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National Obesity  
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# Measuring diet and physical activity in weight management interventions

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## **Executive summary**

This paper identifies a shortlist of practical and validated questionnaires for the assessment of physical activity and diet, to support public health practitioners to evaluate weight management interventions. The shortlist is based on best available evidence and highlights the strengths and limitations of each questionnaire.

### **Shortlist of selected questionnaires**

The questionnaires are categorised according to what they measure, either physical activity or diet, and by target group, either children and young people or adults.

#### ***Physical activity: children and young people***

1. The Physical Activity Questionnaire for Older Children/Adolescents (PAQ-C/PAQ-A)
2. Youth Risk Behaviour Surveillance Survey (YRBSS)
3. The Teen Health Survey

#### ***Physical activity: adults***

1. Stanford 7-day recall (7-DR)
2. International Physical Activity Questionnaire Long version (IPAQ-Long)
3. New Zealand Physical Activity Questionnaire (Short Form) (NZPAQ-Short)
4. 7-day Physical Activity Diary

#### ***Diet: children and young people***

1. Child and Diet Evaluation Tool (CADET)
2. Day in the Life Questionnaire (versions for 7–9 years and 9–11 years (DILQ))
3. Synchronised Nutrition and Activity Programme (SNAP™)
4. Child Nutrition Questionnaire (CNQ)
5. Family Eating and Activity Habits Questionnaire (FEAHQ)
6. Children's Dietary Questionnaire (CDQ)

#### ***Diet: adults***

1. Five-a-day Community Evaluation Tool (FACET)
2. Dietary Intervention in Primary Care (DINE)
3. Short Form Food Frequency Questionnaire (SFFQ)
4. Two-item Food Frequency Questionnaire
5. Dietary Quality Score (DQS)

It is important to bear in mind that the questionnaires have been validated using a variety of methods and, in many cases, have been validated for use in population surveillance rather than intervention studies. In some cases, it is therefore unclear whether the tools are sensitive enough to measure the type and magnitude of change seen in interventions. Despite this important caveat, these questionnaires are strong options for consideration for measuring diet and physical activity in public health interventions.

## Background

Preventing obesity among adults, children and young people is a key public health challenge. There is evidence to suggest that interventions to prevent obesity are more effective if they are multi-component, ideally addressing diet and physical activity together.<sup>1,2</sup> Currently, there is a lack of evidence about what works to prevent obesity. Therefore it is essential to evaluate projects and interventions to contribute to our understanding of the type of interventions that are effective. To support the development of robust and consistent evaluations, the National Obesity Observatory (NOO) has developed the *Standard Evaluation Framework for weight management interventions* (SEF) with how-to guidance, core minimum evaluation criteria, and technical information on data and measurement.<sup>3</sup>

The SEF states that the measurement of diet and physical activity should be an essential component of any intervention that aims to change these behaviours. This paper supplements the SEF by providing guidance on the measurement of physical activity and diet among adults, children and young people. It brings together recommendations from three previous reviews: two NOO papers that independently reviewed measurement tools for physical activity in adults,<sup>4</sup> and diet in adults, children and young people;<sup>5</sup> and a published review of self-reported physical activity measurement tools for children and adolescents.<sup>6</sup>

This paper is intended to be an accessible and practical guide to the measurement of physical activity and diet. It provides a shortlist of practical and validated tools to:

- support people conducting evaluations within a public health setting
- help provide consistency and comparability between evaluations of weight management interventions and to strengthen the evidence base
- support the implementation of the SEF

It is aimed primarily at public health practitioners working to tackle obesity, but may also be useful for academic researchers working in this area.

## Key considerations in the measurement of physical activity and diet

An evaluation of a public health intervention should measure the extent to which it has achieved its objectives. If an objective is to change diet and physical activity behaviours then clearly it is important to measure those behaviours. Decisions about what to measure and why, should be integral to the early planning stages of an intervention, as should the key measures of a specific behaviour. For physical activity these are likely to be frequency, intensity, time and type of activity;<sup>6,4</sup> and for diet, food intake (including intake of specific foods, total energy intake and portion size) and patterns of eating behaviours.<sup>5</sup>

Tools and instruments for measuring physical activity and diet are generally grouped into either direct (objective) measures such as accelerometers, or indirect (subjective) measures such as questionnaires (see Appendix I). However, despite the range of tools available, there is currently no single method that can be considered the 'gold standard' for the assessment of overall physical activity or diet in public health settings.<sup>4,5,6</sup>

In the absence of a gold standard measure, the challenge is to select the tool which strikes the most acceptable compromise between the following criteria:<sup>4,5,6</sup>

- Validity: does the tool measure what it is intended to measure?
- Reliability: does the tool produce a measurement that is stable and reproducible under the same conditions?
- Feasibility: is the tool easy to use by participants and evaluators, and can the data be easily interpreted?
- Cost and practicality: is the tool available and can it be implemented at a reasonable cost?

## Considerations in the selection of measurement tools

### Nutrition

In the context of public health nutrition, self-report methods are commonly used to collect food intake data as they are practical, easy to administer, less invasive and require less human and financial resources than direct methods such as biomarkers or clinical indicators. There are, however, limitations with data collected using self-report methods. For example, response bias can occur when respondents report behaviour that they perceive to be desirable, rather than accurate. Weighed food records are frequently considered to be the best method for dietary assessment but they can still show under reporting of less healthy foods and over reporting of healthier foods. Inaccuracy and bias in self-report data may also arise from the design and administration of data collection tools such as food frequency questionnaires which have not undergone robust validation.<sup>5</sup>

### Physical activity

Until the development of motion sensors, such as accelerometers and pedometers,<sup>a</sup> the most frequently used assessment method for physical activity was also self-report. As a consequence, there are a large number of self-report approaches in use, including questionnaires, diaries and log books, with great variation in reliability and validity.<sup>6</sup> Their reliance on recalling activity from memory can be problematic, especially for children and young people. However, they are extremely useful for providing information on the type and context of physical activity: information which is not available through more direct assessment methods.<sup>6</sup>

Despite these limitations, self-report tools remain the most cost-effective option for population level surveillance, and the most practical option for public health evaluations of diet and physical activity in relation to weight management interventions.

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<sup>a</sup> Further details about accelerometer and pedometer measurement can be found in Appendix I.

## **Selection criteria used in the reviews of the shortlisted self-report assessment tools**

The shortlist of tools in this paper is the product of three separate systematic reviews.<sup>4,5,6</sup> The reviews all considered validity, reliability and feasibility of the shortlisted tools, although they used slightly different inclusion criteria.

- The selection of tools to measure adult physical activity<sup>4</sup> drew on a previous review<sup>7</sup> and included only tools that had been validated against doubly labelled water.<sup>b</sup> This meant that tools were able to estimate total energy expenditure.
- The selection of tools to measure physical activity in children and young people included one tool that had been validated against doubly labelled water, and two that had been validated against accelerometer data.<sup>6</sup> Tools were selected primarily on their suitability for population surveillance.
- The selection of tools to measure diet and nutrition included tools that had been validated against a measure such as a semi-weighed food diary; longer food frequency questionnaires; seven-day checklists; or (in one case) with plasma and urine biomarkers.<sup>5</sup>

It is also important to note that the majority of these questionnaires were originally developed for population surveillance and not for use in individual or group interventions. In some cases, it is unclear whether the tools are sensitive enough to measure the type and magnitude of change seen in interventions. Their potential applicability for use in weight management evaluations is, therefore, a key consideration. Further detail is provided in Appendix I and II.

It should be noted that some of the questionnaires were originally developed for an international audience and, therefore, may not have been evaluated within a European context. In some instances, the language of the questionnaire may need to be modified to ensure it is appropriate for a UK audience. Such adaptations may, however, affect the validity of the tool and this should be considered when interpreting the results.<sup>6</sup>

### **Availability**

Complete copies of the shortlisted questionnaires can be found in the supplementary paper.<sup>8</sup> However, it may still be necessary to obtain permission for use from the authors.

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<sup>b</sup> Further details in relation to doubly labelled water can be found in Appendix I

## Assessment tools for physical activity and diet

The following assessment tools are based on current best available evidence. They offer a range of options for public health practitioners to assess physical activity or diet in the evaluation of weight management interventions. Standardised categories are used to describe the questionnaires; the level of detail provided for each is determined by the accessibility to information.

### Assessment of physical activity: children and young people

There are three measurement options to consider when assessing physical activity in children and young people.

#### 1. *The Physical Activity Questionnaire for Older Children/Adolescents (PAQ-C/PAQ-A)*

**What is it?** The PAQ-C/PAQ-A is a nine-item, seven-day self-report recall questionnaire, designed and extensively used for surveillance and monitoring. There are two versions of the scale: PAQ-C developed for older children and PAQ-A developed for adolescents.

**Target group:** 8–14 year olds and 14–20 year olds.

**What does it measure?** Habitual moderate-to-vigorous activity levels during the school year, providing an estimate of total activity.<sup>6</sup>

**Validity/reliability:** consistently high validity against a variety of direct measures, including doubly labelled water, demonstrating its ability to accurately estimate energy expenditure. Reliability is considered to be moderate.<sup>9,10</sup> This survey tool has mainly been used in the US and Canada; it has not been evaluated in a European context.

**Feasibility:** estimated completion time is 20 minutes. It is considered easy to administer, complete and code, and is a low burden to both the deliverer and the respondent.<sup>6</sup> Analysis involves calculating a mean composite score based on responses to each item; step-by-step guidance is available through the link below. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> In addition, full details including the questionnaires and coding can be found in the PAQ-C/PAQ-A manual<sup>11</sup> and via:

[www.dapa-toolkit.mrc.ac.uk/documents/en/PAQ/PAQ\\_manual.pdf](http://www.dapa-toolkit.mrc.ac.uk/documents/en/PAQ/PAQ_manual.pdf)

#### 2. *Youth Risk Behaviour Surveillance Survey (YRBSS)*

**What is it?** The YRBSS is a five-item, self-report recall questionnaire.

**Target group:** 10–21 year olds.

**What does it measure?** Data on school and leisure time, moderate to vigorous physical activity over the past week or year. Data on sedentary behaviours are also captured, as is frequency of activity.<sup>6</sup>

**Validity/reliability:** validity is considered to be good, as it converged well with accelerometry. Reliability is moderate.<sup>6</sup> The questionnaire has been extensively used with children between 10–21 years old, primarily in the USA, Philippines and Canada.<sup>12,13</sup> It has not been evaluated in a European context.

**Feasibility:** no detail is provided regarding estimated completion time. However, it is short and therefore reasonable to assume that the completion time is minimal. Analysis requires a statistical package. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> In addition, all information including questionnaires and advice on analysis can be downloaded from: <http://www.cdc.gov/HealthyYouth/yrbs/index.htm>

### **3. The Teen Health Survey**

**What is it?** The Teen Health Survey is a two-item, self-report recall questionnaire. It was adapted from the YRBSS and tested for use in primary care.<sup>14</sup>

**Target group:** 14–17 year olds.

**What does it measure?** Moderate-to-vigorous physical activity over the last seven days or a 'typical' week.<sup>6</sup>

**Validity/reliability:** reliability is moderate, and validity is good, showing moderate to good association with accelerometry. However, this methodology only records the number of days young people are active for 60 minutes, it does not record the type of activities which they are doing. It may, therefore, be of limited use in weight management interventions that focus on total energy expenditure.<sup>6</sup> The questionnaire has been used extensively in the US with 14–17 year olds, often as part of larger health surveys.<sup>15</sup> It has not been evaluated in a European context. Further testing is needed to determine its suitability for use with younger children.

**Feasibility:** no detail is provided regarding estimated completion time. However, it is short and it is, therefore, reasonable to assume that the completion time is minimal. Analysis requires totalling the total number of active days; and this is an extremely simple and quick process. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Additional copies can be downloaded from: <http://www.drjamesallis.sdsu.edu> Click 'Measures and Surveys Available to Download' and 'PACE+ Adolescent PA Measure'.

### **Assessment of physical activity: adults**

There are four measurement options to consider when assessing physical activity in adults.

#### **1. Stanford 7-day recall (7-DR)**

**What is it?** The Stanford 7-day recall is a seven-item interview-administered physical activity recall questionnaire, that was originally developed for the Stanford Five Cities project.<sup>16</sup>

**Target group:** adults.

**What does it measure?** The number of hours spent sleeping and undertaking moderate, hard, and very hard activities during the preceding week. The remaining amount of time is not counted as it is presumed to have been spent in light activities. Examples of the types of activities in each category are provided, and the week is separated into weekend days and weekdays. An additional four questions

are included for participants to evaluate the effectiveness or validity of the instrument itself.

**Validity/reliability:** acceptable reliability and validity.<sup>4</sup> Validity has also been assessed against doubly labelled water indicating that the instrument provides a reasonable estimate of daily energy expenditure.<sup>17,18</sup> It has been used in numerous intervention studies including the Activity Counseling Trial (ACT).<sup>19</sup>

**Feasibility:** estimated completion time is approximately 15 minutes.<sup>4</sup> Analysis involves calculating the total energy expenditure based on hours spent sleeping and in activities over the past seven days. Step-by-step guidance is provided through the link below. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Additional copies can be downloaded from: <http://www.drjamesallis.sdsu.edu> Click 'Measures and Surveys Available to Download' then '7 day PAR survey' for the questionnaire and '7 day PAR protocol' for support with analysis.

## **2. International Physical Activity Questionnaire – Long Form (IPAQ-Long)**

**What is it?** The IPAQ-Long is a 27-item self-completion or telephone-administered recall questionnaire.

**Target group:** 15–69 year olds.

**What does it measure?** Walking, moderate intensity and vigorous intensity activities taken in each of the four domains: leisure-time physical activity; domestic and gardening activities; work-related physical activity and transport-related physical activity. It also includes questions on sitting activities such as reading, television viewing and sitting at a desk, although this is not included as part of the summary score of physical activity.<sup>4</sup>

**Validity/reliability:** acceptable reliability and criterion validity.<sup>20,21,22</sup> The IPAQ-Long is a population level instrument designed for surveillance and for cross-national monitoring of physical activity/inactivity. It was not initially designed for evaluating intervention studies and, as such, does not measure change in physical activity over time, although this could be possible if fully tested.<sup>4</sup> It has acceptable measurement properties for use in many settings and in different languages.

**Feasibility:** estimated completion time is approximately 15 minutes.<sup>4</sup> Analysis involves calculating total physical activity MET-minutes per week (a measure of total energy expenditure). Step-by-step guidance is provided through the link below. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Additional copies can be downloaded from: <http://www.ipaq.ki.se>

## **3. New Zealand Physical Activity Questionnaire Short Form (NZPAQ-SF)**

**What is it?** The NZPAQ-SF is a seven-item self-report questionnaire designed to be interview-administered. It is adapted from the IPAQ Short Form and was initially developed to measure population prevalence.

**Target group:** 15 years and over.

**What does it measure?** Frequency, intensity (moderate and vigorous) and duration of activities undertaken in the last seven days. Walking is the only specific activity type to be recorded.<sup>4</sup> It also includes an eighth optional item on 'Stage of Change'.

**Validity/reliability:** validated against the IPAQ-Long<sup>23</sup> and doubly labelled water at lower levels of activity.<sup>22</sup> Although the instrument was designed to measure population prevalence in New Zealand, it has been used in a primary-care based randomised controlled trial that showed a significant difference between intervention and control groups for middle-aged women.<sup>24</sup>

**Feasibility:** estimated completion time is around 10 minutes. Show cards are used to prompt recall. Analysis involves calculating activity-related energy expenditure. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Additional copies can be downloaded from:  
<http://www.activenzsurvey.org.nz/Documents/validation-report-physical-activity-questionnaires.pdf>

#### **4. Seven-day Physical Activity Diary**

**What is it?** The seven-day Physical Activity Diary is a self-completion diary which requires participants to 'tick' blocks of activity as they occur.

**Target group:** adults.

**What does it measure?** Fifteen minute blocks of activity as they occur over the course of each day for seven consecutive days. Activities are grouped into four categories: sleep and rest periods; activities at work including activity on the way to work; leisure time plus home activities; and sports.

**Validity/reliability:** validity is good, although reliability is unclear.<sup>25</sup> The measure was designed for use in epidemiological studies so its usefulness in intervention studies is unknown.<sup>4</sup>

**Feasibility:** no detail is provided regarding estimated completion time. However, it is reasonable to assume that this is minimal. It does not require any verbal instruction for completion. Participants' main challenge is remembering to complete on seven consecutive days.<sup>4</sup> Analysis involves calculating total energy expenditure. Software is provided for this purpose and can be accessed via the link below. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup>

**Diary:**

[http://www.dife.de/de/presse/erhebungsinstrumente/a\\_englisch\\_version/Physical\\_Activity\\_record.pdf](http://www.dife.de/de/presse/erhebungsinstrumente/a_englisch_version/Physical_Activity_record.pdf)

**Database:** <http://www.dife.de/en/index.php?request=/en/presse/downloads.php>

## Assessment of diet: children and young people

There are six measurement options for consideration when assessing diet in children and young people.

### 1. *Child and Diet Evaluation Tool (CADET)*

**What is it?** The CADET is a tick-list record for all foods consumed over one 24-hour period, with a retrospective breakfast section. There are two questionnaires: one for completion at home by the parent or carer, and one for completion at school by a lunchtime supervisor or classroom assistant.<sup>26</sup> The questionnaire was initially developed to evaluate the National School Fruit and Vegetable Scheme.<sup>27</sup>

**Target group:** 3–7 year olds.

**What does it measure?** Dietary intake of 115 food items over a 24-hour period with a focus on fruit and vegetables. Additional questions about dietary behaviours and attitudes, and socio-economic characteristics are also included. Quantity and weight of the food items are not specifically recorded. Portion sizes are based on mean portion sizes in the National Diet and Nutrition Survey and are age and gender specific.<sup>5</sup>

**Validity/reliability:** validity was assessed against a 24-hour semi-weighed food diary. Nutrient intake values were similar to those obtained for the same age group in the 1997 National Diet and Nutrition Survey. It is, therefore, considered appropriate for assessing behavioural change in dietary patterns at a population level or to rank populations according to dietary intake.<sup>5</sup> It is appropriate for use with children from diverse social and ethnic backgrounds across a range of settings, and an adapted version of the questionnaire is currently being validated for use in black and minority ethnic groups. Further testing would be needed for use with different age groups.<sup>5</sup> It is not considered suitable for monitoring diet-related targets in a population.<sup>26</sup>

**Feasibility:** no detail is provided regarding estimated completion time. However, despite relatively long tick lists, parent and teacher evaluation was very positive: parents felt it was easy and quick to complete.<sup>5</sup> Analysis involves calculating average nutrient intake; specific software is required for this purpose and is available from the authors. The questionnaire itself is free to use, although training is needed for those administering CADET and to interpret the results.<sup>5</sup>

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Additional copies can be downloaded and can be used providing the authors are notified and it is cited and acknowledged appropriately:

[http://www.dapatoolkit.mrc.ac.uk/documents/en/Cad/Cadet\\_Diary.pdf](http://www.dapatoolkit.mrc.ac.uk/documents/en/Cad/Cadet_Diary.pdf)

### 2. *Day in the Life Questionnaire (DILQ)(7-9 years and 9-11 years)*

**What is it?** The DILQ (7–9 years) is a 17-item self-completion questionnaire.<sup>28</sup> The DILQ (9–11 years) is a modified version that contains 23 items.<sup>29</sup> Both were developed as a supervised classroom activity to measure fruit and vegetable consumption.

**Target group:** 7–9 year olds and 9–11 year olds.

**What does it measure?** Fruit and vegetable consumption in the previous 24 hours. A mixture of pictures and words are used to aid recall and improve completion of the tool. Fruit and vegetables in composite foods like pizza are not included as the

contribution to diet is considered difficult to estimate.<sup>5</sup> The DILQ tools also collect information about physical activity, transport to and from school, and television viewing.

**Validity/reliability:** validity and test-retest reliability were good for the DILQ (7–9 years).<sup>5</sup> Validity was assessed against same-day observations and it was found to be able to detect changes in intake during a fruit intervention in one school.<sup>28</sup> Validity and reliability for the DILQ (9–11 years) was adequate; validity was assessed against 24-hour dietary recall interviews.<sup>29</sup>

**Feasibility:** estimated completion time for the DILQ (7–9 years) is between 30–40 minutes. No detail is provided regarding estimated completion time for the DILQ (9–11 years). For both questionnaires, more reliable results are produced when the questionnaires are administered in a group, and the questions are read out and supported by verbal prompts. For the DILQ (7–9 years) there is a small fee for the manual, which includes the questionnaire and analysis details. No details are provided regarding costs for the DILQ (9–11 years).

**Where can copies be obtained?** A sample copy of both questionnaires is provided in the supplement to this paper.<sup>8</sup> Anyone wishing to use the DILQ (7–9 years) should contact the authors to obtain a copy of the DILQ (7–9 years) manual. Contact should be made via the Health Experiences Research Group, University of Oxford Department of Primary Care. For the DILQ (9–11 years) details are provided in the reference paper.<sup>29</sup>

### **3. Synchronised Nutrition and Activity Programme (SNAP™)**

**What is it?** The SNAP™ is a web-based programme that uses a typical 24-hour recall method to assess dietary intake and physical activity in children.<sup>30</sup>

**Target group:** 7–15 year olds.

**What does it measure?** Dietary intake of 40 different food and nine different drink items in the previous 24 hours. A free-text box allows for the inclusion of any other food/drink not included in the list. Children are taken through a typical school day and asked to choose the food and drink items they consumed; visual memory prompts are provided. No information is collected on portion sizes.<sup>5</sup> The SNAP™ also records physical activity in the previous 24 hours.

**Validity/reliability:** validity is acceptable when assessed against the 24-hour multiple pass recall.<sup>5</sup> Children also completed an anonymous evaluation questionnaire and reported that they enjoyed using it and were able to complete it. Reliability and its ability to detect change over time has not been tested. The questionnaire is likely to be suitable for the evaluation of school-based interventions.<sup>30</sup> Further testing is needed to determine its suitability for use with black and minority ethnic groups.<sup>5</sup>

**Feasibility:** estimated completion time is 15 to 40 minutes, depending on the reading ability of the child and the internet connection speed. A user licence must be bought from the development team and training is required.<sup>5</sup>

**Where can copies be obtained?** A copy of the website homepage is provided in the supplement to this paper.<sup>8</sup> The user licence is available at: <http://www.snaproject.co.uk>

#### **4. Child Nutrition Questionnaire (CNQ)**

**What is it?** The CNQ is a 14-item questionnaire to be completed by children with support from a helper. It was developed to examine dietary patterns that are known to increase the risk of weight gain.

**Target group:** 10–12 year olds.

**What does it measure?** The consumption of sweetened beverages and non-core foods such as chocolate, lollies and hot dogs as well as fruit, vegetables and water. It also includes questions on the frequency of specific ‘healthy’ behaviours; attitudes towards the consumption of fruit and vegetables; and the day-to-day availability of fruit and vegetables. Instructions on completing the questionnaire are initially provided to a group of children, while posters depicting standard serving sizes of fruit and vegetables are displayed. A ‘helper’ is likely to improve the accuracy of questionnaire completion.<sup>5</sup>

**Validity/reliability:** validity was demonstrated with a highly significant correlation between the questionnaire and an un-weighed seven-day food diary. There was good test-retest reliability for the majority of questions.<sup>31</sup> Whilst its ability to detect change over time was not formally tested, it is considered to be possible.<sup>5</sup> The CNQ was developed in Australia so it may need to be validated for use in the UK. Further testing is also needed to determine its suitability for use with black and minority ethnic groups.<sup>5</sup>

**Feasibility:** estimated completion time is 20 minutes. Advice on coding and analysis should be sought from the development team.<sup>31</sup> The questionnaire is free to use, although it must be cited and acknowledged appropriately.<sup>5</sup>

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Additional copies can be downloaded from:  
<http://www.ijbnpa.org/content/5/1/5/additional/>

#### **5. Family Eating and Activity Habits Questionnaire (FEAHQ)**

**What is it?** The FEAHQ is a 21-item self-administered questionnaire designed for co-completion by parents or carers and their children. It was developed to examine environmental factors and family behaviours associated with weight gain and weight loss in children.

**Target group:** parents or carers of obese children aged 6–11 years old.

**What does it measure?** The FEAHQ has four separate scales based on those factors most likely to be associated with weight change including: activity level, stimulus exposure, eating related to hunger and eating style. Each item is individually scored (based on its association with weight change). Higher numerical scores reflect less-appropriate eating patterns.<sup>5</sup>

**Validity/reliability:** validity was demonstrated with adequate discrimination between behaviours leading to weight gain and those associated with normal weight. Good test-retest reliability was shown if completed by parent/carer.<sup>5</sup> It was considered appropriate for monitoring behavioural change over time as weight loss in a child was associated with an improvement in scores.<sup>32</sup> The FEAHQ was developed in Israel and, whilst it is currently used in the UK, further testing is needed to determine its suitability for use in this country.<sup>5</sup>

**Feasibility:** estimated completion time is less than 30 minutes. Analysis involves calculating a score based on its association with weight change. Guidance on scoring and interpretation of results is provided in the reference paper,<sup>32</sup> although some

basic training may be required.<sup>5</sup> The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> It is also available as an appendix to the reference paper:

<http://www.nature.com/ejcn/journal/v52/n10/pdf/1600647a.pdf>

## **6. Children's Dietary Questionnaire (CDQ)**

**What is it?** The CDQ is a 28-item semi-quantitative food-frequency questionnaire, designed to be completed by a parent or carer (with or without researcher assistance). It was developed to examine patterns of food intake.

**Target group:** parents or carers of 4–16 year olds.

**What does it measure?** Intake of both 'recommended' and 'discouraged' foods. It calculates four different food-group scores for fruit and vegetable; fat from dairy products; non-core foods; and sweetened beverages. It does not measure the actual amount and type of food consumed.<sup>5</sup>

**Validity/reliability:** validity at group level was demonstrated with a good correlation between the questionnaire and a seven-day checklist. It is not, however, valid for use at an individual level. Test-retest reliability was reported to be good.<sup>5</sup> The questionnaire can be used to detect dietary change over time, but further testing is needed to confirm its ability to detect both direction and magnitude of change.<sup>33</sup> It was developed in Australia and further testing is needed to determine its suitability for use in the UK,<sup>5</sup> and for use with black and minority ethnic groups.<sup>5</sup>

**Feasibility:** no detail is provided about estimated completion time. Details of how to analyse and interpret the questionnaire are provided in the reference paper.<sup>33</sup> The questionnaire is free to use although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> Further details can be found in the reference paper.<sup>33</sup>

## **Assessment of diet: adults**

There are five measurement options for consideration when assessing diet in adults.

### **1. Five-a-day Community Evaluation Tool (FACET)**

**What is it?** The FACET is a six-item self-completion questionnaire that focuses on intake of fruit and vegetables and related eating behaviours in adults. It was initially designed to evaluate the impact of an intervention to increase consumption of fruit and vegetables in a local population.

**Target group:** adults.

**What does it measure?** Three main aspects of healthy eating: how often certain foods (especially fruit and vegetables) are consumed; attitudes towards fruit and vegetable intake; and knowledge of relevant health recommendations.<sup>5</sup>

**Validity/reliability:** a valid tool that has good correlation with a food diary, although it may overestimate portions consumed. FACET is able to adequately rank respondents by fruit and vegetable intake. Reliability and its ability to detect change over time has not been tested.<sup>34</sup> Further testing would be required to use this tool with black and minority ethnic adults due to the small representation in the original study.

**Feasibility:** no detail is provided regarding estimated completion time. However, it is considered easy to complete and it is, therefore, reasonable to assume that completion time is minimal.<sup>5</sup> Analysis involves calculating the total number of portions of fruit and vegetables consumed each day; statistical software is required for this. The questionnaire is free to use, although it must be cited and acknowledged appropriately.<sup>5</sup>

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> For further details contact the Faculty of Public Health:  
[http://www.fph.org.uk/uploads/section\\_d.pdf](http://www.fph.org.uk/uploads/section_d.pdf)

## **2. Dietary Intervention in Primary Care (DINE).**

**What is it?** The DINE is a 19-item questionnaire developed for use in interviewer-administered health checks to help health professionals provide personalised dietary advice.

**Target group:** adults.

**What does it measure?** An individual's intake of total fat and dietary fibre, categorised as low, medium or high. Specific foods are included which account for 70% of the fat and fibre in a typical UK diet.<sup>5</sup>

**Validity/reliability:** a valid tool that has good correlation with a validated four-day semi-weighed food diary. DINE can also adequately rank population groups according to intake.<sup>35</sup> Its reliability and ability to detect change over time has not been tested. The questionnaire was designed for use in clinical settings and has not been validated for use with larger populations. Further testing would be required for population groups whose diet differs significantly from the general population and also for black and minority ethnic groups.<sup>5</sup> The questionnaire did not meet the original criteria for inclusion in this paper. However, it has been included due to its use in the Health Survey for England.<sup>36</sup>

**Feasibility:** completion time for an experienced interviewer is 5–10 minutes; no detail is provided regarding estimated completion time. It is free to use for clinical or research purposes. It has been designed for use by those without any nutritional knowledge. Guidance is provided on its use and interpretation in the reference paper.<sup>5</sup>

**Where can copies be obtained?** A sample copy of the first page of the questionnaire is provided in the supplement to this paper.<sup>8</sup> The full questionnaire could not be included as it is not publicly available; distribution is controlled to ensure that it is used appropriately. Copyright is held by the University of Oxford and permission for use must be sought from Liane Roe ([lsr7@psu.edu](mailto:lsr7@psu.edu)).

## **3. Short Form Food Frequency Questionnaire (SFFQ)**

**What is it?** The SFFQ is a 20-item self-completion questionnaire designed to assess overall dietary quality. It is designed for use with large populations.

**Target group:** adults.

**What does it measure?** Overall dietary quality by recording the intake of 20 food items with a focus on fruit, vegetables, fibre-rich foods, high fat and high sugar foods, meat, meat products and fish. Usual intake is recorded over the last month. Results can be used to examine the intake of specific food groups. It is also possible to calculate a dietary score based on specific indicators, i.e. a healthy diet. It may be a useful alternative to longer, more expensive food-frequency questionnaires when

only an indication of dietary quality is required.<sup>5</sup> Additional questions are also included on alcohol consumption, exercise and demographics.

**Validity/reliability:** a valid tool that correlates well with measures from a validated 217-item food frequency questionnaire, but not with measures of diet recall. Its reliability and ability to detect change over time has not been tested.<sup>37</sup> It is relatively new and further testing is needed to determine its suitability for use with different populations including black and minority ethnic groups.<sup>5</sup>

**Feasibility:** no detail is provided regarding estimated completion time. Analysis involves the classification of food groups according to dietary quality. A dietary score is also calculated, which requires specific software. Its application requires support from the research team.<sup>5</sup>

**Where can copies be obtained?** A sample copy of the first page of the questionnaire is provided in the supplement to this paper.<sup>8</sup> The full questionnaire could not be included as it is not publicly available. However, the authors welcome the opportunity to work with other groups who wish to use the tool.<sup>37</sup>

#### **4. Two-item Food Frequency Questionnaire**

**What is it?** The two-item food-frequency questionnaire was developed to estimate intake of fruit and vegetables. It is recommended that the questionnaire is administered by a trained interviewer.

**Target group:** adults.

**What does it measure?** Consumption of fruit and vegetables measured against the recommended daily intake of five portions of fruit and vegetables. Examples of typical portion sizes (including fruit juice) are provided.<sup>38</sup>

**Validity/reliability:** validity was demonstrated with a weak significant correlation with plasma and urine biomarkers. Its reliability and ability to detect change over time has not been tested.<sup>38,39</sup> It was initially designed for use with individuals in nutritional behavioural therapy, but it is considered suitable for use with larger populations. Further testing is required for use with black and minority ethnic groups. Further testing is also required to assess its appropriateness for self-completion.<sup>5</sup>

**Feasibility:** no detail is provided regarding estimated completion time. However, with only two questions, it is reasonable to assume that this is minimal. Analysis is quick and involves totalling the number of portions of fruit and/or vegetables consumed. The questionnaire is free to use, although it must be cited and acknowledged appropriately.

**Where can copies be obtained?** The two questions are listed in the supplement to this paper,<sup>8</sup> and can also be found in the reference papers.<sup>38,39</sup>

#### **5. Dietary Quality Score (DQS)**

**What is it?** The DQS is an eight-item self-completion questionnaire. It assesses the quality of adult diets based on certain nutritional risk factors for cardiovascular disease. It was designed for use at a population level.

**Target group:** 30–60 year olds.

**What does it measure?** Frequency of consumption of foods indicative of a healthy diet, including: vegetables, vegetarian dishes, fruit, fish, and type of fats used in spreading and cooking.<sup>5</sup> Each answer has an assigned score which is used to

calculate an overall dietary score and categorised to give a broad indication of whether the diet is of low, average or high quality.

**Validity/reliability:** a valid tool with good correlation with a 198-item food frequency questionnaire. Its reliability has not been tested. The author suggests that the questionnaire can detect change over time, although this detail has yet to be published.<sup>5</sup> The questionnaire was designed to provide a broad overview of dietary quality in a large population categorised as having overall healthy, average or unhealthy diets. It is not suitable for measuring specific nutrient intakes and is not recommended for an in-depth dietary assessment.<sup>40</sup> It was developed for use in an urban Danish programme and further testing may be needed for use in the UK and with black and minority ethnic groups.

**Feasibility:** no detail is provided regarding estimated completion time. However, as it is short, it is reasonable to assume that this is minimal. Analysis involves the calculation of an overall dietary score. No details are provided regarding costs for the use of this tool.

**Where can copies be obtained?** A sample copy is provided in the supplement to this paper.<sup>8</sup> The authors are willing to be contacted regarding usage.

## Conclusions

This briefing paper provides a shortlist of practical and validated questionnaires for the assessment of physical activity and diet in public health evaluations.

It is important to bear in mind that the questionnaires have been validated using a variety of methods and, in many cases, have been validated for use in population surveillance rather than in intervention studies. Therefore, in some instances, it is unclear whether the tools are sensitive enough to measure the type and magnitude of change seen in interventions. Despite this important caveat, these questionnaires represent strong options for consideration for the measurement of diet and physical activity in public health interventions.

The choice of questionnaire will ultimately depend on what it is being used for, and each has strengths and limitations that will need to be considered when making the final selection. In addition, each questionnaire has been developed and tested for specific purposes with particular population groups; the validity and reliability of a questionnaire will not remain the same when used with an alternative population group.

NOO would welcome feedback on the usefulness of this paper and examples of any evaluations conducted using these questionnaires, to feed into the ongoing development of the *Standard Evaluation Framework*.<sup>3</sup> This will help us better support practitioners and develop our future evaluation work.

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## Appendix I: An overview of physical activity and dietary assessment methods (adapted from<sup>1, 2,3</sup>)

Method	Description	Strengths	Weaknesses
<b>Objective measures</b>			
Doubly labelled water	Water that has had the oxygen (O) replaced with a safe isotope (O-18) so it can be traced when metabolised in the body.	Very accurately measures energy expenditure. Considered the 'gold standard' measure of energy expenditure.	Very costly and requires highly specialist equipment and expertise. Suitable for research purposes only.
Indirect calorimetry	Measures rate of oxygen metabolism through exhaled air.	Very accurately measures energy expenditure.	Very costly and requires highly specialist equipment and expertise. It can only be carried out in a metabolic laboratory. Suitable for research purposes only and will not capture habitual energy expenditure.
Pedometer	Small unit worn on the belt that counts the number of steps taken.	Inexpensive, non-invasive, can be administered in large groups. A good measure of walking activity and can be used to set goals for promoting behaviour change.	Between instrument variation can occur. Only measures walking type activity. It can be tampered with. Accuracy can be reduced during running and exercise classes.
Accelerometer	Small unit, usually worn on the belt that measures duration and intensity of activity through a motor sensor.	Provides an objective measure of body movement. Measures frequency, intensity and duration. Non-invasive.	Expensive, less useful for detecting upper body movement or movement on a vertical plane e.g. cycling. Data analysis requires expertise and specialist software.
Heart rate monitoring	Measures heart rate as a proxy measure of activity, intensity and duration.	Indirect physiologic measure of activity. Provides a measure of frequency, intensity and duration. Non-invasive.	Expensive. Monitor can cause occasional discomfort. Heart rate can also be affected by gender, fitness, arousal and temperature.
Geographical positioning systems (GPS)	Measures movement patterns by global positioning technology.	Detects movement, speed of movement and distance travelled whilst outdoors. Geographical maps of data can be produced.	Expensive, doesn't work indoors, can provide erroneous results (e.g. speed and distance when in a car). Some participant burden. Signal can be poor in some areas.

Biomarkers	Biochemical indicators that can be assessed in blood, bodily fluids, body tissues or excreta.	They provide an indication of a limited number and range of nutrient levels, or can be used, with varying precision.	Expensive and not practical for use for evaluating interventions.
Clinical/Physical indicators	Nutritional deficiencies identified from the physical appearance of the body when clinically examined.	Visible awareness of nutritional status.	Intrusive and time consuming. Not suitable for population level surveillance.  Gives no indication of food intake and eating behaviours.
Anthropometric indicators	Measurements of the human body which, when compared with standards that are typical of a reference population, can indicate abnormal nutritional status.	Accurate measurements of body fat.	Intrusive and time consuming. Not suitable for population level surveillance.  Gives no indication of food intake and eating behaviours.
<b>Subjective measures</b>			
Self report questionnaires (including food frequency questionnaires)	<p>Focus on recall over a specified period of time.</p> <p>Physical Activity Questionnaires record the type, duration and intensity of physical activities done.</p> <p>Food Frequency Questionnaires (FFQs) give an indication of the habitual consumption of particular foods or nutrients.</p>	<p>Captures qualitative and quantitative data. Inexpensive, low participant burden. Can be interview or self-administered, with or without support.</p> <p>Physical activity – possible to estimate energy expenditure from the compendium of activities.</p> <p>FFQs – Assess habitual consumption of food over an extended period of time. Portion size estimates can be used to obtain absolute nutrient intakes. Free text boxes allow respondents to record foods not included on the food list. Computer-readable forms can be scanned into computers reducing data-entry errors.</p>	<p>Reliability and validity problems. Recall bias, misinterpretation of questions possible. Not suitable for very young children or individuals with literacy problems.</p> <p>FFQ's use a closed list of foods which assumes that the list accurately reflects the most commonly consumed foods within the population being examined. This assumption increases the potential for error. Portion sizes may also be difficult to estimate.</p>

Diaries or logs	<p>Provide detailed records of behaviour.</p> <p>Physical activity diaries record activity patterns on a daily basis or as activities are done.</p> <p>Food intake records and diaries require an individual to record everything they eat over a specific period, often four to seven days.</p>	<p>Fewer recall problems as recorded at the point of consumption/activity. More detail than self-report and more accurate.</p> <p>Physical activity diaries record details of specific activities.</p> <p>Food diaries record exact portion sizes and descriptions of foods consumed and eating occasions. Excellent estimates for energy, nutrients, foods and food groups</p> <p>Can be done through PDA or smart phone.</p>	<p>Expensive to administer and analyse. Can be difficult to analyse as very detailed data. High participant burden. May influence subjects (i.e. encourage them to do more activity than usual or alter their eating behaviour). Individuals tend to under-report energy intake.</p>
Direct observation	<p>Visual observation by a researcher and recording of activity type, duration and approximate intensity. It is only usually used for dietary assessment as a means of validating a dietary assessment method.</p>	<p>Can provide qualitative and quantitative data concurrently. Specific physical activity behaviours can be coded.</p>	<p>Observers need to be trained. Method is time and labour intensive, it can therefore be a moderately expensive method. Observer preference may also alter behaviour. Can only be used over short periods.</p>

## **Appendix II: Criteria for selection of self-report assessment tools**

The similarities and differences in the validation criteria across the three reviews, which informed this briefing paper, are described here.

### **Physical activity: children and young people**

A systematic review of available self-report physical activity instruments developed for use for population surveillance among children and adolescents was conducted.<sup>4</sup> The review adopted rigorous selection criteria which involved:

- comprehensive searches of the academic literature for studies that reported the use of a self-report measure of physical activity among participants less than 19 years of age
- selection of a shortlist of 20 instruments that had provided some data on reliability and/or validity
- drafting a summary table of the features of all shortlisted tools
- consideration of the shortlisted tools by a panel of international experts

From this, a shortlist of three quality-assured physical activity assessment tools with the ability to provide estimates of prevalence was identified.<sup>4</sup>

For the purpose of this paper, the original 20 shortlisted instruments from the review were considered, alongside two additional criteria, which assessed the applicability of the tool for use in public health evaluations. The two additional criteria were:

- Can the tool detect change over time?
- Is it short enough to be used in a public health setting?

None of the tools adequately detected change in physical activity over time: a conclusion echoed by the findings of another review of this field.<sup>5</sup> A number of the tools were short enough to be used in a public health setting, although only three met some of the additional criteria. Additional details of this assessment can be found in the supplementary paper.<sup>6</sup>

Whilst further research is required, there is an urgent need to provide some guidance on the physical activity measurement tools available for use within weight management interventions. For this reason, based on the best available evidence, three questionnaires/surveys were identified for population surveillance of physical activity in children and adolescents.

### **Physical activity: adults**

A review of available self-report tools for adults<sup>7</sup> was based on earlier research,<sup>8</sup> which categorised studies according to the direct measure of physical activity used to assess validity. The selection criteria for the inclusion of self-report tools in the review included their ability to estimate energy expenditure and validation against doubly labelled water. Doubly labelled water is considered to be the 'gold standard' measure of energy expenditure. However, it is a complex method that can only be used in a laboratory and it is, therefore, not appropriate for use in the evaluation of public

health interventions. It can, however, be used to validate the accuracy of more subjective responses, for example, responses to questionnaires, as is the case here.

Additional criteria included:<sup>7</sup>

- relatively easy and practical to administer in a field setting
- mean difference between energy estimated by self-report and doubly labelled water <40%
- instrument should have been used in a trial of exercise promotion and detected a significant difference between intervention and control participants
- population in the validity study generalisable to the wider population

In general, log books, diaries and interview-administered questionnaires appear to be more accurate than simple self-completion recall questionnaires.<sup>7</sup> No existing physical activity measure perfectly met all of the above criteria, although four instruments met a high percentage of them.

### **Diet: children, young people and adults**

A review of available dietary assessment tools for use with adults and children in a public health setting focused on a literature search, with an intentionally broad search strategy.<sup>9</sup> The criteria for inclusion were:

- that the purpose of tool was dietary intake measurement or dietary behaviour measurement
- it was intended for use at a community or population level
- it was in a short-form questionnaire format that is suitable for use in public health settings
- that the testing of validity and/or reliability had been undertaken with the target population
- it was designed for use in developed countries and
- it was designed for use in a public health setting at a group or population level

Eleven dietary assessment tools met the specific criteria: six focused on children or their families and five focused on adults. For each, the main reference paper was assessed to determine:

- whether the tool was valid and reliable
- the main target population of the tool
- where the tool had been developed and its suitability for use in the UK
- which elements of diet it measures
- time and effort required from the respondent
- method of administration
- studies in which the tool had been used
- resources needed for its application and subsequent analysis and
- accessibility of the tool for use in public health settings

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## Reader Information

<b>Title</b>	Measuring diet and physical activity in weight management interventions
<b>Author(s)</b>	Debra Richardson Nick Cavill Kath Roberts Louisa Ells
<b>Reviewer(s)</b>	Professor Stuart Biddle, Loughborough University Dr Melvyn Hillsdon, Exeter University Beelin Baxter, Department of Health (East Region)
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<b>Publication date</b>	March 2011
<b>Target audience</b>	Public health professionals working in the field of physical activity, diet and/or obesity, although it may also be of use to academic researchers working in this area.
<b>Description</b>	This paper is intended to be an accessible and practical guide to measuring physical activity and diet by providing a shortlist of practical validated tools.
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