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A computer-based approach for assessing dietary supplement use in conjunction with dietary recalls[1]

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Abstract

In response to the need to assess both food and supplemental sources of nutrients, we have expanded the capabilities of Nutrition Data System for Research (NDSR) software to allow for assessing dietary supplement use. A Dietary Supplement Assessment Module allows for the automated collection and coding of dietary supplement use. The module is designed for use in conjunction with the software's 24-hour dietary recall features. The medication inventory method, commonly used in pharmaceutical research, served as the basis for the module's assessment approach. In adapting this approach for use in our software we designed a tiered structure that involves first screening for use of dietary supplements, then collecting product detail (e.g. full name of product, number of times taken, etc.), and finally reviewing the information with the participant. Preliminary results from a demonstration study being conducted to evaluate the Module indicate the assessment approach is acceptable to both participants and interviewers. Collecting dietary supplement use information significantly increases interview time, especially for those using multiple products. A validation study is needed to determine whether the new method results in accurate estimation of nutrient intake from supplemental sources.

Keywords

Dietary supplements; Dietary assessment

1 Introduction

In populations where the use of dietary supplements is common it is critical that methods to assess nutrient intake capture both food and supplemental sources. The importance of assessing both of these sources of nutrients is illustrated in a recent research report by Archer et al. (2006), in which nutrient intake estimates from only foods were compared with nutrient intakes from food and supplemental sources combined. In that study of middle aged men and women in the US, 52% of participants reported use of at least one dietary supplement. Among those who reported use of a dietary supplement, nutrient intake estimates based only on food sources were substantially lower than those that accounted for both food and supplemental sources.

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For example, among men who reported using a vitamin C containing dietary supplement, mean vitamin C intake from only foods was 134 mg/day, whereas, mean vitamin C intake from food and supplemental sources combined was 623 mg/day.

In response to the critical need to assess both food and supplemental sources of nutrients in population studies, we have expanded the capabilities of Nutrition Data System for Research (NDSR) software to allow for assessing dietary supplement use with a Dietary Supplement Assessment Module (DSAM) that allows for the automated collection and coding of dietary supplement use. The module is designed for use in conjunction with the software's 24-hour dietary recall features, thus facilitating the assessment of both food and supplemental sources of nutrients. In this paper the dietary supplement assessment approach incorporated in the module is described, and results from a demonstration study conducted as an evaluation of the method are provided.

2 Methods

2.1 Assessment Approach

To guide the approach to assessing dietary supplement use we first identified criteria for it, and then reviewed the literature to select a method that most closely met these criteria. The method selected was then modified and refined so that it more completely met our criteria.

Four basic criteria were identified. The first criterion was that the approach must be appropriate for both in-person and telephone 24-hour dietary recalls, including unscheduled (unannounced) telephone recalls. It was also determined that the recall period for supplement use must be concurrent with the dietary recall period (past day) so that daily nutrient intake estimates from food and supplemental sources combined could be easily calculated. The third criterion was that the approach must be designed for assessing use of all types of dietary supplements including both prescription and non-prescription dietary supplements as well as non-prescription antacids. The fourth and final criterion was that the method selected would have established validity.

After reviewing the literature on approaches to assessing dietary supplement use (Block, Sinha et al. 1994; Patterson, Kristal et al. 1998; Patterson, Levy et al. 1999; Radimer, Subar et al. 2000; Ishihara, Sobue et al. 2001; Murphy, Wilkens et al. 2002; Radimer 2003; Satia Abouta, Patterson et al. 2003; Park, Murphy et al. 2006), it was determined that the supplement inventory methodology best met our criteria. This approach, which is based on a method commonly used in pharmaceutical research to assess use of prescription and over-the-counter medications, has been used for both research (Archer SL 2006) and surveillance (Radimer, Bindewald et al. 2004) purposes. Although its validity has not been evaluated with regard to dietary supplement use per se, it has been found to have acceptable validity for assessing medication use (Psaty, Lee et al. 1992; Sjahid, van der Linden et al. 1998; Smith, Psaty et al. 1999; Caskie and Willis 2004).

The general structure of the supplement inventory methodology is that participants are asked to bring all of their dietary supplement products to an in-person interview. From the product containers an interviewer records information such as the product name, name of manufacturer, and product form (e.g. tablet, capsule, lozenge). The participant is asked about frequency of use of the product and amount (dosage) taken each time the product is used. In adapting this methodology for use in our software application, which allows for automated collection and coding, we designed a structured approach akin to the multiple pass approach used in the collection of 24-hour dietary recalls. The multiple-pass approach (Wright, Ervin et al. 1994) is believed to result in more complete and accurate reporting of dietary intake information than other approaches. It involves first, generating a list of all foods consumed during the recall

period, reviewing this list, then gathering food product details (e.g. product type, food additions, amount consumed), and lastly, reviewing the information collected to allow the participant to make additions and corrections.

The assessment methodology we have devised, which we describe as a tiered dietary supplement inventory is designed for collection of dietary supplement use information immediately following completion of a 24-hour dietary recall. Tier 1 of the method involves a series of ten questions to screen for use of dietary supplements and non-prescription antacids. Specific product types queried are as follows: multivitamins and multivitamins with minerals; individual vitamins; individual minerals; amino acids; fatty acids; fiber containing supplements; herbals or botanicals; supplements prescribed by a physician; other types of dietary supplements such as glucosamine chondroitin; and non-prescription antacids. If participants report that they used a specific type of product (e.g. report taking a multivitamin or multivitamin with minerals) they are asked to provide the product name, which the interviewer types into a data entry field. Because the sole intent of Tier 1 is to screen for use of dietary supplements and non-prescription antacids, participants may report products in whatever category they wish. For example, it is acceptable for participants to report use of a vitamin C supplement when asked if they took a multivitamin or multivitamin with minerals.

It is expected that more complete and accurate reporting of supplement use will occur by asking about use of specific types of products than by asking a more global question (e.g., asking participants whether they used a dietary supplement on the previous day) because the more detailed questioning may prompt memory. Also, by asking about specific types of dietary supplements we avoid reliance on participants' conceptualization of "dietary supplements", which may be incomplete or inaccurate. Of particular concern is the possibility that some participants may narrowly view dietary supplements as only vitamin- and mineral containing products, not realizing that many other products such as fiber supplements and amino acid containing products are also dietary supplements. The screening questions, which encompass all type of dietary supplements, should avoid this potential problem.

If participants report using one or more products in response to the tier 1 screening questions, tier 2 questioning is initiated. Tier 2 requires information to be obtained from product bottles or containers. If the interview is being conducted in-person, the participant is asked to give the interviewer the bottles/containers for the products he/she brought from home. If the interview is being conducted over the telephone, the participant is asked to gather the bottles/containers for all products they reported using the previous day. After the bottles/containers have been collected the following information for each reported supplement is entered in turn: 1) full product name from the label, which allows for identification and selection of a matching product in the dietary supplement database linked with the Module; 2) number of times the product was taken the previous day; and 3) number of tablets/capsules/lozenges/etc. taken each time the product was taken the previous day. There are a number of additional questions that those using the software may opt to have included in tier 2 of the interview. Optional questions include asking about frequency of use over the past 30 days, the reason for use, and place of product purchase.

The third and final data collection step (tier 3) involves reviewing the information collected in tier 2 to allow the participant the opportunity to make corrections or additions.

2.2 Dietary Supplement Database

The National Health and Nutrition Examination Survey (NHANES) Dietary Supplement Database is being used to support the Module (Dwyer, Picciano et al. 2003). This database, which is updated regularly, includes dietary supplements and non-prescription antacids reported by NHANES participants. It includes close to 2,000 products including generic names

and strengths for many vitamins and minerals. Also, defaults are available for use in the event that the strength of a product is unknown. The defaults are selected based on the most common strengths reported by NHANES participants. It is a label-based database, meaning that composition information for products (ingredients and amounts) is obtained from product labels.

To accommodate reported products that are not in the database (missing products), the module allows entry of new products. To accommodate their entry, a missing product window appears during the interview. This window includes data entry fields for entering the product name, manufacturer, and contact information for the manufacturer if it is available on the container. Also, ingredients and amounts may be entered. Information for missing products may be entered during the interview or later depending on study specific procedures.

2.3 Demonstration Study

A demonstration study was conducted to test the feasibility of the Dietary Supplement Assessment Module and to assess participant and interviewer satisfaction with it. A total of 99 people (adults and children) who regularly use dietary supplements were recruited through advertisements placed in community newspapers in the Minneapolis-St. Paul Minnesota Metropolitan area. Those who telephoned in their responses to the advertisement were screened for the following study eligibility criteria: 1.) regularly use one or more dietary supplements; and 2.) able to read and speak English. A gift card for a discount store was offered as an incentive for participation.

A single 24-hour dietary recall and tiered dietary supplement inventory were obtained from each participant in the demonstration study. To fully test the interview approach and software, all assessment questions were included (e.g. optional questions such as perceived efficacy, place of product purchase, and use over the past 30 day were included in the assessment).

Approximately one-half of the interviews were conducted in-person (n=48) and one-half over the telephone (n=51) so that the ease of use of the module in both settings could be evaluated. For the in-person interviews participants were mailed instructions that included a listing of the types of products they should bring to the interview. A paper bag labeled with the study name and logo was included to accommodate bringing product containers to the interview. A reminder telephone call was made the day prior to the scheduled interview to remind participants to bring their product containers with them to the interview. The telephone interviews were unscheduled and unannounced and required less preparation.. Participants were simply told that they would receive a phone call at some time over the next few weeks during which they would be asked about their food intake and dietary supplement use.

Evaluation measures included recording the amount of time required to complete the 24-hour dietary recall and supplement inventory portions of the interview. A demographic questionnaire was completed by participants prior to administration of the 24-hour dietary recall and supplement inventory. Immediately after completion of the interview participants were asked to complete a feedback questionnaire that included questions about the supplement inventory portion of the interview. Interviewers were also asked to complete a feedback questionnaire so that their impressions of the supplement inventory questions and process were ascertained. Means and frequencies were calculated to describe the demographic characteristics of the sample and to report results. The correlation between the number of products reported by each participant and the interview length was calculated to evaluate the extent to which this factor influenced interview length.

3 Results

Demographic characteristics of participants in the demonstration study are presented in Table 1. More females than males participated in the study. Participants were mostly white and well educated. The number of dietary supplements reported by participants ranged from 0 to 32 (although one of the study eligibility criteria was regular use of dietary supplements, one participant reported that he did not use any dietary supplements the day prior to the interview).

The amount of time required to complete the dietary supplement inventory among this sample of dietary supplement users averaged 16.1 minutes (range 2–69 minutes) (Table 2). Those at the upper end of the range (53, 54, and 69 minutes) reported using multiple products (19, 14, and 32 products, respectively) whereas, those at the lower end of the range (2, 3, and 4 minutes) reported using only one product. The correlation between the number of products reported and the time taken to complete the inventory was 0.87 ($p<0.01$). Combined with the time required for the 24-hour dietary recall, the total amount of time required for the interview averaged 35.2 minutes (range 12–113 minutes).

When asked whether any questions were unclear or confusing (yes or no), all but two participants responded “no”. One of the participants who responded affirmatively stated that he could not remember the exact amount of a supplement he took. The other participant stated that it was confusing to answer questions asked about information on the product label (the interview with this person was conducted over the telephone, and thus some label information had to be read by the participant). When asked if any questions were so difficult they felt like they were guessing, 19 of the 99 participants responded affirmatively. There were two concerns voiced by multiple participants. Nine participants reported they felt that they were guessing when asked how well they felt the dietary supplement products they were taking were “working” (optional perceived efficacy question). Six stated they were uncertain when asked to report how long they had been using the products (optional duration of use question).

From the perspective of the interviewers, the overall flow of the interview (tiered approach) was found to work well. All of the participants who had an in-person interview remembered to bring their product containers. Likewise, all of those who had a telephone interview were willing and able to gather their product containers at the point in the interview where they were asked to do so. The only significant problems identified were the amount of time required to complete interviews with those using a large number of dietary supplements and the difficult nature of collecting product detail (e.g full product description, brand name) over the telephone relative to in-person interviews.

4 Discussion and conclusion

The Dietary Supplement Assessment Module developed for use in conjunction with the collection of 24-hour dietary recalls may be a feasible and useful tool for comprehensively assessing nutrient intake. The tiered dietary supplement inventory approach incorporated into the Module appears to be acceptable to both participants and interviewers, although it is important to note that study participants were predominately Caucasian and well educated. It is possible that the approach may not work as well among lower income and more ethnically diverse population groups. Collecting dietary supplement use information increases interview time, with the increase substantial for those using many products. However, it also permits estimation of total nutrient intake from all sources.

Some of the optional questions designed to assess issues surrounding use, such as perceived efficacy and duration of use appear to be difficult for some to answer. Consequently, it is possible that the validity of responses to these questions may be poor.

A validation study is needed to determine whether the tiered dietary supplement inventory methodology we have developed results in accurate estimates of nutrient intake from supplemental sources. Ideally it would be validated along with streamlined variations of it so that an approach that is as efficient as possible yet still valid may be identified.

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Table 1

Demographic characteristics of participants in the NDSR dietary supplement assessment module demonstration study (n=99)

	% (n)
Sex	
Female	74.7 (74)
Male	25.3 (25)
Race	
White	93.5 (86)
Non-white	6.5 (6)
Age (years)	
5–18	13.1 (13)
19–30	13.1 (13)
31–50	25.3 (25)
51–74	48.5 (48)
Education level	
High school. grad or less	16.3 (16)
Some college	26.5 (26)
College graduate	57.1 (56)
Number of products reported	
0–3	36.4 (36)
4–5	38.4 (38)
6–8	12.1 (12)
9–11	6.1 (6)
12–14	4.0 (4)
15–32	3.0 (3)

Table 2

Time required for completing the 24-hour dietary recall and dietary supplement assessment module (n=99)

	Minutes Mean (range)
24-hour recall	19.3 (8–44)
Diet supplement assessment	16.1 (2–69)
Total	35.2 (12–113)