Strategies to Develop Food Frequency Questionnaire
Food choices are one of the health related behaviors that are culturally determined. Public health experts and nutritionists have recognized the influence of culture on health related behaviors that help to improve the intervention strategies and assessment techniques for developing food-frequency questionnaires.

The development of food-frequency questionnaires is based on the awareness, sensitivity, appropriateness and competency of the culture. The cultural competency is the most likely approach to reduce miscommunication between culturally distinct population (investigators and participants) and to yield reliable data.

The food frequency questionnaires (FFQs) specify the frequency, portion size and few details on other characteristics such as methods of cooking or the combination of foods in meals. Portion size questions are incorporated to estimate the relative or absolute nutrient intakes. Overall nutrient intake estimates are derived by summing of all the foods and reported frequency of each food by the amount of nutrient in that specific serving.

The purposes of FFQs are mainly to ranking individuals and providing a measure of absolute intake. FFQs are continuously customized to rank the individuals in many epidemiological studies (risk of chronic diseases) to provide information on the variety of food consumed over a longer period than a 24-hour recall. Many FFQs are available, and many continue to be adapted and developed for different populations and different purposes. However, respondents may also tend to overestimate food consumption and report their routine or typical diet rather than the specifics of what they ate over the selected period.

Contents of FFQ: The basic Food Frequency Questionnaire consists of two sections. One is Food List and the other one is Frequency Response.

1) Food List:
The objective of designing a questionnaire is to measure intake of a few specific nutrients or to comprehensively assess the desired dietary intake.

- A comprehensive assessment of food intake is generally desired for the following reasons:
  - To anticipate all the questions regarding diet at the beginning than that appear at the end of the study
  - An important item may not have included in a highly restricted food list
  - Total nutrient intake may be related to disease outcome and thus confound the specific food effects

It may not be feasible to include a complete diet assessment in a particular questionnaire. It is reasonable to select a few specific food items, when the focus is on only one nutrient.

- The purpose of FFQ:
According to the epidemiologic applications, ranking individuals is the primary objective, and conversion to absolute intake by post hoc statistical methods.

- To be informative, the food item must have the following general characteristics:
It must be used reasonably often, must have a significant content of the nutrients of interest and the use must vary from person to person.

- Compilation of a food list:
  - Identifying the foods that contain extensive amounts of the nutrients of interest from the published food composition tables (this includes foods having high nutrient concentration but are not eaten with sufficient frequency)
  - Systematically reducing the long list of potentially important nutrient sources by pilot testing
Pilot testing:
- Each nutrient’s regression analysis:
  Dependent variable - Total nutrient intake
  Independent variable - The food explain the most between-person variance in nutrient
- Computer algorithm - Mark and coworkers developed a computer algorithm to select all possible combinations of foods, calculate nutrient intakes from each combination, and pick the combination having the highest correlation with the calculated intakes
- Open ended data - Obtained by diet records or 24-hour recalls, to identify the important foods that contribute to the total absolute intake of a nutrient. These methods are typically coded much more specifically than would be appropriate for items on questionnaire

Some principles of food list organizing:
- The organization and structure of a food list is important because one item can change the interpretation of another
- More specific items should precede general items
- It’s tempting to maximize the comprehensiveness of a questionnaire while maintaining brevity by combining several foods into a single question
- The deletion of a clarifying item can alter the response to another item
- Arriving at the optimal balance between splitting foods into many detailed separate questions or collapsing items into a few broad questions is extremely important

Modifying an existing questionnaire:
When a FFQ is being developed for a population with a substantial different cultural background from the investigators, considerable effort will be needed to learn about dietary patterns and the description and the preparation of foods.

2) Frequency Response:
- Options for portion size information: Information depends on size of the portion. Based on this, there are two types:
  1. Simple FFQ
  2. Semi quantitative FFQ
     - Food that come in natural or typical unit: For foods that come in natural or typical unit (such as one egg) this additional specific can add clarity to the question
     - Food that does not come in natural or typical unit: It’s possible to specify a typical portion; if a subject’s usual portion is twice that amount, they would be expected to double their reported frequency of use
     - Describing in words or using realistic model, picture: A third alternative is to include an additional item for each food to describe the usual portion size. This may involve describing a medium portion in words and asking subjects to describe their usual portion as small, medium, or large; using realistic model or a simple sharp as a unit of reference; or providing pictures of different portion sizes as multiple choices questions
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Although it may be tempting to add portion size questions because there is “nothing to lose,” this is not necessarily true. If the amount of variation due to error exceeds the amount of information gained on true variation in portion size, validity can actually be reduced.
Computation of nutrient intakes:
- If portion sizes have been specified on the questionnaire, the nutrient values relate to that portion size.
- If no portion sizes have been specified, the nutrient content for a typical or average portion size should be used.
- If open-ended questions are included, it’s necessary to obtain specific data for each possible response.

Overall questionnaire design and administration:
The accurate collection of dietary data requires motivated subjects; thus, emphasizing the scientific importance of the information and assuring confidentiality is basic. Clear instructions are essential, which can usually be enhanced by the use of the relevant examples. If a questionnaire to be used in an interview format, standardized procedures are essential.

The administration of FFQ:
1. Personal interview
2. Telephone
3. Self-administered, including by mail

Response rate
- Telephone interview > mail questionnaires

Willingness
- Telephone interview > at-home interview

In constructing FFQ, careful attention must be given to the choice of foods, the clarity of the questions, and the format of the frequency response section.

Advantages of FFQ:
1. Easy for subjects to complete
2. Processing is readily computerized
3. Inexpensive
4. Feasible for prospective studies involving tens of thousands of subjects

The underlying principle of the food-frequency approach is that average long-term diet is conceptually important exposure rather than intake on a few specific days.

It’s typically easier to describe one’s usual frequency of consuming a food than describe what foods were eaten at any specific meal in the past.

Reproducibility and Validity of Food-Frequency Questionnaire:
Reproducibility refers to consistency of questionnaire measurements on more than one administration to the same person at different times.

Validity refers to the degree to which the questionnaire actually measures the aspect of diet that it was designed to measure.

Approaches for evaluating dietary questionnaires
1. Comparison of means
2. Proportion of total intake accounted for by foods included on the questionnaire
3. Reproducibility
4. Validity (comparison with an independent standard)
5. Comparison with biochemical markers
6. Correlation with a physiologic response
7. The ability to predict disease
8. Validity (comparison with an independent standard)

- The choice of a population for a validation study:
  Ideally, the subject in a validation study should be a random sample of the study population in which the questionnaire is being used. This is often not practically possible, particularly if the population is widely scattered, as face-to-face contact is usually necessary.

- The choice of a comparison method for a validation study:
  1. Dietary record
  2. 24-hour recall
  3. Biochemical indicator
     For some specific dietary factors, such as sodium, potassium, beta-carotene, or certain fatty acids

- The choice of an appropriate time frame:
  Collection of comparison data over 1-year period is generally appropriate so that seasonal effects and other poorly defined fluctuations in diet are incorporated. Because intake of almost all foods and nutrients varies greatly from day to day, collection of data from multiple days per subject is essential to measure the true between-subject variation in dietary factors and the ability of the questionnaire to discriminate among subjects.

- The sequence of data collection in a validation study:
  Because questionnaire is relatively inexpensive, the best solution seems to have subjects complete the questionnaire twice, before and after the period of detailed recording. This providing a conservative estimate of the true correlation between the questionnaire and the detailed method (provided by the first questionnaire), as well as an optimistic estimate (provide by the repeated questionnaire).

- Calibration Study:
  The conceptual issue is to determine the true intake that corresponds to response to the questionnaire being evaluated. We don’t have to measure true intake for an individual to accomplish this; the true average for a group of individuals with the same questionnaire response is sufficient.

Data analysis and presentation of validation/calibration studies:

Data analysis
In analyzing data from a validation study, crude nutrient intakes are of interest, but it is also important to adjust nutrient intakes and biochemical factors for variable that are ultimately controlled in an epidemiologic analysis.

Age and sex are almost always controlled in epidemiologic analyses, because the between-person variation in dietary intake due to these covariates tends to increase observed correlations between methods. It is usually important to adjust for total energy intake in case-control or cohort studies, it is important to adjust for energy intake in validation study as well.

Data presentation
Many alternatives exist for presenting data on the associations between the questionnaire and comparison methods.

1. Contingency tables: This method may become cumbersome when many nutrients are being studied
2. Correlation coefficient
3. Regression coefficient: Two measurements can be described as a simple regression