer at a central location, by mail, or via the Internet</td>
<td>Requires a certain degree of literacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Several types exist that target a specific nutrient (e.g., folate) or all food or nutrient groups. Generally effective at ranking individuals within a group. Results can be scanned or entered into a software program.</td>
<td>Relies on long-term recall ability Generally not as effective at determining absolute intake of nutrients May not include foods that are unique to the culture or important for the health condition of interest</td>
</tr>
<tr>
<td>Biomarkers</td>
<td>Biochemical tests such as plasma nutrient levels, gene expression levels, urinary metabolites, or doubly labeled water</td>
<td>Considered to be free from patient bias or reporting errors. Some nutrients are associated with specific foods or food groups. May provide relatively low participant burden</td>
<td>Some tests may be expensive, invasive, or time-consuming. Plasma concentrations of nutrients may be affected by factors other than intake.</td>
</tr>
</tbody>
</table>

*Table adapted from Tucker, 2007.*
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Marks, Hughes, and van der Pols (2006) compared 12 days of weighed food records with the results of a food frequency questionnaire. The 115 healthy adult participants from the Nambour Skin Cancer Prevention Trial completed two non-consecutive days of weighed food records every two months over a 12-month period. The long study period was important to minimize seasonal variability. Overall, intakes estimated by the FFQ were greater than the weighed food record, suggesting that the high respondent burden associated with weighed food records may reduce the ability of this technique to detect habitual intake (Marks et al., 2006).

Food Diary or Dietary Records

The food diary or dietary record is similar to the weighed food record in that each food item and beverage is recorded but the portion sizes are estimated rather than weighed. Dietary records are kept for a predetermined period, which usually is 3–14 days. The recommended length of study duration varies for each vitamin, mineral, and macronutrient (Seaman, 1995; Willett, 1990; Wylie-Rosett et al., 1990). Food portion sizes may be estimated using household measures, photographs, or food models. The participant’s ability to accurately estimate the portion size can have a significant impact on the results and validity of the study. Food diaries are used frequently to assess the efficacy of dietary interventions, such as low-fat, diabetic, or low-sodium diets (Rutishauser, 2005; Wylie-Rosett et al., 1990). Estimated food diaries or dietary records require a certain level of literacy, respondent training, and motivation, but they are less reliant on patients’ long-term memories and may be more accurate for culture-specific or unique foods.

Gariballa and Forster (2008) compared food diaries (seven days in hospital and seven days in community) for 116 older adult patients with the weighed intakes of a subset of 18 patients. All participants, including the subset of 18 patients, were 65 years or older, recovering from mild to moderate acute illness, recruited while in the hospital, and then followed during discharge to home. The food diaries were more accurate in the hospital than in the home, but the authors found significant correlations between the food diaries and weighed intakes.

The European Prospective Investigation into Cancer and Nutrition (EPIC) is a longitudinal study that has enrolled more than half a million participants to assess the relationships between diet, nutritional status, lifestyle, and environmental factors and the incidence of cancer and other chronic diseases over a minimum of a 10-year period. A relatively long latency period likely exists between suboptimal diet and potential cancer initiation and/or progression, so a lengthy study with a large sample size should, in theory, produce high-quality data. On the other hand, challenges with long-term studies include the influence of new food products, changing diet fads, waning staff and participant enthusiasm for the study, economic changes, and turnover in the interviewers or coding staff.

The EPIC study uses three methods to assess diet: an FFQ, food diary, and 24-hour dietary recall (Bingham, 1997). The accuracy of the three methods was assessed using weighed food records and biomarkers in a preliminary analysis with a subset of 93 healthy adult participants. The correlation between dietary nitrogen intake from estimated food diaries and urinary nitrogen was high. The food diary was superior to the FFQ and 24-hour dietary recall for plasma carotenoids and vitamin C, as well.

24-Hour Dietary Recall

The single 24-hour dietary recall is used most frequently to determine the average intake of a population or groups (Fowles et al., 2007). A single 24-hour dietary recall with a large sample size can provide information about the average intake of a population. With the 24-hour dietary recall method, a trained interviewer asks participants (or parents or caretakers) to recall their exact food intake for the previous day or previous 24-hour period. That may occur during face-to-face or telephone interviews. The interviewer will attempt to elicit information about the foods and amounts that were consumed (Gibson, 2005; Willett, 1990). The interview needs to be conducted in a nonjudgmental manner to increase the accuracy of the reported data (Rutishauser, 2005). Under-reporting is a frequent finding with dietary recall that is affected by obesity, gender, social desirability, restrained eating, education literacy, perceived health status, and race or ethnicity (Burrows et al., 2008; Johansson, Wikman, Ahren, Hallmans, & Johansson, 2001; Marks et al., 2006).

The multiple pass technique is used frequently because the cognitive cues appear to enhance recall compared to chronologic cues (Rutishauser, 2005; Tucker, 2007). The interviewer asks the participant to list the foods that can be recalled. That list then is reviewed for details regarding amounts, preparation method, and any brand names. The interviewer then prompts the participant about any snacks, forgotten items, dietary supplements, or condiments.

The 24-hour dietary recall method may not be suitable for young children or people with impaired short-term memory (Gibson, 2005; Wylie-Rosett et al., 1990), but it can be used in illiterate and literate populations (Fowles et al., 2007; Gibson, 2005). In one study, Buzzard et al. (1996) found the unannounced 24-hour dietary recall more accurate for assessment of fat intake during a low-fat diet intervention study compared with four-day food diaries. The study participants were 290 postmenopausal women with localized breast cancer. The enhanced accuracy with unannounced 24-hour dietary recalls may be because it was a retrospective method and the women may have been less likely to alter their diet as a response to research scrutiny compared to the food diaries.

The National Health and Nutrition Examination Survey data were used to identify an association between diet and liver disease. Dietary intake of the 9,221 participants was obtained using a single 24-hour dietary recall at the start of the study, and participants were followed for a mean of 13.3 years. The subset of participants identified with cirrhosis and liver cancer had reported high-protein diets and high cholesterol intake at the start of the study (Ioannou, Morrow, Connole, & Lee, 2009).

The single 24-hour dietary recall consists of an open-ended interview, has a relatively low respondent burden, and can be used with literate or illiterate populations. However, it requires a skilled interviewer and can be affected by inadvertent or intentional reporting errors, seasonal variations, and the day of the week.
Multiple 24-Hour Dietary Recalls

Twenty-four-hour dietary recall information may be collected for two to five nonconsecutive days (one should be a weekend day) to enhance the likelihood that the data reflects usual intake (Fowles et al., 2007; Tucker, 2007). In addition, if the measure is repeated over several months, the impact of seasonal availability will decrease (Gibson, 2005). The disadvantages of the technique are similar to those for a single 24-hour dietary recall (i.e., the need for a trained interviewer, time-consuming data entry, reliance on the respondents’ memory), but the time required for data collection is increased. The single and multiple 24-hour dietary recalls allow participants to describe what they are actually eating (as opposed to selecting from a predetermined list) and, therefore, may be more appropriate for cultural foods or unique dishes (Fowles et al., 2007; Tucker, 2007).

One study used 10 24-hour dietary recalls over the period of a year with 94 men and 99 women from the general population. The reported intakes were compared to body mass index, estimated activity level, gender, and age. The authors found that a higher body mass index, older age, and smoking seemed to contribute to under-reporting of energy intake (Johansson et al., 2001).

Multiple 24-hour dietary recalls have similar advantages to the single 24-hour dietary recall, but the impact of day of the week or seasonal availability may be reduced. Respondent and investigator workload, however, increase with each replication.

Food Frequency Questionnaires

The goal of FFQs is to determine the average long-term dietary intake of a nutrient, as this exposure (or lack thereof) may be important for health maintenance or disease risk and development. Some precision may be sacrificed to gain insight into the habitual dietary patterns (Willett, 1990). FFQs often are used, therefore, in large epidemiologic studies of health and diet, as they often are self-administered, relatively inexpensive, and the data collection and analysis can be relatively straightforward. Many computerized versions are available and even the paper forms can be scanned for ease of use (Tucker, 2007). FFQs may range from a short list (fewer than 50 items) to a long list (more than 200 items) of foods. An associated set of frequency-of-consumption response categories (e.g., times per day, week, month, year, rarely or never) exists for each food or line item. The most widely used versions of the FFQ include those based on the Block type, Willett type, or EPIC type. Those are named for their creators (Gladys Block, PhD, Walter C. Willett, MD, PhD, and the EPIC group). Some versions of the FFQ attempt to quantify intake and may include either standard portion size options or portion size questions (Fowles et al., 2007; Gibson, 2005; Molag et al., 2007; Rutishauser, 2005).

One study in 56 healthy pre-pregnant and pregnant women demonstrated that the FFQ underestimated intake compared to four-day weighed food records (Brown et al., 1996). However, most studies report that some FFQs tend to overestimate intake compared to food records (Ambrosini, de Klerk, O’Sullivan, Beilin, & Oddy, 2009; Errkola et al., 2001). The length of the FFQ used may affect the accuracy of the reported intake (Kristal et al., 2000). In a meta-analysis of 40 validation studies, Molag et al. (2007) demonstrated the following characteristics for FFQs: (a) those with longer food lists (e.g., 200 items) were better at ranking participants for most nutrients compared to the shorter lists (e.g., 100 items); (b) those with portion-size questions had higher correlation coefficients for energy-adjusted alcohol intake but, surprisingly, lower correlation coefficients for energy-adjusted protein and energy-adjusted vitamin C compared to FFQs with predefined standard portions; and (c) FFQs were able to distinguish between a subpopulation such as energy intake in men versus women, but the gender differences were underestimated compared to the reference methods. In another semisystematic review of the literature, the authors reviewed 227 validation studies to determine the mean correlation coefficients between the FFQs and alternate diet assessment techniques. The correlation coefficients were highest for calcium and fat but lowest for vitamin A and vegetables (Cade, Burley, Warm, Thompson, & Margetts, 2004).

A cohort of 195 participants in the California Teachers Study completed four 24-hour dietary recalls and two FFQs over a 10-month period. The researchers noted an increased risk of breast cancer with higher alcohol consumption and found that a single FFQ is equivalent to about two to six 24-hour dietary recalls in reporting true intake of most nutrients for an individual and the FFQ was valid and reproducible for all nutrients except unsaturated fatty acids (Horn-Ross et al., 2008).

FFQs also are used routinely with case-control studies, as they can measure long-term intake retrospectively. In a study of renal cell carcinoma risk, investigators identified 335 cases and 337 matched controls. Eating habits were assessed using a FFQ, and the authors noted a protective effect of high vegetable intake and increased risk of renal cell carcinoma with elevated red meat consumption (Grieb et al., 2009).

FFQs are relatively easy to administer and can be tailored to the specific research question or study population. However, they do require participant literacy, are susceptible to over-reporting, and rely on the respondent’s long-term memory capability.

Biomarkers

Biomarkers are substances found in tissues, blood, or urine that can be used to indicate a biologic state, organ function, disease progression, or response to treatment. Biomarkers can be used to examine energy intake (e.g., doubly labeled water) or specific nutrient levels (e.g., serum glucose). Biomarkers that have been used in diet assessment include doubly labeled water, urinary metabolites of protein, urinary potassium, urinary sodium, plasma levels of vitamins, serum cholesterol, blood glucose levels, glycohemoglobin, urinary glucose, and tissue levels of minerals or fatty acids (Rutishauser, 2005; Wylie-Rosett et al., 1990). Doubly labeled water is used to determine energy expenditure and often is regarded as the gold standard reference method for validation of measurements of energy intake, rather than a particular nutrient. Study participants are administered doubly labeled water, which contains enriched quantities of the stable isotopes deuterium (²H) and oxygen-18 (¹⁸O). The difference in elimination rate between the two isotopes indicates
energy expenditure (Johnson, Herring, Ibrahim, & Siega-Riz, 2007). The participant burden for the technique is low, but the data analysis requires expensive laboratory equipment (Rutishauser, 2005).

Biomarkers may be used to validate other diet assessment methods or to quantify levels of nutrients with a large within-food variation in content (Jenab, Slimani, Bictash, Ferrari, & Bingham, 2009; Willett, 1990). For example, the carotenoid content of tomatoes may vary widely, depending on the tomato variety and geography (Aherne, Jiwan, Daly, & O’Brien, 2009). Biomarkers are not as susceptible to psychological or cognitive factors such as underreporting, impaired memory, or literacy.

Currently, no perfect biomarkers exist for the macronutrient proportions of a diet (Fowles et al., 2007; Thiébaut, Kipnis, Schatzkin, & Freedman, 2008). Analysis of existing biomarkers for a specific nutrient may be time-consuming, expensive, or invasive to collect. For example, a 24-hour urine collection may be difficult in the community setting, but accurate collection is important (Wylie-Rosett et al., 1990). In addition, biomarker levels may be affected by body size, smoking, supplement use, bioavailability, source of the nutrient, food preparation, disease status, metabolic rate, age, and vitamin supplementation (Dehghan et al., 2007; Fowles et al., 2007; Resnicow et al., 2000; Wylie-Rosett et al., 1990). Lower plasma carotenoid concentrations have been documented for overweight and obese children (Burrows et al., 2008). However, whether that observation was from lower intake or simply higher levels of carotenoids sequestered in adipose tissue was unclear.

Dehghan et al. (2007) conducted a meta-analysis that compared plasma vitamin C levels with food frequency questionnaires and dietary recalls or records. Interestingly, the degree of correlation (r) between plasma levels of vitamin C and food frequency questionnaires was stronger for men (r = 0.46) compared to women (r = 0.39), and the correlation between this biomarker and dietary recalls or records was stronger for women (r = 0.44) compared to men (r = 0.36).

Biomarkers may be less susceptible to reporting errors but may be invasive and expensive. In addition, plasma levels of some nutrients are affected by factors unrelated to dietary intake.

Selection of an Appropriate Method

The focus of this review was diet assessment methods used in large oncology research studies. The data collected are meant to help answer a specific research question. They cannot be used on their own to estimate the strength of the association between diet and cancer, but may provide insight for future research. The methods presented here are also used by registered dietitians to evaluate the nutritional status of individual patients in the clinical setting, particularly the 24-hour dietary recall and the food diary or dietary record. Such information collected by a registered dietitian for clinical purposes guides nutrition intervention and/or counseling.

Several considerations must be made when selecting a suitable dietary assessment method for research studies, including the anticipated sample size, budget, literacy level, availability of skilled interviewers or laboratory technicians, logistics such as access to a telephone or computer, population density, the impact of seasonal variability of food consumption, participants’ ages, study duration, and the specific research question (see Table 2). In the clinical practice setting, variables that impact the assessment method selected include the nutrient (macronutrient versus micronutrient), patient diagnosis, inpatient versus community setting, and the level of precision required. Frequently, a compromise is made between the most precise methods of dietary assessment (e.g., intensive use of biomarkers and weighed food records for a long study duration), the logistics (e.g., sample size, cost, geography), and the respondent burden or intensity of measurements that the study population will tolerate (Seaman, 1995).

Each method of diet assessment has its strengths and limitations. Weighed food records can be very precise, but the respondent burden may be higher. They may be more accurate than other methods with populations such as young infants, where the portion sizes are harder to determine. Dietary records are slightly less precise, but reported intakes appear to correlate well with biomarkers such as plasma carotenoids, urinary nitrogen, and vitamin C. The single 24-hour dietary recall and multiple 24-hour dietary recalls have the advantage of being open-ended interviews and, therefore, may more accurately reflect unique or cultural foods. Disadvantages include the reliance on participants’ meticulous short-term memory and the susceptibility of the method to seasonal availability and weekend versus weekday effects. The accuracy of FFQs is enhanced by a longer list of foods and they perform well with case-control or retrospective strategies. FFQs may not be the best method to determine absolute intake of a nutrient. Participants using FFQs appear to routinely over-report intake of certain foods, but the method still can be used to rank individuals within a group.

Table 2: Goal of a Proposed Study and Recommended Diet Assessment Method

<table>
<thead>
<tr>
<th>GOAL</th>
<th>RECOMMENDED METHOD</th>
</tr>
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<tbody>
<tr>
<td>Average or mean nutrient intake of a population (e.g., national surveys)</td>
<td>A single 24-hour dietary recall or single food diary or dietary record with a large sample size and appropriate data collection for the days of the week</td>
</tr>
<tr>
<td>Identification of the proportion of a population at risk for nutrient deficiency or excess</td>
<td>Repeated observations (e.g., multiple 24-hour dietary recalls, dietary records) for each individual or one-day food intake data and a subsample with repeated measures</td>
</tr>
<tr>
<td>Usual nutrient intake of an individual to assist with ranking within a group or the need for a dietary intervention</td>
<td>Long-term data are required, such as multiple replicates of 24-hour dietary recalls or a food frequency questionnaire with portion size questions</td>
</tr>
<tr>
<td>Usual intake of an individual to determine correlation or regression analysis for chronic health conditions (e.g., epidemiologic studies)</td>
<td>A large sample size and long-term data are required (e.g., multiple replicates of 24-hour dietary recalls or a food frequency questionnaire with portion size questions)</td>
</tr>
</tbody>
</table>

Note. Based on information from Gibson, 2005; Rutishauser, 2005.
In general, the studies that focused on the mean nutrient intake of a group (e.g., fruit and vegetable intake) used a 24-hour dietary recall, estimated food record, or FFQ with a large number of participants (e.g., national surveys). The studies that investigated the usual intake of nutrients in individuals (e.g., vitamin C, calcium, folate) predominately used multiple 24-hour dietary recalls, dietary records, biomarkers, or semiquantitative FFQs. Data collection must be much longer than 24 hours to accurately rank individuals within a group or determine habitual intake. The selection of an appropriate methodology is dependent on the size of the study population, duration of the study, financial resources, and whether the goal is to determine the exact nutrient intake of individuals or simply the average usual nutrient intake of a group or population.

Implications for Nursing

Currently, limited information regarding diet assessment methods, advantages, and limitations exists in the nursing literature. Additional research also is needed to adapt assessment measures so that they are reliable and valid, yet feasible to administer in a fast-pace clinical setting. Opportunities exist to work with information technology companies to develop applications that can record and calculate appropriate nutrient properties.

Oncology nurses are increasing their involvement in nutritional and epidemiologic research. Nursing research is a skill that requires background knowledge, exposure to the methods, and practice. The oncology nurse may be an expert in clinical practice and patient care but a novice or advanced beginner in the area of nursing research and diet assessment methods in particular. Increased theoretical knowledge may allow the nurse to move from detached observer of nutrition research to involved performer (Benner, 1984; Rizzuto, Bostrom, Suter, & Chenitz, 1994).

Evidence-based nutritional interventions are gaining recognition and importance in health care (Etminan, Takkouche, & Caamaño-Isorna, 2004; Schenq, Neuhausser, Lin, & Kristal, 2009). An enhanced understanding of diet assessment will strengthen research participation of oncology nurses, assist with sharing the study results with colleagues in the healthcare field, and improve patient education. Nurses, particularly those in oncology, need to understand the nutritional epidemiology literature and nursing implications.

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