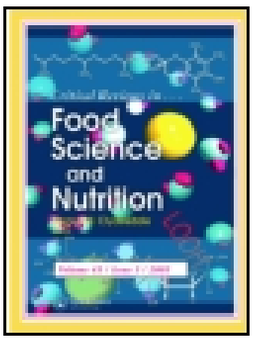

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Domestic Cooking and Food Skills: A Review

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Domestic cooking and food skills: A review.

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Abstract

Domestic cooking skills (CS) and food skills (FS) encompass multiple components, yet there is a lack of consensus on their constituent parts, inter-relatedness or measurement, leading to limited empirical support for their role in influencing dietary quality. This review assessed the measurement of CS and FS in adults (>16 years); critically examining study designs, psychometric properties of measures, theoretical basis and associations of CS/FS with diet. Electronic databases (PsychInfo), published reports and systematic reviews on cooking and home food preparation interventions (Rees et al. 2012; Reicks et al. 2014) provided 834 articles of which 26 met the inclusion criteria. Multiple CS/FS measures were identified across three study designs: qualitative; cross-sectional; and dietary interventions; conducted from 1998-2013. Most measures were not theory-based, limited psychometric data was available, with little consistency of items or scales used for CS/FS measurements. Some positive associations between CS/FS and FV intake were reported; though lasting dietary changes were uncommon. The role of psycho-social (e.g., gender, attitudes) and external factors (e.g. food availability) on CS/FS is discussed. A conceptual framework of CS/FS components is presented for future measurement facilitation, which highlights the role for CS/FS on food-related behaviour and dietary quality. This will aid future dietary intervention design.

Abbreviations:

ADL: activity of daily living

CWC: cooking with a chef programme

FFQ: food frequency questionnaire

FF: fast food

CS: cooking skills

FS: food skills

PPF: pre-prepared food

RM: ready-meals

FV: fruit and vegetables

FBC: food behaviour checklist

SCT: social cognitive theory

JMoF: Jamie Oliverôs Ministry of Food programme

HE: home economics

SES: socio-economic status

Introduction

The ability to prepare and cook food to eat *for oneself* is considered an essential activity of daily living (ADL) (Mechling, Gast & Fields, 2008). The skills and components of this ADL have

become an issue of growing importance in Western countries as food consumption patterns are changing (Blake, Wethington, Farrell, Bisogni, & Devine, 2011): lifestyles have become increasingly busy in many industrialised countries leaving individuals time poor (Jabs & Devine, 2006). The food industry has responded by providing an ever-expanding array of convenience products, i.e., those which are commercially pre- or part-prepared to ease preparation and cooking time at home (Mintel, 2012). Growing use of these convenience products is reflected in statistics which show a reduction in the frequency and time spent preparing and cooking meals at home from fresh and basic ingredients in the UK versus other countries such as France, and greater availability of ready-meals, particularly in the UK (Pettinger, Holdsworth & Gerber, 2006; Gately, Caraher & Lang, 2014).

The rise of convenience products and increases in eating food purchased away from home (Mintel, 2014) appears to parallel a decline in dietary quality, leading some to suggest that a growing cohort of individuals lack the necessary cooking skills (CS) and food preparation knowledge to allow for the production of healthy, home cooked meals (Caraher, Dixon, Lang & Carr-Hill, 1999; Soliah, Marshall Walter & Jones, 2011). Indeed it is argued that people cannot be expected to consume food recommended in dietary advice if they do not know *how* to prepare the food (Caraher, Dixon, Lang & Carr-Hill, 1999). Data supporting this proposition often originates from cross-sectional studies which have attempted to assess individual cooking abilities and quantify the relationship with food purchasing and food consumption patterns simultaneously (Vrhovnik, 2012, *unpublished*; Larson, Perry, Story & Neumark-Sztainer, 2006; Hartmann, Dohle & Siegrist, 2013). Additionally, an observational study conducted in the US

which examined in-home food preparation highlighted the use of convenience products to create a meal requiring fewer cooking skills and less time (Beck, 2007).

In order to address poor dietary quality many school and community-based interventions have been designed focusing on individual CS as a conduit for dietary change, particularly with those from lower socioeconomic groups or those considered to have limited resources (Greenwell Arnold & Sobal, 2000; Swindle, Baker & Auld, 2007; Wrieden, Anderson, Longbottom, Valentine, Stead, Caraher, Lang, Gray & Dowler, 2006). The intervention content typically aims to increase nutritional knowledge, cooking confidence and food-preparation skills and cooking techniques as a means to improving nutritional status. A number of these interventions are underpinned by theory - most commonly social cognitive theory (Bandura, 1977) - where observational learning and modelling are key components of skill development (Clifford, Anderson, Auld & Champ, 2009; Condrasky, Graham & Kamp, 2006; Levy & Auld, 2004). In most intervention studies pre- and post-measures of CS are included, targeting multiple aspects of cooking and meal preparation behaviours, though these measures are typically secondary to dietary assessments. For example, in a food skills (FS) intervention by Wrieden and colleagues (2007) ó*Cookwell',* which was delivered in areas of social deprivation in Scotland, primary outcomes comprised of dietary changes in FV, fish, bread, pasta and rice; with cooking methods used and cooking confidence evaluated as secondary outcomes.

In 2004, Stead, Caraher et al. highlighted the multi-faceted aspects of ócookingô using qualitative research methods. They illustrated how ócookingô embraces a wide range of skills required to feed families; including not only factors involved with the meal preparation, such as chopping, mixing, and heating basic ingredients, understanding the language and terminology of

recipes, following recipes, understanding measurements and cooking techniques; but also, knowledge of how to plan and budget for food and organise and plan meals that other members of the household will find acceptable.

CS have been defined as a óset of mechanical or physical skills used in meal preparationô (Short, 2003) such as chopping, mixing, heating etc., but they are thought also to encompass perceptual and conceptual skills relating to understanding how food will react when cooked (Short, 2003). Yet beyond these aspects of CS, the wider components of home meal production increasingly referred to as ófood skillsô (FS) (Fordyce-Voorham, 2009; Vrhovnik, 2012, *unpublished*) are also of key importance, for example: meal planning, ingredient shopping, food budgeting, food safety and eating healthily. FS have been defined as the ability to ópurchase, prepare and cook food materials using available resources, to produce well-balanced and tasty meals, appropriate to the age and needs of the individuals consuming themô (Fordyce-Voorham, 2009). The term FS has grown in popularity, with most using it to highlight the wide variety of knowledge and skills involved when performing the tasks associated with the selection, purchase, preparation and consumption of foods (Porter, Capra & Watson, 2000). In addition, literacy has also been linked specifically to cooking and food skills with the term ófood literacyô emerging recently across research and policy:

ñ[Food literacy is…] the scaffolding that empowers individuals, households, communities or nations to protect diet quality through change and strengthen dietary resilience over time. It is composed of a collection of inter-related knowledge, skills and behaviours required to plan, manage, select, prepare and eat food to meet needs and determine intake.ò
(Vidgen & Gallegos, 2014, p54)

Food literacy is growing in popularity as it is considered to be highly contextual, taking account of the social and wider environmental dimensions of eating alongside an individualôs skills and abilities; for example, maintaining dietary quality could be challenging as a result of many factors at the individual, household and even the global environment level, and those considered to be ófood literateô should have the skills and capabilities to revise and adapt their diet and sources of food in response to such changes in order to maintain dietary quality (Vidgen & Gallegos, 2014).

The diverse components of individual CS and FS alongside the wider social and contextual elements of food literacy set out here, highlight that defining and measuring these constructs is not straightforward. This has led to difficulties generating sound empirical support for the role of CS, FS and food literacy and the role they might play in determining dietary intake and subsequent health (Reicks, Trofholz, Stang & Laska, 2014; Rees, Hinds, Dickson, OôMara-Eves & Thomas, 2012). Thus, the present research reviews the literature relating to the composition and measurement of an individualôs domestic CS and FS, providing a conceptual and critical analysis of existing measures (including study design, psychometric properties of CS and/or FS measures and theoretical basis). A secondary objective was to report on associations of CS and FS with dietary outcomes. This analysis of CS and FS measures allows for the *ódeconstruction and analysis of these concepts into their constituent partsô* in order to gain a better understanding of what is involved (Beaney, 2003). Providing a comprehensive overview of these constructs and describing them from an integrated perspective will provide clarity for future intervention designs and measurement.

Methods

A structured approach involving a number of key steps (see Figure 1) was adopted to reviewing the literature. Firstly, a rapid review of the literature was conducted in May 2014 in relation to CS and FS. Literature searches were conducted on PsychInfo focusing both on CS terms e.g., c*ook*, food*, food preparation, cooking confidence*; and also on the broader aspects of FS such as: *food literacy,* m*eal plan*, culinary skill, culinary nutrition, shopping, food budget*, food label, nutrition* knowledge, food safety* etc. Additional searches were conducted on food and eating patterns using the terms: *convenience food, ready meal*, pre-prepared food, fast-food, take-away, eating pattern*, healthy eating, diet*, food habit*, food intake and diet outcomes.* Searches on the various CS, FS terms and diet and eating pattern terms were then combined with terms relating to the assessment or measurement of these constructs, including keywords such as: s*kill*, measure*, tool, assess*, survey, questionnaire, scale*. Searches were limited to English language articles, journal articles (peer-reviewed) on adults over the age of 16 years. Database searching was supported by a pragmatic approach which utilised two recently published systematic reviews on cooking and home food preparation interventions (one UK based - Rees et al., 2012; one international - Reicks et al., 2014 [both reviews examined intervention design only]); these reviews provided a framework of 41 articles relating to cooking and meal-preparation interventions, many of which included CS and FS measurements. Furthermore, references from a recent published report; ó*Food Skills: Definitions, influences and relationship with health*ô (safefood, September 2014) were cross-checked for additional articles if not already returned via the other search methods. Reference lists were manually searched for key articles and authors in the field contacted where appropriate; searches were also performed on Mintel and Keynote databases for CS and FS literature from a consumer and marketing perspective. No

new peer-reviewed articles were returned via these additional methods that was not already identified by the literature searches and the framework of review papers (Rees et al., 2012; Reicks et al., 2014).

Articles from all sources were screened using titles and abstracts (where available) for relevance. Articles were deemed eligible for the review if they: were in English, were peer-reviewed journal articles, assessed some components of CS and FS (qualitatively or quantitatively) *and* provided sufficient detail which could be extracted on the measurement or assessment of CS and FS. Information was also extracted on factors influencing CS and FS, such as socio-demographic information where possible. Articles which did not examine CS and FS in relation to eating patterns and dietary outcomes were included in the review however, diet-related outcomes were extracted when available in order to answer the secondary objective of the review.

[INSERT FIGURE 1 HERE]

Results

Twenty-six studies identified as relevant for this review were published between 1998 and 2013; a high-level overview of the main components of existing CS and FS measures are presented in Table 1. Of these, 11 measured CS and FS through cross-sectional surveys (see Table 2 for detail on scales and items); 11 measured CS and FS as part of intervention outcomes (see Table 3 for scales and items); and, four qualitative articles aimed to operationalise or measure the components of CS and/or FS (see Table 4 for detail). The following sections will present the CS and FS components identified by the review, including an overview of study characteristics

(country, design, sample size), theoretical underpinnings, psychometric properties of the CS and FS measures identified, and finally, any reported associations with dietary outcomes.

[INSERT – TABLE 1]

[INSERT – TABLE 2, 3 & 4]

Components of Cooking Skills and Food Skills Measures

Studies typically assessed a number of varied components relating to CS and FS, most frequently (in descending order): meal patterns; food preparation methods and techniques and cooking frequency; general cooking confidence or cooking ability (with foods, techniques, specific meals etc.); planning food shopping and writing lists (frequency and responsibility); cooking attitudes and enjoyment of cooking; purchasing and shopping behaviours (label reading etc.); food choices; menu and meal planning behaviours (including advance food preparation behaviours); food safety and hygiene practices and behaviours (hand-washing, thawing food correctly, etc.); nutrition knowledge; health consciousness and confidence relating to choosing foods and feeding others; food budgeting; barriers to cooking and food choices (time, equipment, etc.); utilisation and confidence with recipes; food practices (adding salt etc.); food preparation complexity (typical number of ingredients etc.); food management (ensuring food lasts adequately etc.); and, source of learning to cook (see Table 1 for an overview). Details of the scales and items used for measurement in each study can be found in Tables 2, 3 & 4.

Study Characteristics

Overall, eight studies were conducted in a UK setting (two cross-sectional, three interventions, three qualitative); three studies in Europe (specifically Switzerland) all cross-sectional; nine studies in the US (two cross-sectional, seven interventions); three studies in Canada (two cross-sectional and one intervention); and, two studies in Australia (one cross-sectional and one qualitative). One further study compared the CS and meal practices of two populations; one drawn from England and one from France in a cross-sectional survey design (Pettinger et al., 2006). Thus all eligible studies appeared to be conducted in Western countries.

Sample sizes for the cross-sectional studies[1] ranged from 80 to 5, 553 participants, with eight of the 11 studies reporting final samples greater than 700 participants (1,2,3,4,5,6,10,11). These eight studies used random sampling of households, either via the electoral roll or census-based household data to administer postal self-reported surveys or to conduct interviewer-assisted survey data collection. The majority of cross-sectional studies targeted adults aged approximately 16-74 years, except one which specifically targeted students aged 18-23 years (2). Three cross-sectional studies (7,8,9) with smaller sample sizes (153, 417 and 80 participants respectively) focused on specific target groups such as: low-income, food insecure mothers; mothers of pre-school aged children; and, older and younger women respectively. One survey conducted in an Australian sample also focused exclusively on women (10), and two further studies targeted the person *'mainly responsible for buying and cooking food'*, resulting in more

[1] *Studies 1-26 are denoted numerically in the results and discussion section and in tables 2, 3 & 4. Corresponding numbers are also noted in the alphabetised reference list.*

women than men respondents (4,5). Nine of the 11 cross-sectional studies also included a form of dietary assessment (1,2,3,4,5,6,7,10,11) such as food frequency questionnaires (FFQs), food diaries or brief dietary indicators focusing on FV intake and food usage.

Across the 11 intervention studies, sample sizes ranged from 19 to 602 participants (17,21 respectively), with the majority containing less than 120 participants (12,14,16,17,18,19,20,22) and power calculations were rarely discussed in relation to outcomes. Two intervention studies exclusively recruited women (18,20); six contained both men and women, although women made up the majority of respondents (12,14,15,16,19,22); one intervention focused specifically on retired men over 65 years of age (17); and, two interventions comprised largely mixed gender samples (13, 21). The two intervention studies which focused on student populations (16, 22) assessed dietary outcomes including FV and overall meal patterns. Most other intervention studies focused on low-income or socially deprived populations, and assessed dietary outcomes at least in terms of FV (12,13,19,21). Two studies assessing the Cooking with a Chef programme (CWC) focused on outcomes relating to the Food Behaviour Checklist (FBC) which covers FS such as: food selection and preparation, food safety and meal patterns (14,15), although dietary behaviour is discussed, measures are not reported. Dietary outcomes were not directly assessed in the intervention with older men (17); and detailed outcome assessments were not available for two intervention studies (18,20) although the broad components of CS and FS were identifiable.

The qualitative studies ranged in size from 16 people (in a focus group setting), to 51 semi-structured interviews (23,24,25,26 - NB study 24 and 25 report on slightly different elements of the same research piece). Two studies had an overarching aim of identifying

components of CS and FS to inform intervention development (23,26); the third aimed to provide a ósystematic way of thinking about cookingô (24,25). One study exclusively focused on participants from areas of high socio-economic deprivation (26) and aimed to elicit meanings of CS and food practices, alongside priority CS and FS which they would like included in an intervention (such as shopping, cooking methods, food budgeting and specific meal types etc.). It suggested that overall cooking confidence was low and there was little interest in healthy eating (including cooking fish and vegetarian dishes), and that making sauces, budget cooking and soups were of interest to this low socio-economic status (SES) group (26). One study focused on the meanings and experiences of domestic cooks, though this sample comprised a more middle-class demographic (24,25). Using interview methodology it explored childhood cooking experiences, how people learnt to cook and the role convenience products and cultural influences on food (24,25). This study concluded a broad range of skills are involved in cooking and meal preparation, from practical to perceptual and conceptual (24,25). The final qualitative study comprised of interviews with ófood expertsô about FS required for healthy eating (23) including homemakers and young people, as well as home economics teachers, chefs, dietitians and nutritionists. Discussion occurred around topics such as food planning skills, food shopping skills and food preparation and cooking skills, and elicited views upon what knowledge, information sources, skills and resources were needed to prepare and cook healthy food (23). Findings showed both óhands-onô practical cooking experience as well as ócognitiveô skills were deemed key, with the following 12 essential components: instruction relating to 1. cookery methods knowledge, 2. equipment knowledge, 3. nutritional health knowledge, 4. terminology knowledge, 5. troubleshooting knowledge, 6. access and use sources of information, 7. consumer

knowledge and skills, including understanding seasonal produce (nutrition and cost benefits), 8. hygiene and safety knowledge and skills, 9. meal knowledge and skills; plus, there should be opportunities for learning that include food exposure, trial and error processes, and opportunities for practice to help motivate students, and to include parental and community support and involvement (23).

Overall, study designs varied (cross-sectional quantitative surveys, interventions and qualitative studies); with each providing a unique perspective on CS and FS. Qualitative articles by nature involved smaller samples and provided an in-depth exploration of the meanings and key elements of CS and FS; whereas cooking and food preparation intervention studies tended to focus on measuring dietary outcomes, rather than extensive assessments of how CS and FS had changed. Cross-sectional surveys typically provided population-level data on CS and FS and their determinants and in most cases focused on linking these to dietary outcomes or meal patterns and food choices. The majority of studies reported associations between greater CS and FS and more healthful dietary choices (including greater FV, reduced fast-food (FF) consumption and less eating out of home etc.) though these outcomes are fully reported in the dietary outcomes section.

Theoretical Underpinnings of Studies

Overall, reference to theory was identifiable in seven of the 26 studies (8,12,14,15,16,22,23). One cross-sectional study was reported as being informed by social cognitive theory (SCT) and included measures of self-efficacy for meal management and coping strategies (either away-from-home or home-based strategies) (8). Five of the 11 intervention studies reported use of

theory when designing intervention content; however, none report explicitly basing CS or FS evaluation measures on theory (12,14,15,16,22). The qualitative articles examining CS and FS do not note the use of a theoretical framework in their research however, one article cites that several theories were reviewed prior to data collection yet none provided a suitable fit for understanding the acquisition of CS and FS (23). Thus there appears to be an overall explicit lack of theory in the construction of CS and FS measures across all of the eligible studies in the review.

Psychometric Properties of Measures

Psychometric properties of the CS and FS measures were reported in five of the 11 cross-sectional studies (2,3,6,8,11) with varying levels of detail on face, content and discriminant validity, internal reliability, and temporal stability (i.e., test-retest reliability). Four of the intervention studies did not explicitly report measurement development work relating to the CS and FS measurement scales (14,17,18,20); three reported limited psychometric data (typically relating only to the internal reliability of scales, i.e., Cronbachôs alpha values) (12,16,21); and, four reported extensive psychometric evaluations covering multiple aspects of both reliability and validity (13,15,19,22), though (13) and (15) were publications specifically outlining the development of scales relating to CS and FS.

One CS scale developed with five items was used in the same format across three cross-sectional studies (by the same research group) asking about a personôs ability to cook specific meals (e.g., I can prepare soup, gratin, cake) (3,4,5). Beyond this, studies used differing scales, items and wording but there was overlap with regard to the components used to measure CS and

FS. As shown in Table 1, approximately one third of the 26 studies commonly assessed: food preparation methods and cooking frequency e.g., grilling, frying etc., and peeling and chopping vegetables etc. (n=13); general cooking confidence or ability (n=12); meal patterns e.g., frequency of breakfast/lunch/dinner consumption, eating out etc. (n=11); cooking attitudes and enjoyment of cooking (n=9); and planning of food shopping and writing grocery lists etc. (n=8), with less overlap between the remaining components of CS and FS identified. From these components identified, food preparation and cooking frequency and general cooking confidence or ability are classified as CS in this review, with planning of food shopping and writing lists etc., considered part of broader FS. Meal patterns and cooking attitudes or enjoyment are classified as external factors which may influence CS and/or FS, though there isn't sufficient data to quantify the direction of such relationships.

Overall, it was difficult to find evidence of extensive psychometric testing of CS and FS measurement scales, particularly within the intervention studies; and although most interventions reported on initial development work with target population groups, this was more often related to intervention content rather than intervention evaluation measures relating to CS and FS per se.

CS and FS and Dietary Outcomes

Associations between CS and FS and dietary outcomes were reported in seven of the 11 cross-sectional studies (1,2,3,4,5,7,10); all indicated that greater CS (such as number of cooking methods or techniques used e.g., grilling, frying, roasting, etc., or a person's confidence with cooking certain foods etc.) and greater FS (e.g., forward planning of meals, and use of shopping lists, food budgeting, etc.) were associated with healthier overall dietary choices (increased FV,

less convenience food and take-away consumption) and thus greater nutritional adequacy of the diet. Higher CS and more frequent cooking with basic, raw or fresh ingredients (or ófrom scratchô) was associated with greater vegetable intake (for females) (3), whereas lower CS were associated with increases in convenience food consumption (3,4,5). The latter CS measure asked about a personôs ability to prepare a range of dishes including soup, gratin, bread, etc. One study examining differences between French and English cooking and snacking patterns showed that the 62% of French respondents cooked from raw ingredients daily (assessed by one item) versus 22% of English respondents, furthermore, 59% of English respondents reported eating crisps and fried snacks at least once per week versus 6% of French respondents, indicating a pattern of greater dietary quality in the French (6). In addition, greater home food preparation (versus eating out and eating take-away, two items) was associated with increases in FV intake, lower convenience product consumption, and an increase in the likelihood of meeting wholegrain, calcium and fat dietary recommendations (2). These findings provide some evidence for cross-sectional relationships between CS and FS and dietary intake, although the nature of study designs does not allow for causality to be determined.

The majority of intervention studies had a primary aim of improving dietary outcomes via increasing CS and FS. Three studies reported significant increases in FV post-intervention (12,21,19). One study noted increases in FS (such as making healthy balanced meals, using a list when shopping, food safety versus CS) alongside increases in FV (12) at three and six months follow-up. Sample sizes were small however, (n=27 and n=14 respectively) as they followed a cohort of individuals through the intervention primarily seeking to test the effectiveness of taking measurements at differing time points (12). Another intervention with a large sample size

(n=373 adults) designed to improve FV preparation skills, food safety and nutritional intake reported significant increases in FV post-intervention of over half a serving per day (and also amongst youths included in the study), alongside increases in food handling behaviours (or FS) such as washing FV before use (21). An intervention targeting cooking confidence and food preparation methods in adults living in social deprivation the UK reported significant increases in fruit intake pre-post intervention however, increases in fruit intake werenôt maintained at six months (19). One study reported a non-significant trend for reduction of eating out and fast-food (FF) consumption in the intervention (vs control group) at three months post-intervention (16), despite greater gains in cooking knowledge and positive cooking attitudes in the intervention group. Three further studies reported increases in FS such as writing shopping lists, nutritional knowledge and hand-washing during food preparation yet these did not translate into dietary changes post-intervention (14,18,22). Thus overall it appears that small positive diet and food choice changes can be identified from the cooking and food preparation interventions however, long-term outcomes are weak and the study findings are limited by a lack of reliable, valid and standardised measurement instruments. Additionally, other barriers to healthful food choices must be considered given several studies appear to achieve in increase in CS and/or FS without this translating into dietary benefits.

Qualitative studies reported on the importance of having the ability and skills to understand and use different cooking methods or techniques (e.g., frying, roasting) as this allows an individual to select the most appropriate preparation and cooking method for health and dietary outcomes; nutritional knowledge was also posited as integral to assisting with healthful dietary choices, as were food skills (i.e., being able to shop for healthy food, read labels, etc.)

(23). Having the ability to prepare and cook raw foods ófrom scratchô (i.e., possessing greater CS) was also highlighted as impacting upon the ability to eat healthily (24,25). Participants from deprived backgrounds in one study who reported low levels of confidence with cooking ófrom scratchô (i.e., using basic or raw ingredients) described relying on ready-meals, frozen convenience products (e.g., burgers, nuggets, fish fingers), and fried food (26). This group reported less frequent óhome cookingô i.e., casseroles, soups, stews etc., and of topics they would like to see included in a cooking intervention, healthy dishes were unpopular (FV, fish, etc.) (26). The latter study appears to highlight a link between poor CS and FS and unhealthy food choices in low SES adults (26), a theme which was prevalent across the other qualitative findings.

Discussion

Overall, 26 studies were deemed eligible for this review of CS and FS measurement in adults (>16 years) in the domestic setting. Results illustrate the vast array of components, scales and measures used to assess CS and FS across a number of study designs (see Tables 1, 2, 3, 4). The majority of studies examined CS and FS in relation to dietary outcomes and food choices and stemmed from a public health perspective. All measures included in the review were based upon self-report. A number of key discussion points relating to the CS and FS measures identified are outlined below.

A large number of studies reported development work for the measures used to capture CS and FS such as consulting previous literature, conducting focus groups, and target testing pilot versions of measures with relevant population groups; however, despite the benefits this affords in terms of ecological validity, there were few instances of rigorous empirical testing to validate

the CS and FS measures post-development. Three studies which reported rigorous instrument development all primarily focus on the measurement of CS, covering aspects such as confidence (self-efficacy) for using specific cooking techniques and methods, or to prepare specific meals (soup, gratin, etc.) along with general cooking confidence and data on basic food intake. FS such as self-efficacy for eating and cooking FV, and external factors such as cooking attitudes were also covered. The instrument developed by Barton and colleagues (2011) measures other aspects of FS such as food safety (eating food past use-by dates, etc.) and nutritional knowledge (knowledge of FV portions), and thus could be considered a more comprehensive CS and FS assessment tool. A further point to note is that very few of the studies reported the use of theory in the design or assessment of CS and FS. Intervention studies were more likely to report theory in relation to the development of the intervention content, despite none specifically relating it to the measurement of CS and FS. Upon closer inspection of several intervention evaluation measures, some CS and FS scales did appear to measure theoretically derived components such as self-efficacy (from social cognitive theory) though this was not explicitly stated. Future studies would benefit from added detail when reporting the development of CS and FS measures to allow theoretically-based, reliable and valid instruments to be used across studies.

The three main types of study designs identified in this review were: cross-sectional surveys, interventions and qualitative studies, with the type of design influencing the CS and FS measurement. In cross-sectional studies, measurement items were identified *a priori* to capture CS and FS and it was not common for extensive development work relating to the scales to be reported in published articles. Therefore, it could be said that CS and FS are defined and

measured by virtue of the scales and items chosen by researchers, thus illustrating a *'top-down'* approach. Additionally, measurement of CS and/or FS was not the primary aim of the research in around half of the 11 studies (the focus was more upon dietary outcomes), therefore the development of CS and FS scales and items or outcomes were not prioritised in the reporting.

By contrast, the small number of qualitative articles identified (n=4, with two reporting from same piece of research) focused on eliciting CS and FS components from a range of participants including home cooks, young people, adults from deprived backgrounds, home economics teachers (HE), chefs and health professionals (e.g., dietitians) through semi-structured, open questions about the necessary information, skills, resources and knowledge individuals need for CS and FS; the role of learning in CS and FS; and, what type of topics or areas of meal preparation and cooking they would like to know more about. Certainly within two of these studies with members of the public (i.e., not chefs, cooks or HE teachers), this approach could be described as a *'bottom-up'* approach, where the important components of CS and FS are elicited more freely.

The majority of intervention studies shared the over-arching goal of improving food-related behaviours to increase the nutritional quality of the diet; with CS and FS considered a conduit for dietary change. This focus on improving CS and FS can be partly attributed to the increasing rhetoric around the decline of cooking skills and parallel rise in consumption of convenience foods; where convenience products are typically considered to be of poorer nutritional quality and higher energy content when compared to home prepared and home cooked meals (Gillman, Rifa-Shiman, Frazier, et al., 2000). Indeed studies have shown positive associations with consumption of convenience foods and increases in body composition indices such as body mass

index (BMI) (Alexy et al., 2011; Cornelisse-Vermaat & van den Brink, 2007), highlighting food preparation and cooking as key intervention targets. However, most interventions designed to improve diet quality by way of increasing CS and FS were unsuccessful when evaluated in these terms. Brown & Herman (2005) showed an increase in FV immediately following a brief intervention targeting FV preparation and food safety behaviours ï yet long-term data is not available. Wrieden and colleagues (2007) reported significant changes in fruit but not vegetable intake following a food skills intervention which focused on the development of practical cooking skills and cooking confidence through meal preparation. It could be argued that the change in fruit but not vegetable intake could be attributed to the nutrition education that was given as part of this programme discussing the benefits of FV, and the easier behaviour change required to increase fruit (i.e., it typically does not require cooking or extensive preparation). In addition fruit is sweeter than most vegetables, therefore the influence of individual taste preferences could also play a role in the selection and consumption of these foods, both for oneôs self and for family members, especially children (Cooke & Wardle, 2005). It should be noted however that even the positive gains in fruit consumption were not maintained at six months (Wrieden et al., 2007). The authors suggest this fits with previous research highlighting how dietary outcomes often diminish once the ócactiveô intervention is withdrawn, as participants may not be adequately equipped with the skills to overcome novel barriers and may lack the ability to find ways of maintaining access to FV in an often challenging wider social and environmental context ï this capability is considered a core component of food literacy (Kennedy et al. 2001; Vidgen & Gallegos, 2014). The Cooking with a Chef intervention (CWC) which was based upon social learning theory, explicitly targeted CS and FS in order to ó*expand the food choices of*

the home cook, thereby fostering good nutrition'. The main outcome of this study was the Food Behaviour Checklist (FBC) which focused on FS such as food selection and preparation, food safety and meal patterns; alongside measures of confidence or self-efficacy in cooking techniques (knife skills, stewing, baking, etc.), and self-efficacy for cooking and eating FV. CWC, like most other interventions targeting nutrition outcomes, did not report significant dietary changes following the intervention (Condrasky, 2006). However, significant FS changes were observed on 4 out of 10 items on the FBC, specifically relating to improvements in shopping with a grocery list, thawing frozen food safely (i.e., in the fridge), reading food labels, and eating breakfast (Condrasky, 2006). These findings again indicate that without addressing wider psycho-social determinants of home cooking, e.g., time demands, food poverty, and familial preferences; increasing levels of CS and FS will fall short of significantly impacting dietary quality (Stead et al. 2004). It is worth noting however, that the lack of effect with regard to improvements in vegetable intake in most cooking and food preparation interventions could also relate in some part to measurement difficulties; vegetables are more often consumed as part of mixed dishes making it difficult to recall or visualise (Fitt et al. 2010), and accurate recording of vegetables has been noted as particularly challenging within the research field (Chaplin, 2005).

As stated, the aim of most cooking and food skills interventions is to improve participantsô practical cooking and food skills in the hope that this will have a beneficial impact upon their overall dietary quality (through increased cooking from basic and fresh or healthier ingredients etc.); however, consideration should also be given to the reverse scenario, for example, those actively seeking to improve their diet may develop their cooking and food skills

as a result of the diet-related behaviours they engage in. Official Government advice on healthy eating and guidelines for consumption of a healthy diet in the UK, Australia, and USA focus heavily on individualsô preparing and cooking nutritious food at home whilst limiting convenience food and food eaten out of the home. Public information on Government-related websites discusses the need to make meals at home; highlighting food safety and hygiene practices and providing recipes and cooking tips on how to eat a balanced diet. In addition, they provides information on FS such as how to plan meals, write shopping lists and freeze/thaw food etc., (see footnote[2] for web links to sites in Australia, UK, and USA). The types of meals and recipes considered ónutritious and balancedô often include foods from a range of food groups, particularly vegetables and starchy foods (rice, pasta, potatoes, etc.) and ingredients which require a number of preparation *and* cooking methods. Therefore it is entirely plausible that an individual with greater dietary quality would have better cooking and food skills as they have learnt to prepare and cook a variety of healthy meals, picking up the skills as they progressed; thus this relationship could be best considered as bi-directional with gains in one domain leading to gains in the other.

[2] http://www.eatforhealth.gov.au/eating-well/tips-eating-well/healthy-eating-budget (accessed 7th July 2015)

http://www.cdc.gov/healthyweight/healthy_eating/index.html (accessed 7th July 2015)

http://www.nhs.uk/livewell/healthy-eating/Pages/Healthyeating.aspx (accessed 7th July 2015)

The top five core CS and FS components identified by the review were: frequency and type of cooking and food preparation (CS), cooking confidence or self-efficacy (for cooking in general and for preparing and cooking specific meals or foods) (CS), planning food shopping and writing lists (FS), frequency of shopping behaviours such as label reading, using coupons etc., (FS) and food safety and hygiene knowledge and behaviours (FS). Nutrition knowledge was assessed in several intervention studies (n=4) and has been classified as a component of FS in this review (Table 1). Understanding nutritional information can be seen as *one* prerequisite for healthy food selection (i.e. the ability to consume a diet in line with current recommendations). This also feeds into multiple aspects of the emergent term ófood literacyô as nutrition knowledge allows an individual to make ófeasible food decisionsô, balancing nutritional needs against taste and hunger etc., alongside a consideration of constraints (money, time, facilities, CS), as well as having the knowledge to safely prepare foods and eat them in the correct quantities for health (Vidgen & Gallegos, 2014). Nutrition knowledge may then impact upon other FS such as shopping and meal planning behaviours, and may also directly impact aspects of CS for example selecting cooking methods or techniques (i.e., choosing a healthier cooking method such as steaming as opposed to frying).

Many CS and FS components appear highly inter-related when judged upon face and content validity (for example, food safety and hygiene behaviours such as hand-washing and food preparation behaviours such as washing FV), yet this review has attempted to make some distinctions between components; for example, a person might have high self-confidence for cooking methods such as frying, grilling, etc., (considered CS) yet lack the skills to shop and manage food effectively i.e., work with food budgets, select healthy food, or prepare and plan

meals in advance (considered here as FS). Findings from the intervention studies in this review which observed changes in only selected aspects of CS or FS would seem to support this proposition (Wrieden et al. 2007); yet other interventions have reported simultaneous changes in both CS and FS (Greenwell Arnold & Sobal, 2000). These distinctions are considered important given the implications for the range of potential targets in future cooking and food skills interventions; perhaps it would prove most fruitful to cover multiple elements of both. It is important to note that since this review of the literature was conducted in late 2014, several publications have emerged evaluating the outcomes of a large-scale CS intervention implemented in Australia, Jamie Oliverôs Ministry of Food (JMoF) (Flego et al. 2014; Herbert et al. 2014). This programme was originally developed in the UK though these represent the first published quantitative (and qualitative) evaluations. Jamie Oliverôs manifesto is *'to inspire individuals to cook simple basic meals both for themselves and for their families'*, and JMoF programme comprises of 10 weekly sessions (1.5 hours each) where participants learn how to prepare and cook a variety of recipes along with specific cooking techniques (e.g. frying, chopping, roasting etc.). It incorporates messages about good nutrition, meal planning and budgeting for food (all FS), with a focus on cooking with fresh ingredients (practical CS). Primary programme outcomes are cooking confidence (self-efficacy) and vegetable servings per day and the items used to measure cooking confidence were based upon items previously reported in this review from Barton et al. (2011) (four items) (13) and Keller et al. (2004) (one item) (17); the vegetable servings per day item is based on an existing measure from the Queensland Self-Reported Health Status Survey. Findings from this community-based JMoF programme showed significant increases in cooking confidence in intervention versus control

participants; with intervention participants sustaining significant increases in cooking confidence from pre-programme to six months (Flego et al., 2014). Effects were also reported on dietary outcomes, as vegetable servings per day increased by over half a portion pre-post intervention, and when intervention participants were compared to a state-wide monitoring survey comparison group at six months post intervention, intervention participants consumed significantly more vegetables per day, with a difference of 0.74 portions (Flego et al. 2014). Increases in fruit consumption and a reduction in take-away food consumption remained significant at six months, and small but sustained effects were noted on positive cooking attitudes, food knowledge and enjoyment of cooking; as well as improvements in meal behaviours such as eating at a table, and small gains in self-perceived health and self-esteem (Herbert et al. 2014). Even these small dietary changes, such as an increase of just one portion of fruit or vegetables per day can bring meaningful reductions in CVD and mortality risk if sustained (Artinian et al., 2010; Dallongeville et al., 2011). Evidence reported on the wider benefits provide support for community-based cooking programmes on a number of fronts, but replication of these findings in other countries will provide stronger support (Herbert et al. 2014). This large-scale evaluation would indicate that targeting both CS and FS is necessary to achieve such change, although detailed process evaluations of change mechanisms are not reported and sample limitations in the JMoF evaluation should be noted; it was predominantly female (over 80%, with significantly more in the intervention vs control group); there were differences in employment status with more retired participants in the intervention group; and a significantly greater number of younger participants in the control group. In addition, both intervention and control participants started with relatively high levels of cooking confidence e.g., the mean score at baseline for ócconfidence

to follow a simple recipeô was 4.0 (0.04 SE) (out of 1-5) for the intervention group, and 4.1 (0.06 SE) for the control group. Therefore although outcomes were deemed successful (i.e., increased vegetables consumption and greater cooking confidence), these data suggest the participants attracted to JMoF may not have been those most lacking in cooking confidence, nor those who were unlikely to be cooking at home and thus at risk of poorer dietary quality (Flego et al. 2014). Furthermore, it should be noted that whilst JMoF participants reported greater confidence in preparing a meal from basics that was low in cost, actual weekly expenditure on food and drink did not decrease, and proportionally more was spent on fruit and vegetables (Herbert et al. 2014). In low-income populations or those from areas of high deprivation, focusing on strategies for the reduction or removal of internal and external barriers such as attitudes or cost might be more salient.

Objective measurement of CS and/or FS, or lack of, is a point raised by Flego et al., (2013) in relation to the evaluation of JMoF. In this programme there is no direct assessment of CS *per se* and indeed there were no instances of objective validation of any CS and FS measures in the review findings e.g., by way of a practical skills test or observation. This highlights a significant limitation of the research conducted in the field of CS and FS to date which other have acknowledged, e.g.., Hartmann et al. (2013) ï i.e., the sole reliance of self-report in relation to CS and FS measures. Furthermore, in the absence of detailed information on exactly *how* people prepare meals in their home, i.e., using only or primarily basic and raw ingredients, using convenience foods, or a mixture of both, means that two people answering questions regarding cooking confidence might feasibly respond in the same way, despite one person frequently using convenience products to prepare meals and the other using only fresh or raw ingredients and a

greater variety of CS. This is further illustrated by recent findings which showed that low income mothers considered oven-cooking pre-prepared waffles, pizza etc., as ócooking from scratchô(Lovelace & Rabiee-Khan, 2013).

It was clear from the studies contained in this review that CS and FS showed a significant relationship with socio-demographic factors; most commonly reported associations were with gender (females tended to report greater CS and FS), though most research was weighted towards females; and, age (older participants, typically women, tended to report greater CS and greater CS confidence). This highlights the importance of capturing socio-demographic data in any assessment of CS and FS as noted by Caraher et al. (1999). Psychological factors were also commonly assessed in relation to CS and FS, with attitudes towards cooking, food shopping, meal planning, willingness to invest time in cooking, and cooking enjoyment deemed of importance across a number of studies. Interventions designed to improve CS and FS in order to achieve dietary change should therefore aim to target not only knowledge, confidence and practical skill development, but also consider attitudinal changes in order to influence cooking and food-related behaviour, perhaps utilising a theoretical framework such as the theory of planned behaviour (TPB) to find suitable intervention targets. External factors were also measured in a number of studies and found to impact upon CS and FS; for example, participants reported on practical aspects such as access to food transport and food storage, access to cooking equipment, money for food, and access to recipes and cookbooks, though these were not common across multiple studies. These findings reiterate the importance of considering the wider psychological, social and environmental aspects relating to CS and FS which may act as

barriers or facilitators to diet quality (Stead et al. 2004) and though a thorough assessment of the social and environmental context was beyond the scope of this review, recent research on the components of food literacy by Vidgen & Gallegos (2014) has taken this expansive approach; placing CS and FS into the wider social and environmental context and examining the relationship with nutrition. Emergent findings indicate that the relationship between food literacy and diet is indirect, with food literacy proposed to improve nutrition through making food intake more certain (or predictable), more pleasurable (through taste and social eating) and by giving an individual more choice (or helping to inform choice in the complex food environment) (Vidgen, 2014, *unpublished*). By accounting for context, food literacy can also reflect the changing patterns of eating; where for example the availability of convenience foods may have reduced the need for an individual to possess numerous cooking and food preparation techniques, yet may increase the need for greater comprehension skills required for the selection of healthier options. As such, future studies measuring CS and FS should aim to contextualise findings where possible.

Conclusion

It is suggested that the lack of a clear consensus on the constituent parts of CS and FS and the lack of an appropriate measurement tool is a fundamental barrier to their study and to the understanding of their impact on dietary quality and health (Rees et al. 2012; Reicks et al. 2014). This review evaluated a totality of evidence and extends previous research findings as it examined existing CS and FS measures from a broad range of study designs (interventions, cross-sectional and qualitative studies), synthesised their component parts, and reviewed evidence for their role in diet. Findings indicated the presence of multiple measures of domestic

CS and FS within existing literature, which are composed of distinct, yet inter-related components. Few measures identified by the review appeared to thoroughly capture the components of CS and FS adequately, however, the instrument devised by Barton et al., (2011) showed promise, addressing aspects of both CS and FS with extensive development work and psychometric testing. It is suggested that researchers utilise and explicitly report a theoretical basis in any future development of CS and FS measures, and conduct extensive reliability and validity testing where feasible to give rigour to measures. Overall, the cross-sectional studies in this review highlighted the importance of measuring confidence with cooking methods and techniques (grilling, frying, etc.) and with specific foods (e.g., chicken, fish, red meat etc.) (CS) and the role of adequate meal planning (FS) in achieving greater dietary quality. The limited dietary changes resulting from existing intervention studies however, suggest that an increasingly comprehensive approach to improving aspects of both CS and FS is required in order to meaningfully influence dietary quality, with recent programmes such as JMoF showing some promise. Addressing the psychological components (e.g., attitudes), and external barriers (e.g., budget, access to equipment, food storage, etc.) which people face in conjunction with targeting knowledge, confidence and practical CS and FS, particularly in socio-economically deprived populations might prove more fruitful.

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Table 1. Conceptual heat map* of common components relating to the measurement of cooking skills and food skills in adults extracted from the literature.**

Component extracted from the literature	Positioned in Cooking Skills *n=frequency measured*	Positioned in Food Skills ***n=****frequency measured*	External Factor *n=frequency measured*
Food preparation and cooking frequency (type of cooking, peeling veg etc.)	13		
General cooking confidence/cooking ability	12		
Meal patterns (frequency of breakfast, lunch, dinner, eating out etc.)			11
Cooking attitudes/enjoyment of cooking			9
Planning food shopping/writing lists		8	
Typical food selection (e.g. pasta, rice, chips, FV etc., as measured by FFQ)			7
Purchasing and shopping behaviours (frequency of reading food labels etc.)		6	
Confidence/ability to cook specific meals	6		
Confidence/ability with specific cooking techniques (knife skills, baking, frying, etc.)	6		
Menu planning behaviours (frequency of planning menus/meals)		5	
Food safety and hygiene practices/behaviours (frequency of hand-washing, thawing food correctly etc.)		5	
Confidence/ability to cook specific foods (e.g. chicken, meat, vegetables, etc.)	4		
Health consciousness relating to choosing foods and feeding others		4	4
Confidence/self-efficacy in choosing and preparing healthy and nutritious foods (e.g. FV)		5	
Budgeting for food, comparing prices and using		4	

Component extracted from the literature	Positioned in Cooking Skills *n=frequency measured*	Positioned in Food Skills ***n=****frequency measured*	External Factor *n=frequency measured*
coupons etc.			
Nutrition knowledge		4	
Barriers to cooking and food choices (e.g. time, equipment, resources)			4
Cooking practices (type of cooking oil, adding salt etc.)	3		
Confidence following a recipe	3		
Food preparation complexity (types of ingredients, no. of ingredients in a recipe, etc.)	3		
Source of learning to cook			3
Frequency of recipe use	3		
Food management (ensuring food lasts for week/month etc.)	2	2	
Responsibility for cooking and shopping			2
Advance planning and food preparation behaviours (specifically pre- part-preparing/cooking meals)		2	

** Darker shading indicates the component of CS and/or FS was more frequently measured across multiple studies; lighter shading represents the less commonly assessed components. Note some components which appeared only once across all 26 studies are not reported here.*
*** Note that where a component is deemed to represent part of CS and FS both columns are highlighted.*

Table 2. Measures extracted from cross-sectional surveys which assess cooking and/or food skills

Reference	Summary of paper (including study aim, design, sample)	Relevant cooking skills (CS) and/or food skills (FS) measure
Caraher, Dixon, Lang, Carr-Hill (1999)[1]	To undertake secondary data analysis of data from the 1993 Health and Lifestyles Survey of England (HLS) to characterise the relationship between cooking skills and food choices. A cross-sectional survey was conducted via in-home interviews with 5,553 adults aged 16-74 years across England. A random sample of addresses was selected, stratified by NHS region, however, it was necessary to weight data as the sample was biased in relation to methods used for stratification by region, age groups and the policy of only interviewing one person per household. Weights were applied to compensate for this.	**Learning to cook:** 1) When you first started learning to cook, which if any of these did you learn from? *Scale: multiple pre-defined responses including: mother, father, school, friends, etc., alongside don't know, and other/own response.* **Practical usage of cooking skills:** How often do you cook a meal (i.e. any meal)? *Scale: Everyday – Never, including Don't know/no response.* **Confidence in cooking generally:** 1) How confident do you feel about cooking from basic ingredients in general? *Scale: Very confident – not at all confident* **Confidence in applying cooking techniques:** 1) How confident do you feel about the following cooking techniques: *Scale: Very confident – not at all confident* - e.g., boiling, steaming, shallow-frying, deep frying, grilling, poaching, etc. **Confidence in cooking certain food types:** 1) How confident do you feel about cooking the following foods: *Scale: Very confident – not at all confident* - e.g., red meat, chicken, white fish, oily fish, pulses, pasta, etc. **Cooking and other barriers to food choice:** 1) Do you feel your food choices are restricted because of cooking skills? 2) Are your food choices restricted because of concerns about: food going off, you have difficulty storing food, you have difficulty carrying food from

		the shops? 3) Are your food choices limited by: not knowing how to cook certain foods? Access to cooking facilities? 4) Do you have access to a: - e.g., microwave, non-stick pans/wok, steamer, food processor, etc. **Views on Cooking Skills:** 1) How important do you think it is to teach cooking to: *Scale: Very important – not important* - Girls, Boys
Larson, Perry, Story, Neumark-Sztainer (2006)[2]	To describe food-preparation behaviours, cooking skills, resources for preparing food, and associations with diet quality among young adults in the US. Cross-sectional analysis of data from the second wave of a population-based longitudinal study. Males (n=764) and females (n=946) aged 18-23 years responded to a mailed survey assessing self-reported food preparation behaviours and diet via a food frequency questionnaire.	**Food Preparation and Purchasing Behaviours:** How often have you done the following over the past 12 months: a) bought fresh vegetables; b) wrote a grocery list; c) prepared a green salad; d) prepared a dinner with chicken, fish, or vegetables; and e) prepared an entire dinner for two or more people? *Never-Daily* **Degree of Adequacy Perceived in Skill and Resources for Food Preparation:** My skills and resources are: *(Scale: 1-5 very inadequate-very adequate)* regarding: a) cooking skills; b) money to buy food; c) appliances for food preparation; d) food selection in local stores; and, e) time available to prepare food. **Dietary assessment included via food frequency questionnaire (FFQ).**
Hartmann, Dohle, Siegrist (2013)[3]	To design a cooking skill scale which is reliable and applicable to most people (European adults). A secondary aim was to explore what predicts cooking skills and also explore the association between diet and cooking	**Cooking Skills:** *(Scale: 1-6, 1 do not agree to 6 totally agree, same for all)* 1. I consider my cooking skills as sufficient. 2. I am able to prepare a hot meal without a recipe. 3. I am able to prepare gratin. 4. I am able to prepare soup. 5. I am able to prepare sauce. 6. I am able to bake cake. 7. I am able to bake bread.

	skills. Data from the first and second waves of the Swiss Food Panel study (2010 and 2011) were used to conduct both cross-sectional and longitudinal analyses. This is a longitudinal study of the eating behaviour of the Swiss population conducted via mailed surveys to randomly selected households. Data was available from 4436 participants (47.2% males) with a mean age of 55.5 years.	**Psychological Variables:** Health-consciousness: *(Scale: 1-6, 1 do not agree to 6 totally agree, same for all)* - e.g., I think it is important to eat healthily; My health is dependent on how and what I eat, etc. Willingness to invest time: - e.g., Since Iôm always under time pressure, I try to save time while cooking; Preferably, I spend as little time as possible on meal preparation, etc. Willingness to invest physical effort: - e.g., After a busy day, I find it physically very exhausting to prepare a meal; Cooking means physical effort that I try to avoid if possible, etc. Willingness to invest mental effort: - e.g., I donôt want to think about what to cook for a long time; I try to minimise the mental effort for preparing meals **Cooking enjoyment:** 1) Cooking is an important type of relaxation for me 2) Preparing a meal brings joy in my life 3) While preparing a meal I can play out my creativity 4) Preparing a meal is a satisfactory activity for me **Dietary assessment included plus other subscales.**
Brunner, van der Horst,	To predict the consumption of convenience products	**Cooking skills:** *(Scale: 1-6, 1 do not agree at all, 6 agree very much)* 1) I can prepare ôgratin potatoesô from scratch

Siegrist (2010)[4]	using a number of socio-demographic and psychological factors. A self-report cross-sectional mailed survey was sent to adults in random households across Switzerland in 2009. N= 918 complete datasets from persons mainly responsible for buying and preparing food in the household were included in this cross-sectional analysis. Mean age of respondents was 51.2 years and 70.3% were women.	2) I can prepare a soup from scratch 3) I can prepare a sauce from scratch 4) I can bake a cake from scratch 5) I can bake bread from scratch **Time spent cooking** *(Average score used across 3 measures)* How long do you spend cooking on a weekday, Saturdays and Sundays? **Value for money: (wider FS)** - e.g., I compare prices between product variants in order to get the best value for money, I always check prices even on small items, etc. **Price:** 1) I abstain from buying convenience products in order to save money **Consumption of convenience products assessed by FFQ.**
Van der Horst, Brunner, Siegrist (2010)[5]	To examine what factors are associated with ready-meal (RM) consumption including demographic factors, attitudes and cooking skills. A self-report cross-sectional mailed survey was sent to households randomly selected from the telephone book across Switzerland in 2009. The person mainly responsible for buying and preparing food was asked to fill out the questionnaire. The final sample was n=903 with adults aged 17 - > 65 years.	**Cooking Skills:** *(Scale: 1-6, 1 do not agree at all, 6 agree very much)* 1) I can cook complicated multi-course meals 2) I can prepare a lot of meals even without a recipe 3) I can prepare gratin potatoes 4) I can prepare a soup 5) I can prepare a sauce 6) I can bake a cake 7) I can bake bread **Ready-meal consumption assessed via a convenience product FFQ.**
Pettinger, Holdsworth, Gerber	To evaluate whether meal patterns and cooking practices in England and	**Meal Patterns and Cooking Habits:** *(Scale: Daily, 2-6 times per week, at least once a week, at least once a month or never)*

(2006)[6]	France conform to stereotypes with regard to eating together, meal preparation, food purchasing and cooking practices. A cross-sectional study conducted in England and France using self-report postal surveys. A stratified random sample of 1000 males and 1000 females aged 18-65 years was generated for each country from the electoral roll resulting in 826 respondents in England (58% male; mean age 44 years) and 766 respondents in France (42% males; mean age 42 years).	How often do you eat together as a household? How often do you eat breakfast? How often do you eat lunch? How often do you eat an evening meal? How often do you cook from raw ingredients? How often do you use ready-prepared meals (i.e. oven-ready)? Who decides what food to purchase? Who does the food shopping? How often do you go out for a sit-down meal? How often do you purchase a take-away meal? **Dietary assessment of snack food consumption included.**
McLaughlin, Tarasuk, & Kreiger (2003)[7]	Secondary data analysis of at-home food preparation among low income, food-insecure women. Data was drawn from 153 women who participated in a study of food insecurity and nutritional vulnerability in those using food assistance programs in Toronto (1996-1997), response rate of 68%. Data was collected by conducting 3 in-person interviews supplemented with questionnaires.	**Food Preparation Complexity** (NB calculated from the recall and recipe data) 1) Number of foods in a recipe 2) Number of foods reported in an eating occasion not part of the recipe **Frequency of food preparation from scratch** 1) Presence of multiple ingredients 2) Application of one or more standard cooking techniques (washing; subdivision and fractioning; combining and mixing; heating, and the removal of heat). **Diet estimated from dietary recalls and recipe forms.**
Morin et al (2013)[8]	To assess the associations between meal management self-efficacy (confidence) and food	**Self-efficacy related to meal management:** *(Scale: 11-point Likert scale, 0-11, 0= this is not at all what I think, 11= this is exactly what think)* 1) I feel very competent to plan our meals

	coping strategies (away from home or home-based) amongst parents with young children. A cross-sectional survey was administered to a convenience sample of 417 parents who worked with at least one child aged 2-5 years in Quebec (French-speaking Canada). Those with primary responsibility for the childôs diet took part, meaning mostly mothers participated and most worked full-time.	2) I feel very competent in choosing healthy and nutritious foods at the grocery store 3) I feel very competent in cooking for the family **Food Coping Strategies:** **Away from home food strategies:** *(Scale: 1 = never to 5 = very often)* How often do you: 1) eat in a family restaurant? 2) eat in a fast-food restaurant? 3) use delivery and quick takeout services? 4) buy convenience foods? **Home-Based Food Strategies** *(Scale: 1 = this is not like me at all to 5 = I am extremely similar)* How often do you: 1) determine a menu for the upcoming week? 2) make a weekly grocery list 3) prepare a healthy meal with only few ingredients on hand? 4) prepare meals in advance? 5) double recipes?
Lyon, Syder, Flellstrom, et al (2011)[9]	To evaluate how younger and older women (25-40 years 60-75 years respectively) compare in terms of their food practices and the cooking skills they currently use in the kitchen. Cross-sectional data was collected by questionnaire in a convenience sample of younger and older women in Dundee, Scotland, UK. 37 younger women took part, mean age 32.5 years and 43 older women participated, mean age 68.2 years.	**Food Preparation Techniques:** How often do you use the following food preparation techniques: *(Scale: 4-6 times a week; 2-3 times a week; only weekends; less often or never)* - e.g., washing and peeling vegetables, chopping or slicing vegetables, washing and peeling fruit, filleting fish, filleting meat etc. **Cooking Techniques:** How often do you use the following cooking techniques: *(Scale: 4-6 times a week; 2-3 times a week; only weekends; less often or never)* - e.g., baking in oven, frying ï deep fat, frying ï shallow, stir-frying, boiling, etc. **Use of Ingredients:** Do you ever use any of these ingredients to make meals? *(Scale: 4-6 times a week; 2-3 times a week; only weekends; less often or never)*

		- e.g., root vegetables, green vegetables, potatoes, raw meat, fish, eggs, etc. **Meal Patterns:** How often do you "eat out"? *(Scale: 4-6 times a week; 2-3 times a week; only weekends; less often or never)* - e.g., lunch in the canteen at work, fast-food restaurant, hotel or restaurant, etc. **Self-evaluation of cooking skills:** How would you rate your cooking skills? -I struggle with basics (poor skills/just OK) -I manage well (competent) -I feel confident even with complicated dishes (excellent).
Crawford, Ball, Mishra, Salmon, Timperio (2007)[10]	To examine associations between shopping, food preparation, meal patterns, eating behaviours and fruit and vegetable intake. 1580 women aged 18-65 years living in Melbourne, Australia were randomly selected from the electoral roll to participate in a mailed survey.	**Shopping Behaviours:** *(Scale: never/rarely, sometimes, most of the time, always)* - e.g., I do food shopping whenever I can fit it into my routine, I plan meals for the week before I go shopping, I write a shopping list to take with me when I shop for food, etc. **Food Preparation Behaviours:** *(Scale: never/rarely, sometimes, most of the time, always)* 1) How often do you know or plan in the morning what you will eat for dinner that night? 2) How often do you know or plan the day or night before what you will eat for lunch the next day? 3) How often do you prepare or cook dishes ahead of time to eat through the week? 4) How often do you enjoy cooking? 5) How often do you like trying new recipes and cooking new things? 6) How often do you spend less than 15 minutes preparing dinner? 7) How often do you tend to cook the same meals a

		lot of the time? 8) How often do you find cooking a real chore? 9) How often do you decide on the night what you will eat for dinner that night? **Meal Behaviours:** *(Scale: never, less than 1 meal/week, about 1 meal/week, 2-3 meals/week, 4-5 meals/week, 6-7 meals/week or more, not applicable)* - e.g., About how many times per week do you: eat meals that are prepared/cooked and eaten at home? eat meals inside fast-food restaurants? eat takeaway food from non fast-food restaurants/cafes eaten at home/work/study? etc. **Eating Behaviours:** *(Scale: never/rarely, sometimes, most of the time, always, not applicable)* - e.g., Meals are an important part of the day for me/my household, My family/household eat dinner together, I eat dinner at the dinner table in my house, I eat dinner while watching television, I eat on the run, etc. **Dietary assessment – FV measured.**
Wansink (2003) [11]	To use personality segmentation to profile nutritional gatekeepers/ influential cooks who are capable of changing taste preferences and eating habits of their families based on cooking behaviour, food usage and personality.	**Cooking behaviour** *(Scale for items 1-5: 1-9, 1 strongly disagree, 9 strongly agree)* *(Items 6-9 insert frequency)* 1) I often cook new recipes 2) I have many cookbooks 3) I usually cook new recipes by instinct 4) I consider myself a creative cook 5) I use a wide variety of spices 6) I tried _ different recipes in the past 12 months

Data was gathered from 770 adults across 50 US states aged 21-74 years. 61% were female and 508 of the respondents reported they were the primary meal planners.	7) I had guests over for dinner _ times in the past 12 months 8) I used the oven to cook dinner _ times in the past 12 months 9) I made _ casseroles in the past 12 months **Food Usage** *(Scale: frequency)* 1) How many times in the past month have you served: - e.g., beef, chicken, pork, broccoli, eat 5+ FV daily, etc. **Cooking Ability** *(Scale: 1-9, 1 strongly disagree, 9 strongly agree)* 1) I am a good cook 2) Others view me as a good cook 3) I am a relatively better cook than my friends **Adoptability relating to new foods and healthy eating** *(Scale: 1-9, 1 strongly disagree, 9 strongly agree)* 1) I am socially influential 2) I am inclined towards healthy behaviour 3) I am predisposed to try new foods 4) I am eager to learn **Personality Characteristics were also assessed.**

Table 3. Measures extracted from interventions which assess cooking and/or food skills

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
Swindle, Baker, Auld (2007) [12]	To test the most effective measurements for evaluating Operation Frontlineôs *Eating Right* class series in the US. Longitudinal study with data drawn from a number of differing time-points: pre-post, and at 3 and 6 months following participation in the *Eating Right* class series. 53 participants took part, 90% women and 49% were aged between 20 and 29 years. Data was collected via a number of methods: items were read aloud to participants on the course; delivered via telephone; or, mailed to participants.	**General Behaviour:** How often do you: a) make meals that include a variety of foods from the Food Guide Pyramid? b) think about healthful choices for family? c) have healthful snacks available? **Shopping Behaviour:** How often do you: a) read food labels when shopping? b) use a grocery list when shopping? c) compare prices when shopping? **Items (analysed individually):** How often do you: a) wash your hands? b) thaw food at room temperature? c) leave leftovers out of the fridge for more than 3 hours? d) eat breakfast? ****Eating Behaviour:** *(Scale: 0-4, never to almost always. Same for all sub-scales)* How often do you: a) use olive oil in cooking?** b) eat 2-4 fruits per day? c) eat 3-5 vegetables per day? d) drink low-fat milk? e) prepare foods without salt?** ***Eating behaviour subscale is less relevant however the two items marked are related to food preparation methods and cooking.*
Barton,	To test the	**Meal preparation:**

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
Wrieden, Anderson, (2011) [13]	validity and reliability of a short questionnaire which can be used to assess the impact of cooking skills interventions. A number of different samples were used to assess aspects of reliability or reliability including experts and those drawn from the general population.	1) What kind of cooking do you do at the moment? *Scale: cook convenience foods and ready-meals, through to prepare from basic ingredients* 2) In a normal week, how often do you prepare and cook a main meal from basic ingredients, e.g. a Shepherdôs pie starting with raw mince and potatoes? *Scale: Daily – never* **Plus:** - *How many adults do you usually prepare food for on a day to day basis?* - *How many children do you usually prepare food for on a day to day basis?* **Cooking Confidence:** How confident do you feel about: - Being able to cook from basic ingredients? - Following a simple recipe? - Tasting foods that you have not eaten before? - Preparing and cooking new foods and recipes? **Cooking and food safety behaviours:** *Scale: 1-6; 1, always, 5, never, 6, don't know.* 1) Do you eat food past its ôuse byô date? 2) Do you follow the instructions for storage on packaged food? 3) Do you check that food is piping hot when reheating? 4) Do you wash fruit and vegetables that donôt need to be peeled before eating them? **Nutrition Knowledge:** 1) Do you think you will increase the amount of FV you eat in the next 12 months? 2) How many portions of FV do you think experts recommend eating each day? 3) How many portions of FV do the following provide: - e.g., one medium glass of unsweetened orange juice, a

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
		thin slice of tomato, three heaped tablespoons of carrots, etc. **Food Selection:** 1) How often do you eat: - e.g., fruit, vegetables or salad (not including potatoes), pasta or rice, etc.
Condrasky (2006) [14]	To assess outcomes of the *Cooking with a Chef* (CWC) program in the US (a nutrition education intervention designed to enhance the skills and food choice behaviours of the home cook via participation in a series of 6 weekly interactive cooking lessons with a chef and dietitian). Intervention design with pre-post measures from 41 participants (39 females, 2 males) with a mean age of 25 years. 60% were African	**Food Behaviour Checklist (FBC):** *Scale: 1-5, 1, Do not do, 5 Almost always do.* 1) How often do you plan meals ahead of time? 2) How often do you compare prices before you buy food? 3) How often do you run out of food before the end of the month? 4) How often do you shop with a grocery list? 5) This question asks about meat and dairy foods. How often do you let these foods sit out for more than 2 hours? 6) How often do you thaw frozen foods at room temperature? 7) When deciding what to feed your family, how often do you think about healthy food choices? 8) How often have you prepared foods without adding salt? 9) How often do you use the ôNutrition Factsô on the food label to make food choices? 10) How often do you or your children eat something in the morning within two hours of waking up?

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	American, 30% Hispanic and 10% Caucasian and all were drawn from South Carolina. All participants had qualified for The Emergency Food Assistance Program (TEFAP) via Head Start participation.	
Condrasky, Williams, Catalano, Griffin (2011) [15]	To develop psychosocial scales which could be used to assess the impact of the *Cooking with a Chef* (CWC) program (a nutrition education intervention). The overall aim of the intervention was to foster good nutrition and a healthy body. Survey of CWC participants (parents and caregivers, n=162) and cooks (not professional chefs) (n=83). The total sample was largely	**Cooking Techniques and Meal Preparation Self-Efficacy:** Indicate the extent to which you feel confident about performing each of the following activities: *(Scale: 1-5, not at all confident-extremely confident)* - Using knife skills in the kitchen - Using basic cooking techniques: e.g., steaming; sautéing; stir-frying; grilling, etc.; Preparing fresh or frozen green vegetables (e.g. broccoli); Preparing root vegetables (e.g. potatoes); Preparing fruit (e.g. peaches); Using herbs and spices (e.g. basil). **Negative Cooking Attitude:** Indicate the degree to which you agree or disagree with each statement: *(Scale: 1-5, strongly disagree-strongly agree)* - I do not like to cook because it takes too much time. - Cooking is frustrating. - It is too much work to cook. - I find cooking tiring. **Self-efficacy for Eating/Cooking Fruit and Vegetables:** Indicate the extent to which you feel confident about performing each of the following activities: *(Scale: 1-5, not at all confident-extremely confident)* - e.g., Eating fruits and vegetables at every meal every day; Eating fruits or vegetables as a snack even if everybody

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	female, Ó35 years and worked full or part time.	else were eating other snacks; Cooking from basic ingredients (e.g. whole lettuce heads, fresh tomatoes, raw chicken), etc.
Levy & Auld (2004) [16]	To examine the usefulness of cooking classes vs cooking demonstrations to improve college students knowledge, attitudes towards cooking, and to improve CS, cooking confidence, reduce the frequency of eating out and increase home prepared meals. Intervention study with 65 college students in the US (25% male, mean age 19.7 years); comparing 2 treatment groups (hands-on cooking classes vs cooking demo). The intervention group attended 4 x 2 hour cooking classes based on Social Learning	**Eating Habits Survey* & Cooking Survey* Items:** Background items: 1) Do you know how to shop for groceries? *Y/N* 2) Do you know how to cook? *Y/N* 3) Have you ever taken a cooking class? *Y/N* 4) Do you own any cookbooks? *Y/N* 5) Have you ever taken a nutrition class? *Y/N* 6) Growing up, whoé - Shopped for your familyôs groceries? Taught you to shop? Cooked for your family? Taught you how to cook? *Scale: mum, dad, sibling, self, caregiver, other.* **Cooking and Eating Attitudes:** *Scale 1-5, 1 strongly disagree, 5 strongly agree)* 1) Eating healthful food is important to me 2) Preparing healthy food is too hard 3) I like to cook 4) I feel comfortable food shopping 5) Cooking helps you eat more healthfully and save money 6) Cooking is hard and takes too much time 7) I feel confident using various cooking techniques 8) I feel comfortable buying produce and reading food labels 9) Cooking meals is expensive **Eating Behaviour:** How manyé - e.g., Servings of FV do you eat per day? Meals do you eat per day? Snacks do you eat per day? Nights a week do you cook dinner? etc. **Knowledge:** 1) I know how to use a knife and stir-fry (*4 items on scale) **Food Preparation Survey*:**

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	Theory and included a supermarket tour.	72 hour food preparation recall (administered at 3 time-points following the intervention) which asked about previous 9 meals consumed; if they cooked; ate leftovers; ate premade meals; ate out or ate take-away; skipped meals. Also asked if they shared recipes with friends or if they taught their friends the cooking skills they learned. **Not all items on scales are included here as not available.*
Keller, Gibbs, Wong, et al. (2008) [17]	To assess process and outcome evaluations of a community-based nutrition and cooking education program for older men held within a recreation facility. Cooking skills were measured via a questionnaire devised by the researchers and qualitative interviews were conducted to increase the depth of understanding. Older men (n=19) took part in this community-based cooking and nutrition education intervention. 60% of the men were aged 75-85	**Cooking Questionnaire:** 1) Have you prepared a hot meal ófrom scratchô in the past year? *Y/N* 2) How often do you prepare a hot meal? *Scale: almost everyday; a few times per week; once per week; hardly ever.* 3) How often do you use a recipe when cooking? *Scale: often or always; sometimes; rarely; never.* 4) How often do you try new ways of cooking? *Scale: at least once per week; a few times a month; about once a month; less than once a month.* 5) How would you describe your cooking skills: *(Choose one)* - I do not know how to cook at all - I can only prepare basic dishes - I can cook most dishes on my own - I can cook almost any dish on my own **Attitude towards cooking:** *Scale: 1-5, 1 totally disagree, 5 totally agree* 1) I get a lot of pleasure from cooking 2) I get a lot of satisfaction from cooking my meals 3) I am confident that what I cook will óturn outô 4) I have a positive attitude towards healthy eating 5) I have a positive attitude towards cooking 6) I have good cooking skills 7) I like to try new foods

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	years, and all were retired from paid employment. All participants took part in a brief survey at the start of the intervention and again after 8 months (at the end of the evaluation year). 10 of the 19 men also took part in qualitative interviews.	
Greenwell Arnold and Sobal (2000)[18]	To examine the outcomes of participation in the Expanded Food and Nutrition Education Program (EFNEP) which is a federally funded nutrition education program in the US designed to help low-income families understand nutrition and food safety. A prospective within-subjects design was used to evaluate the EFNEP with 59	**Food Skills Measure:** 1) How often do you: - Use processed food - Prepare food from scratch - Reduce fat in cooking - Leave food unrefrigerated* - Thaw food at room temperature* - Dispose of garbage daily - Run out of money for food* - Compare food prices* - Purchase advertised foods - Shop with a grocery list* - Eat breakfast*

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	graduates drawn from 2 New York State counties. All participants were women and 95% were Caucasian. 41% of participants did not complete high school. Participants were assessed at 3 time points; baseline, program completion, and 1 year follow-up (maintenance).	- Plan meal preparation* *Scale: Items 1-11; 1-4, 1, almost never, 4, almost always. Item 12; 1-4, 1, just before you make it, 4, each family member makes own decision.* **Items overlap with the Food Behaviour Checklist (FBC) Condrasky (2006))* **Nutrition Knowledge:** Assessed specific knowledge regarding frequency of consumption of the following food groups: - Grains, Dairy, Iron-rich foods, Calcium-rich foods.
Wrieden, Anderson, Longbottom, Valentine, Stead, Caraher, et al. (2007)[19]	To evaluate the feasibility of a food skills intervention targeting cooking confidence, food preparation methods and dietary choices in areas of social deprivation in the UK (Scotland). 113 adults (over 80% female) living in areas of social deprivation in Scotland recruited though there were a	**Frequency of:** 1) family meals (main meals ï lunch or evening) 2) eating take-away foods **Frequency of Food Preparation and cooking methods:** 1) preparing basic ingredients (including FV, starchy foods) 2) cooking basic ingredients 3) assembling ready-made ingredients 4) using convenience foods 5) adding salt during cooking **Cooking confidence:** How confident are you: 1) following a recipe 2) cooking from basic ingredients (including FV, starchy foods) 3) cooking lentil soup* 4) cooking white sauce* *Scale: 4 points from 'Very confident' to 'Not at all confident'* **These dishes were cooked in the intervention sessions.* **Cooking confidence:** 1) cooking techniques (grilling, frying etc.) 2) cooking specific foods (including FV, starchy foods, meat, chicken, pulses etc.)

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	number of withdrawals leaving 51 intervention participants and 42 comparison participants), mean age 32.3 years and almost 50% of all participants were on income support.	*Scale: Yes, No, Don't know* **Cooking time knowledge:** 1) pasta 2) cabbage **Access to kitchen equipment and resources:** 1) including cooker, fridge, freezer and specific electrical and mechanical equipment and utensils. **Dietary intake:** 7-day food diary and a detailed FFQ covering the broad areas of: - Fruit, Vegetables, Total fish, Tuna, Total bread, Pasta, Rice (and reasons for non-consumption of items). Also includes: Reasons for food choice and food availability in the home. *Full questionnaire and other measures available at:* http://www.foodbase.org.uk//admintools/reportdocuments/83-1-1638_Cookwell_final_report_with_appendices_Nov_2002.pdf
Kennedy, Hunt & Hodgson (1998) [20]	To develop and test the nutrition education programme ôFriends with Foodô (FWF) aimed at low income families in England. 26 low-income mothers with young children from England took part in the final evaluation of FWF. Data were compared with 13 non-participating matched controls from a neighbouring town.	Specific items not available but measures assessed improvements on nutritional knowledge, the extent and nature of changes to food-related practices, and the range of factors found to initiate, facilitate, inhibit and support dietary change.

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
Brown & Hermann (2005) [21]	To evaluate the Oklahoma Cooperative Extension Service ï a program using cooking classes to provide education on FV preparation skills, food safety practices and nutrition. Trained educators delivered classes to 602 adults and youths over a period of 2 months.	**Safe Food Handling Behaviours:** 1) washing hands before preparing or eating FV 2) washing fresh FV before preparation 3) using a clean knife and cutting board to prepare FV **Dietary change FV also measured briefly.**
Clifford, Anderson, Auld, Champ (2009)[22]	To evaluate the impact of 4 short theory driven cooking programmes aimed at college students living off-campus would positively impact cooking self-efficacy, and FV knowledge, attitudes and behaviours. An RCT with 101 college students (63% females and n=94 lived off campus). The intervention	**Cooking confidence:** *(Scale: 1-5, 1=extremely confident, 5 not at all confident)* How much do you agree or disagree with the following statements: 1) I can cook a nutritious meal 2) I can cook a meal in a short amount of time 3) I can cook a nutritious meal without spending a lot of money 4) I can follow a recipe **Cooking attitudes:** *(Scale: 1-5, strongly agree, strongly disagree)* 1) Cooking takes too much time. 2) I enjoy cooking. 3) Cooking meals is expensive. 4) If you know how to cook, it is easier to eat more fruits and vegetables. 5) Cooking is hard. 6) I feel comfortable in the kitchen. **Eating Habits:** 1) FV per day 2) Frequency of eating out (i.e. at a restaurant, campus food

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
	group watched 4 weekly episodes of a cooking show óGood Grubbinôô, the control group watched 4 episodes of a sleep disorders programme.	court, or take-out) 3) How often do you: - e.g., Cook or prepare meals*, Eat pre-made meals**, Eat out or eat take out (including campus food court), Eat in a dining hall on campus, Skip meals (donôt eat)? Assessed breakfast, lunch and dinner separately. *cook or prepare includes cereal, making sandwiches, and cooking from basic ingredients. **eat pre-made meal includes breakfast bars, yogurt, frozen dinner, frozen pizzas, etc. **Nutrition Knowledge:** (4 items addressing the 2005 Dietary Guidelines recommendations for fruits and vegetables in the USA) **Barriers and motivators to eating FV:** (18 items) **FV self-efficacy:** (20 items).

Table 4. Measures extracted from qualitative studies describing and/or assessing cooking and/or food skills

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
Fordyce-Voorham (2011) [23]	To identify the food skills deemed essential for a skill-based healthy eating programme in secondary schools. Qualitative interviews with 51 food experts (including home economics teachers, chefs, dietitians and nutritionists, homemakers and young people).	The semi-structured interview questions were designed to generate data about consumer habits including: 1) food-related shopping skills (including decision-making), 2) food planning, 3) food preparation, 4) cooking skills. Questions: 1) Thinking about nutritional family-type meals what knowledge must individuals have to shop, prepare and cook such meals? *This 'Knowledge' includes a personal awareness and understanding about nutrition and what would constitute a nutritious family-type meal etc.* 2) Thinking about nutritional family-type meals what information sources must individuals be able to access to be able to shop, prepare and cook such meals? *'Information sources' includes examples of written or electronic data such as recipe and nutrition books etc.* 3) Thinking about nutritional family-type meals what skills must individuals have to shop, prepare and cook such meals? *'Skills' require an application of knowledge and include practical and cognitive ability to be able to plan, shop, prepare and cook a meal etc.* 4) Thinking about nutritional family-type meals what resources (other than skills and knowledge) must individuals have to shop, prepare and cook such meals? *'Resources' include human (energy, motivation) and non-human (time, cooking equipment, and transport) assets that would assist an individual to plan, shop, prepare and cook a meal.*

Reference	Summary of paper/ use of measurement	Relevant cooking skills (CS) and/or food skills (FS) measure
Short (2003a & b) [24&25]	A qualitative study to provide a ósystematic framework for thinkingô about domestic cooking and cooking skills. Convenience/ opportunistic sampling of thirty ódomestic cooksô from England aged 30-50 years ï i.e. those who had prepared food, any food, for themselves or for others on at least one occasion. Stage 1 interviewed seven couples and Stage 2 interviewed 16 individuals from varied household structures.	The semi-structured interview questions covered the following topics (**Stage 1**): 1) childhood experiences of cooking and eating 2) current cooking practices 3) the role of ready-meals 4) typically British food **Stage 2 asked about:** 1) importance of learning to cook 2) using recipes 3) making a pizza.
Stead, Caraher, Wrieden, Longbottom, Valentime, Anderson (2004) [26]	A qualitative study conducted with potential participants of a food-skills initiative to inform the specific content of the cooking skills intervention. Three focus groups took place with potential intervention participants (n=16 in total). Two groups were held in a large port town in Scotland, the other in a small industrial town. Most participants were women, with children, and around half were unemployed.	For this ófood-skillsô initiative aiming to improve cooking skills, a topic guide was followed covering: Participantsô experiences of food shopping, food preparation, food preferences, feelings about and experiences of cooking. Cooking methods were discussed (including boiling, poaching, roasting etc.), as well as familiarity with specific dishes (such as pasta, cheese sauce and soup). Participants were also asked which foods they would like to learn more about and what specific components they would like to learn about with regard to cooking the foods/dishes.

Figure 1. Flow diagram depicting the selection and assessment of articles for the review.