RESEARCH PAPER
Validity and reliability of a short questionnaire for assessing the impact of cooking skills interventions
K. L. Barton, W. L. Wrieden* & A. S. Anderson

Centre for Public Health Nutrition Research, University of Dundee, Dundee, UK

Introduction
Food preparation practices have evolved dramatically over the last century in the UK, shifting from the almost exclusive use of raw ingredients to that of being heavily dependant on processed foods. This shift has also led to a change in cooking skills (Caraher et al., 1999; Lang & Caraher, 2001). Improving the food skills of adults from low income communities has been a focus for improving dietary intake (Engler-Stringer, 2010a). There is some evidence that food preparation and meal structures are associated with dietary intake, especially in young adults (Larson et al., 2006, 2009; Engler-Stringer, 2010b). In women in families seeking charitable assistance, McLaughlin et al. (2003) reported that the frequency and complexity of at home food preparation were positively related to women’s energy and nutrient intakes. In the UK, food skills programmes are widely used as a means to improve confidence in food preparation, the use of basic food skills and food selections amongst low income communities, as demonstrated in the CookWell intervention (Wrieden et al., 2007).

The aim of the CookWell programme was to develop, implement and evaluate a transferable, food skills...
(cookery) programme for adults living in low income communities. The main objectives were to contribute to an increase in consumption of starchy foods, fish, vegetables and fruits, and a decrease in consumption of fat in adults living in areas of deprivation. The content of the intervention was developed from formative research findings with potential participants of a cooking skills intervention (Stead et al., 2004). An extensive evaluation was undertaken to examine changes in food choice, nutrient intake and a wide range of factors that influence food choice. The evaluation employed both quantitative and qualitative research methods and provided a detailed account on the process, nature and extent of change in food habits associated with cooking skills interventions. This intensive evaluation used trained researchers and considerable resources and is not therefore transferable to community-run food skills interventions. However, the results obtained provided data on the key domains shown to be influenced by community food-based programmes and indicate directions for the development of a short assessment tool (Wrieden et al., 2007).

It was recognised that an assessment tool should be easy to administer, short in length (should be completed in 10–15 min), have simple questions allowing self-completion, be easy to check for completion, be easy to analyse, have the capability to pool multicentre data, and be suitable for use ‘pre’ and ‘post’ intervention (i.e. to avoid use of retrospective questions and reliance on memory). Various methods are used to test reliability and validity of questionnaires. ‘Content validity’ aims to ensure that the content of the instrument covers the domains of relevance (e.g. the extent to which a test adequately samples the domain of information, knowledge, or the skill that it purports to measure) and is determined primarily by expert judgment. ‘Face validity’ enables respondents to describe in their own words what they think the questions are asking or not asking (i.e. ensuring the questions are interpreted as intended). It is a particularly useful approach for identifying areas of ambivalence and it is essential that the researcher undertaking the validity procedures uses a structured face to face interview approach to explore the perceived meaning of the questions. ‘Reliability’ aims to ensure that a questionnaire is reproducible, through measures of internal consistency with groups of similar questions and repeatability ensures consistency of the questionnaire over time. In addition, the feasibility of using a questionnaire should be tested in a group similar to that for which it has been designed (Litwin, 1995).

The present study aimed to undertake an assessment of validity and reliability of a short questionnaire designed to measure the impact of cooking skills interventions on cooking confidence, the use of basic food skills, and food selections amongst low income communities. The objectives were: to assess the content validity, face validity, internal reliability and repeatability of the instrument; to apply and test modifications (as required) in the draft instrument within a community project undertaking the CookWell programme; and to produce a validated instrument for use in local communities.

Materials and methods

Questionnaire development

A working draft of the questionnaire was compiled following a literature search (and subsequent review of suitable questionnaires (Anderson et al., 2002; Turconi et al., 2003; Lang et al., 1999) and an assessment of the original CookWell programme evaluation tools (Wrieden et al., 2002). The initial questions used in the development of the questionnaire were based on the key domains shown to be influenced by the CookWell initiative. These reported changes were:

- confidence in using a recipe
- frequency of using basic ingredients for preparation of meals
- buying less convenience food
- increased likelihood of tasting and experimenting with new foods
- fruit and vegetable consumption

These topic areas were presented in short question, closed format. Consideration was given to enhancing fruit and vegetable intake, and questions 1, 2 and 4 (part 2) of the FACET questionnaire used in the UK Department of Health ‘Five a Day’ evaluation work (Department of Health, 2006), were also included. The general aim was that the questionnaire should have no more than two pages of questions with an additional section on demographics; take no longer than 10 min to complete; and have wording and layout suitable for self-completion. The working draft was checked by nutrition colleagues for content, clarity and layout prior to validity testing.

Content validity

Assessment of content validity was undertaken by an independent panel of dietitians and public health nutritionists and community development workers who acted as expert judges to ascertain the relevance of the content of the tool. The panel were contacted through the British Dietetic Association Community Nutrition Group (n = 118), and the Public Health Nutrition Network, a predominantly Scottish group (n = 42). Using e-mail, each individual was sent a copy of the 19 item test questionnaire and for each item asked to give a score out of 10 in relation to: (i) clarity; (ii) content in terms of appropriateness; (iii) cognitive complexity (i.e. ‘How...
important is this question?'; 'Is the content appropriate?'; 'Is the phrasing clear?'; and 'Overall opinion of question'); and (iv) relevance. Responses were collated and the questionnaire was amended as appropriate.

The amended questionnaire was then assessed by an independent panel of community development workers (n = 26), working in the field, who were identified by the panel in the first stage of content validity. These individuals were contacted via e-mail or post using the same methodology as described above with an amended score sheet. Responses were collated and the questionnaire was amended as appropriate.

Face validity
Assessment of face validity of the amended questionnaire was undertaken by individual discussions with 20 adults residing in Tayside, Scotland, who were typical of those who may attend cooking skills classes. The number selected for interview was based on previous work on a similar topic (Longbottom & Anderson, 2003), which indicated that approximately 15 people were sufficient to provide a wide range of relevant responses for consideration. These adults were not involved in cooking skills intervention classes but were typical of individuals who attend community classes. They were selected on a purposive basis with care being taken to include a range of ages and to include males. Individuals were asked to complete the questionnaire and were then interviewed regarding ease of completion and comprehension, with further probing if they appeared to have misunderstood any of the questions. Responses were collated and the questionnaire was amended as appropriate.

Reliability testing
Assessment of repeat reliability of the amended questionnaire was undertaken with a further group of adults attending community-based classes (other than cooking) in Tayside, Scotland. Repeat administration of the questionnaire (time 1 and time 2) was carried out within 1 week of the initial questionnaire. Individuals were approached at various community groups throughout the region and asked to complete the self-administered questionnaire. They were briefed that they would not be attending the group the following week did not complete the questionnaire. Community groups included parent and toddlers, pensioners groups, and craft and fitness classes. The participants involved in the reliability test stages were not the same as those involved in the validity testing and were not likely to have had previous exposure to the items under test. Correlation analysis was undertaken for repeat reliability testing; criteria for validity based on previous repeat reliability work (Longbottom & Anderson, 2003) was that each question must reach significance and have a correlation coefficient >0.5. Cronbach's alpha coefficients were computed to ensure internal consistency with groups of similar questions. Cronbach's alpha values >0.70 were considered satisfactory for inclusion (Bland & Altman, 1997). In addition, as further measures of reliability, the Item Difficulty Index and Item Discrimination Index were calculated for the questions on knowledge about fruit and vegetable portions (questions 14 and 15). The Item Difficulty Index is the percentage of the population answering the question correctly (P-value). For inclusion, Kline (1993) suggests that the P-value should be between 20% and 80% (with anything <20% being considered too difficult and anything above 80% being considered too easy). The Item Discrimination Index is the correlation of the score for each item with the total score, with correlations above 0.20 being considered suitable for inclusion (Kline, 1986).

Feasibility testing
Assessment of the feasibility of using the finalised questionnaire (as a tool for evaluating cooking programmes) was undertaken in the community setting. The questionnaire was tested for ease of use, response rate and data coding as part of the first year of the 'Get Cooking' project based in West Lothian (WL), Scotland (funded by NHS Lothian New Opportunities Fund). All individuals participating in the intervention were invited to complete the baseline questionnaire, which was then repeated at the completion of the CookWell programme. This stage involved the questionnaire being administered by WL project staff who noted: (i) any difficulties participants had with completion; (ii) any missing responses (although they were expected to ensure completion); (iii) any queries that arose from respondents; and (iv) any personal comments on perceived ease of administration. Completed questionnaires were then returned to the researchers for analysis.

Because the study comprised developmental work for service evaluation, ethical approval was not sought.

Results
Content validity
Sixteen dietitians/public health nutritionists (10% of those contacted) responded to the request for comments. Amendments to the questionnaire included minor changes to the wording and layout to improve clarity. Three questions on recipe ingredients were removed because it was felt that these were very subjective,
dependent on the actual dishes made in the cooking class and varied by regional preference. A question on re-heating was added to the food safety questions because it was felt that this was considered a major issue.

Twelve community development workers (46% of those contacted) responded to the request for comments. Amendments to the questionnaire again included minor changes to the wording and layout to improve clarity. Two questions were also added on tasting and experimenting with new foods and recipes because it was considered that these topics were not fully covered.

Face validity

Twenty adults (16 females and four males), with an age range of 21–69 years, completed the questionnaire and were interviewed. The typical completion time was 5–10 min; however, this was occasionally longer where reading skills were poor. Minor adjustments were made to improve clarity and understanding (e.g. adding examples of fish to question 12). Two questions took longer to complete than the others because they were more complex; however, no-one reported any questions or words that they did not understand. Many individuals passed comment on the question about knowledge of fruit and vegetable portions. They were either unsure of the answers or they could not understand why they were being asked a question on portion size. However, this question was not changed because it measures familiarity with the concept of fruit and vegetable portions and it is hoped that, if an individual did not know the answer before the intervention, then they should have been given sufficient information throughout the cookery sessions to enable correct completion post-intervention.

Reliability testing

Eighty-two adults were approached and asked to complete the questionnaire. Of these, a total of 74 adults, eight males and 66 females, completed the questionnaire at time 1 (eight individuals knew that they would not be present 7 days later and so were deemed ineligible because they could not complete the re-test). Ages were in the range 23–81 years with a mean (SD) of 44.7 (15.2) years. Fifty-five adults completed the same questionnaire 1 week later at time 2, with a further two adults completing it 2 weeks later (totalling 57 adults). The 57 respondents comprised eight males and 49 females, with age in the range 23–81 years, with a mean (SD) of 46 (15.1) years. The majority of questionnaires were fully completed. All respondents were Caucasian and were evenly distributed across the Scottish Index of Multiple Deprivation deciles (Scottish Government, 2010a,b).

Internal consistency of the confidence (Q3–Q6) (see Appendix) and knowledge (Q14 and Q15) sections were assessed by Cronbach’s alphas to ensure that the components of each section were related to the total section assessment. The other sections of the questionnaire were not tested because the domains within each section were assessing different constructs. Cronbach’s alphas were assessed on time 1 data because there was a larger number of responses and less risk of external contamination than with time 2 data. Cronbach’s alphas were 0.86 and 0.84 for the confidence and knowledge questions, respectively, showing good internal consistency.

Repeat reliability testing was carried out on the data for the 57 respondents completing the questionnaire at times 1 and 2. Spearman correlation coefficients were in the range 0.46–0.91 and were statistically significant ($P < 0.001$), indicating good temporal stability (Table 1). Item Difficulty Index analysis was carried out using questionnaires completed at time 1 ($n = 73$). Six of the seven questions were correctly answered by 44–73% of respondents, demonstrating that these items were suitable for inclusion in the final questionnaire (Table 2). These findings re-enforced the decision to keep these items in the questionnaire following face validation. The knowledge question on fruit and vegetable recommendations was answered correctly by 85% of respondents, indicating that it was too easy for inclusion in the final questionnaire. However, because increased knowledge about dietary recommendations is often a key outcome of interventions, it was decided to keep this question in the questionnaire. In the Item Discrimination Index analysis, all questions achieved correlations above 0.20 (Kline, 1986), significant at $P < 0.001$, with $r$ in the range 0.40–0.86 (Table 2), demonstrating that these items were suitable for inclusion in the final questionnaire.

Following reliability testing, one further adjustment was made to the questionnaire, namely the removal of the option ‘all of the above’ to question one to ease understanding.

Feasibility testing

Thirteen participants (three males and 10 females) from the WL ‘Get Cooking’ project completed the questionnaire at time 1, and eleven at time 2. Age was in the range 23–79 years, with a mean (SD) of 35.0 (20.8) years. All lived in areas in the lower deciles (most deprived) of the Scottish Index of Multiple Deprivation (Scottish Government, 2010a,b). The majority of questionnaires were completed fully. Three questionnaires were incomplete, with one item missed on each (a different item on each questionnaire).

The Community Health Development Officer in charge of the WL project reported that no assistance was
Table 1: Spearman’s correlation coefficient for each question

<table>
<thead>
<tr>
<th>Question</th>
<th>Test-retest reliability*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1. Cook convenience foods and ready-meals</td>
<td>0.62</td>
</tr>
<tr>
<td>Q1. Put together ready-made ingredients to make a complete meal</td>
<td>0.59</td>
</tr>
<tr>
<td>Q1. Prepare dishes from basic ingredients</td>
<td>0.71</td>
</tr>
<tr>
<td>Q2. How often do you prepare and cook a main meal from basic ingredients?</td>
<td>0.56</td>
</tr>
<tr>
<td>Q3. How confident do you feel being able to cook from basic ingredients?</td>
<td>0.76</td>
</tr>
<tr>
<td>Q4. How confident do you feel about following a simple recipe?</td>
<td>0.78</td>
</tr>
<tr>
<td>Q5. How confident do you feel about tasting foods that you have not eaten before?</td>
<td>0.71</td>
</tr>
<tr>
<td>Q6. How confident do you feel about preparing and cooking new foods and recipes?</td>
<td>0.78</td>
</tr>
<tr>
<td>Q7. How often do you eat fruit?</td>
<td>0.90</td>
</tr>
<tr>
<td>Q8. How often do you eat vegetables or salad?</td>
<td>0.76</td>
</tr>
<tr>
<td>Q9. How often do you eat pasta or rice?</td>
<td>0.71</td>
</tr>
<tr>
<td>Q10. How often do you eat baked, boiled or mashed potatoes?</td>
<td>0.69</td>
</tr>
<tr>
<td>Q11. How often do you eat chips, fried or roast potatoes?</td>
<td>0.84</td>
</tr>
<tr>
<td>Q12. How often do you eat fish or fish products?</td>
<td>0.81</td>
</tr>
<tr>
<td>Q13. Do you think you will increase the amount of fruit and vegetables you eat in the next 6–12 months?</td>
<td>0.73</td>
</tr>
<tr>
<td>Q14. How many portions of fruit and vegetables do you think health experts recommend eating every day?</td>
<td>0.46</td>
</tr>
<tr>
<td>Q15. Portions of fruit or vegetables in a medium glass of unsweetened orange juice</td>
<td>0.54</td>
</tr>
<tr>
<td>Q15. Portions of fruit or vegetables in one glass of orange squash</td>
<td>0.91</td>
</tr>
<tr>
<td>Q15. Portions of fruit or vegetables in a thin slice of tomato</td>
<td>0.79</td>
</tr>
<tr>
<td>Q15. Portions of fruit or vegetables in three heaped tablespoons of carrots</td>
<td>0.53</td>
</tr>
<tr>
<td>Q15. Portions of fruit or vegetables in one medium apple</td>
<td>0.65</td>
</tr>
<tr>
<td>Q15. Portions of fruit or vegetables in one small raspberry yoghurt</td>
<td>0.61</td>
</tr>
<tr>
<td>Q15. Do you eat food past its ‘use by’ date?</td>
<td>0.75</td>
</tr>
<tr>
<td>Q16. Do you follow the instructions for storage on packaged foods?</td>
<td>0.62</td>
</tr>
<tr>
<td>Q16. Do you check that food is piping hot when re-heating?</td>
<td>0.91</td>
</tr>
<tr>
<td>Q16. Do you wash fruit and vegetables that don’t need to be peeled before eating?</td>
<td>0.84</td>
</tr>
</tbody>
</table>

*Significant at P < 0.001.

requested by individuals when filling in the questionnaire. The WL project team printed the questionnaires on pale pink paper to aid participants who might be dyslexic, in line with current recommendations from the British Dyslexia Association (2010). Completion time was similar to that noted during face validation at 5–10 min. It was noted that more detailed instruction (in the form of notes to accompany the tool) was necessary for the class tutor to check that a response is given for each item in the returned questionnaires, thus improving the completion rate of the individual questions, and enabling matching of the ID codes of the questionnaires pre- and post-intervention.

Following feasibility testing, one final adjustment was made to the questionnaire comprising the addition of two questions to the demographics section asking how many adults and children the respondent usually prepares food for on a daily basis. This was added because the questionnaire that was feasibility tested was not capable of measuring the number of individuals that an intervention could potentially benefit. The final version of the post-intervention questionnaire (the same as the pre-intervention questionnaire but including open-ended questions on likes and dislikes, suggestions for improvements and comments on the cooking course) is shown in the Appendix. Pre- and post-intervention questionnaires along with instructions for use are also available on the Food Standards Agency website (Food Standards Agency, 2005).

Discussion

Achieving a healthy balanced diet remains a challenge for many of the British population, especially those living in deprived communities. Over the last decade, new and practical approaches to engage low income consumers in interventions to improve diet have been widely...
recommended (Department of Health, 2005; Scottish Government, 2008) and there are now many practical food skills community-based projects that aim to aid and influence food choices [Community Food and Health (Scotland) (2010); Sustain, 2003]. Many interventions also target confidence in cooking which is known to be lower amongst men, low education and lower income consumers and higher levels of confidence have been demonstrated to be associated with a greater variety of vegetable purchase (Winkler & Turrell, 2009). It is recognised that intervention strategies should be designed hand in hand with evaluation procedures so that, at each stage of the process, relevant evaluation is applied to collect robust evidence to support continuing and further work in the area (Anderson, 2004). Local evaluation should fundamentally inform planned and on-going intervention work. It should be designed primarily on local needs to assess local efforts but, in addition, standardised formats of evaluation allow a national picture to develop and shared findings to be explored for the benefits of the wider community.

Assessing the effect of community based interventions requires practical tools that are acceptable and comprehensible to the client group. Within the context of cooking skills interventions, previous evaluation studies have used detailed quantitative approaches that are often too academic and expensive for practical use, or qualitative data which can be difficult to analyse in a systematic way (Dobson et al., 2000; Revill et al., 2001; Lawton & Stockley, 2003; Symon & Wrieden, 2003; Wrieden & Symon, 2003). Evaluation methods used within these programmes included both qualitative (in-depth interviews and focus groups) and quantitative self-completion and interview administered questionnaires, as well as self-completion diaries. On a day-to-day level, these approaches are too intense, too expensive and impractical for community workers to undertake and may be too burdensome for lay food and health workers (Kennedy et al., 2008).

Personal communications through the Community Nutrition Group of the British Dietetic Association, individual contacts and requests from community projects and the Scottish Community Diet Project have all highlighted a need for practical evaluation tools for cooking skills projects. The use of an independent panel of experts to assess content validity is a common starting point for questionnaire design (Medeiros et al., 2004; Gower et al., 2010; Mackison et al., 2010) and ensures that the domains explored are perceived as relevant to practitioners as well as academic communities.

The main foci of interest were meal preparation practices, cooking confidence, knowledge (about recommendations for fruit and vegetable consumption and food safety) and food choice. Many design factors were taken into consideration including reading age, clarity and the ability of the questionnaire to be used pre- and post-intervention so that change over time could be monitored.

The feasibility testing demonstrated the usefulness and practical capability of the final tool. Reliability and validity testing does not guarantee that the tool is suitable for all regions of the UK, ethnic minorities, age groups or people with limited literacy. However, the questionnaire has been developed with all of these aspects in mind, and the content domains reflect the aims and objectives of a practical skills-based project. The need to have a short assessment tool (as a result of limited time and cognitive capability) has meant that each domain contains only key questions related to intervention topics. It is recognised that other skills-based projects may have different aims (e.g. budgeting skills) and that this tool will not assess these areas. Repeat reliability tests show a wide range of correlations. However, it should be noted that the statistical significance of the correlations demonstrate that each item has a strong reliability measure ($P < 0.001$). In test–retest analysis, it is assumed that participants are not influenced by first exposure to the question items. In addition, because no intervention work was taking place with these participants, there was no reason why responses should change unless the initial exposure had acted as a prompt to discover/change initial answers.

It should be noted that the reliability and validity testing undertaken is for the complete set of items and, if any new items are added or any existing parts of the current questionnaire are edited, the questionnaire should undergo further validation testing. The questionnaire was designed to evaluate practical cooking skills interventions that had covered all the topics under investigation in the questionnaire. It is recognised that these interventions may take different forms depending on resources and needs. Wider feasibility testing is required to assess the tool in a range of settings, including its use with groups with literacy problems and/or learning difficulties, although preliminary feasibility suggests the tool can give a useful broad indicator of intervention effect and would be suitable for use in multicentre projects. Consideration needs to be given to any training that support staff may need to use the tool in a way that will not alienate individuals when used in a mixed user setting. User groups should also be reminded to record detail on content of the interventions and collect further information about participants, as required for evaluation purposes (e.g. demographics, number of sessions attended and ability).

In conclusion, the final questionnaire (Food Standards Agency, 2005) comprised five topic sections: meal preparation; confidence in cooking and tasting; usual food consumption patterns; knowledge about fruit and vegetables; and knowledge of good practice (19 questions in total), as well as a demographic section. The
post-intervention questionnaire also includes qualitative questions on likes, dislikes and suggestions. This tool provides a standardised method of evaluating cooking skills interventions that could be utilised in the development and evaluation of multicentre cooking skills interventions. Analysis of the relationships between sociodemographic intervention effects should also enable further targeted intervention design.

Acknowledgments

The authors would like to thank all the individuals who completed the questionnaires for their participation and Rhian Baxter who assisted with data collection and entry.

Conflict of interests, sources of funding and authorship

The authors declare that they have no conflict of interests. Funding from the UK Food Standards Agency is gratefully acknowledged. KLB coordinated the study, analysed the data and co-wrote the article. WLW and ASA developed the protocol, KLB coordinated the study, analysed the data and co-wrote the article. All authors critically reviewed the manuscript and approved the final version submitted for publication.

References


Supporting information

Additional Supporting Information may be found in the online version of this article: Appendix S1. Post-intervention. Questionnaire for cooking skills programmes.

Please note: Wiley-Blackwell are not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.