

**Facilitating communication with overweight  
children in dietetic settings: development and  
feasibility testing of an interactive e-resource  
(*Feed-back*)**

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## **Abstract**

Child obesity is a significant health concern and treatment typically involves referral to child weight management services (CWM). Evidence suggests that preadolescent children may benefit from greater involvement in their treatment but the younger child can find it difficult to enter treatment discussions, and being overweight can negatively affect child self-esteem and capacity to communicate. Digital technology has the potential to provide scaffolding for child consultations with dietitians by presenting information in an accessible, engaging and interactive format. This research aimed to develop a theory driven, evidence-based interactive e-resource (*Feed-back*) and to explore the feasibility and acceptability of using *Feed-back* to facilitate communication between children aged 7 to 11 years and the dietitian within child weight management (CWM) appointments.

To identify effective digital technology a systematic review critically evaluated existing e-resource interventions for children with chronic health conditions. The findings confirmed that these tools can have a positive effect on satisfaction, knowledge, self-efficacy, and health outcomes, but their use to improve child-clinician discussions had not been adequately investigated, with only one (out of the 14 studies) evaluating their effect on quality of face-to-face communication. Lack of health professional involvement in the

development of these e-resources was also identified as an area of weakness.

To understand current dietetic treatment approaches to preadolescent CWM, a qualitative study captured themes that emerged from discussions with dietitians (n=18) specialising in this field. Themes described their views and approaches to child-communication, recognising the importance of partnership working to engage the child and parent. Visual aids were discussed as visual frames of reference for verbal exchanges with the child and their family.

These evidence-based guidelines and researched clinical practice were brought together in a sound theoretical framework used to design and develop the *Feed-back* e-resource prototype. Emphasis was on user-centred design; dietitians contributed to development, and usability testing was undertaken by 7 to 11 year olds (non-patients (n=15) and overweight child-patients (n=5)).

Finally, a feasibility study (n=15) introduced the prototype to clinical settings on an iPad tablet device. Child knowledge and communication (TRI-COM-RS) measures were developed, and found to be reliable and demonstrated construct validity. Child knowledge about obesity was low but increased following the consultation using feedback ( $p=0.001$ ). Children and parents satisfaction ratings were high, and the prototype was suited for use in dietetic CWM

appointments. Further research is needed to understand its effect on child communication, motivation, adherence to treatment and long-term health outcomes, such as BMI.

## **Preface and contributions to thesis**

The original concept for this thesis, to design and evaluate an e-resource to facilitate face-to-face child-dietitian communication within a child weight management appointment, was suggested by the author and developed with the help of Professor Cris Glazebrook and Professor Heather Wharrad (the author's supervisors). The research documented in *Chapters One to Five*, which contributed to the development of the intervention, was designed by the author, with guidance and oversight from her two supervisors. The author was responsible for acquiring approval from the University of Nottingham Faculty of Medicine and Health Sciences Ethics Committee (*Chapter Three*), the Health Research Authority National Research Ethics Service Committee East Midlands – Nottingham 2 (*Chapters Four and Five*), and Staffordshire and Stoke on Trent Partnership NHS Trust (*Chapter Five*), as well as the associated participant recruitment, data collection, analyses and interpretation in these studies. Design, development and usability testing of the e-resource was carried out by the author.

Recruitment in Chapter Six was assisted by health professionals in the Healthy Kid5 Team (Ms Gerry Arnold, Ms Nicky Dodgson, Ms Elaine Isherwood and Ms Sue Plews). Data (*Chapter Five*) were independently analysed by Dr Siya Lodhia and Dr Bethan Davies, to assist with inter-rater reliability. Dr Charlotte Beer and Dr Helen Quirk also helped with this process in *Chapter Three*.

## **Publications and presentations arising from this thesis**

The following publications and presentations have been produced from work found within this thesis:

### ***Publications***

*Chapter Two:* Raaff C., Glazebrook C. & Wharrad H. A systematic review of interactive multimedia interventions to promote children's communication with health professionals: implications for communicating with overweight children. *Biomed Central Medical Informatics and Decision Making*, 2014; 14(8) (Appendix 1).

*Chapter Three:* Raaff C., Glazebrook C. & Wharrad H. Dietitians' perceptions of communicating with preadolescent, overweight children in the consultation setting: the potential for e-resources. *Journal of Human Nutrition and Dietetics*, 2014; 28: 300-312 (Appendix 2).

*Chapter Four:* Raaff C. Child weight management app – downloading part 1 of 3: designing an e-resource for clinical practice. *Network Health Dietitians*, 2014; 96:38-41 (Appendix 3).

*Chapter Four:* Raaff C. Child weight management app – downloading part 2 of 3: developing an e-resource for clinical practice. *Network Health Dietitians*, 2014; 97:38-41 (Appendix 4).

*Chapter Four:* Raaff C. Child weight management app – downloading part 3 of 3: finalising an e-resource for clinical practice. *Network Health Dietitians*, 2014; 99:32-34 (Appendix 5).

*Chapter Four:* Raaff C. Designing an e-resource for child weight management. *Blog* available at: [dietitian-feed-back.weebly.com](http://dietitian-feed-back.weebly.com) (Appendix 6).

### ***Presentations***

*2014 (May)* Raaff C., Glazebrook C. & Wharrad H. *Dietitians' perceptions of communicating with preadolescent, overweight children in the consultation setting: the potential for e-resources*. Oral presentation delivered at the Institute of Mental Health Postgraduate Research Study Day, University of Nottingham.

*2014 (July)* Raaff C, Glazebrook C. & Wharrad H. *Introducing the Feed-back e-resource*. Oral presentation and demonstration at the Trust-wide paediatric dietetic meeting, Staffordshire and Stoke on Trent Partnership NHS Trust.

*2014 (September)* Raaff C. *Feedback: An e-resource for child weight management*. Poster presentation for the Childhood Obesity Beyond Healthy Eating and Being More Active study day, Paediatric



Group and Obesity Group (British Dietetic Association) (Appendix 7).

## Abbreviations

<b>AMED</b>	Allied and complimentary medicines database
<b>App</b>	Application (downloadable software)
<b>Appt</b>	Appointment(s)
<b>B.D.</b>	Dr Bethan Davies
<b>BDA</b>	British Dietetic Association
<b>Blog</b>	Web-log (an internet-based discussion forum, consisting of a number of discrete entries)
<b>BMI</b>	Body mass index
<b>CAMHS</b>	Child and Adolescent Mental Health Service
<b>C.B.</b>	Dr Charlotte Beer
<b>CCCS</b>	Child Contribution Coding System
<b>CD-ROM</b>	Compact disk (read-only memory)
<b>C.G.</b>	Professor Cris Glazebrook
<b>CHEKQ</b>	Child Healthy Eating Knowledge Questionnaire
<b>CI</b>	Confidence interval
<b>CINAHL</b>	Cumulative Index to Nursing and Allied Health Literature
<b>C.R.</b>	Carol Raaff
<b>CWM</b>	Child weight management
<b>D</b>	Day(s)
<b>DfES</b>	Department for Education and Skills
<b>DoH</b>	Department of Health
<b>DNA</b>	Did not attend
<b>EMBASE</b>	Excerpta Medica dataBASE
<b>FEV<sub>1</sub></b>	Forced expiratory volume in one second (measure of

	lung function)
<b>E-SAM</b>	E-resource Satisfaction and Acceptability Measure
<b>eHealth</b>	Electronic health
<b>E-resource</b>	Electronic resource
<b>ES</b>	Effect size
<b>F/up</b>	Follow-up
<b>FSA</b>	Food Standards Agency
<b>GCSE</b>	Subject-specific school qualification(s) taken between 14 and 16 years
<b>GP</b>	General practitioner
<b>H</b>	Hour(s)
<b>HbA1c</b>	Glycated haemoglobin
<b>Healthy Kid5</b>	Healthy Kid5 Child Weight Management Service
<b>HK5</b>	Healthy Kid5
<b>H.Q.</b>	Dr Helen Quirk
<b>HRA</b>	Health Research Authority
<b>HSCIC</b>	Health and Social Care Information Centre
<b>H.W.</b>	Professor Heather Wharrad
<b>ICC</b>	<i>Intraclass correlation coefficient</i>
<b>ISRCTN</b>	International standard randomised controlled trial number
<b>ISRCTNR</b>	ISRCTN Registry
<b>IT</b>	Information technology
<b>MEDLINE</b>	Medical literature analysis and retrieval system online
<b>mHealth</b>	Mobile health
<b>MI</b>	Motivational interviewing

<b>Min</b>	Minute(s)
<b>Mth</b>	Month(s)
<b>N/A</b>	Not applicable
<b>NAFLD</b>	Non-alcoholic fatty liver disease
<b>NAO</b>	National Audit Office
<b>NCMP</b>	National Child Measurement Programme
<b>NHS</b>	National Health Service
<b>NICE</b>	National Institute for Health and Care Excellence
<b>N/K</b>	Not known
<b>NNR</b>	National research register
<b>No.</b>	Number
<b>NOO</b>	National Obesity Observatory
<b>NS</b>	Not significant
<b>NVQ</b>	National vocational qualification(s) (work-based awards)
<b>PCCCS</b>	Patient-Centred Communication Coding System
<b>PEF</b>	Peak expiratory flow
<b>PHE</b>	Public Health England
<b>RCT</b>	Randomised control trial
<b>SACN</b>	Scientific Advisory Committee on Nutrition
<b>SD</b>	Standard deviation(s)
<b>Sec</b>	Second(s)
<b>SE</b>	Standard error
<b>SENCO</b>	Special educational needs co-ordinator
<b>SIGN</b>	Scottish Intercollegiate Guidelines Network
<b>S.L.</b>	Dr Siya Lodhia
<b>SMART</b>	Specific, measurable, attainable, realistic, timely

<b>SONET</b>	School of Nursing, Midwifery and Physiotherapy Educational Technology
<b>SSOTP</b>	Staffordshire and Stoke-on-Trent Partnership NHS Trust
<b>TRI-COM-RS</b>	Triadic Communication Rating Scale
<b>UK</b>	United Kingdom
<b>UNICEF</b>	United Nations Children's Emergency Fund
<b>WHO</b>	World Health Organisation
<b>Wk</b>	Week(s)
<b>Y</b>	Year(s)

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# **Chapter One: An overview of the approach to preadolescent child weight management**

## **1.1 Introduction**

Reducing child obesity is a global priority (World Health Organisation (WHO), 2016a).

“Childhood obesity is one of the most serious public health challenges of the 21<sup>st</sup> century.” (WHO, 2015a)

Excessive body weight affects almost every organ system in a child’s body (Daniels *et al.*, 2005; Choudhary *et al.*, 2007), with far-reaching consequences into adulthood. Associated risks include cardiovascular disease, certain types of cancers, type 2 diabetes, musculoskeletal problems, breathing difficulties and asthma. The effects of childhood obesity also have a psychosocial cost that can lead to poorer quality of life (Must *et al.*, 1992; Friedlander *et al.*, 2003). Despite evidence-based clinical guidelines and recommended treatment strategies (Scottish Intercollegiate Guidelines Network (SIGN), 2010; National Institute for Health and Care Excellence (NICE), 2014a), more than a quarter of preadolescent children in England are still overweight or obese (Health and Social Care Information Centre (HSCIC), 2015). The UK government has invested in child weight management (CWM) programmes (Department of Health (DoH), 2008; DoH, 2011) but the number of children who become obese by the age of 11 shows no sign of decline (HSCIC, 2013; HSCIC, 2014; HSCIC, 2015).

The trend in healthcare has been to prioritise parental contribution to CWM treatment (Clark *et al.*, 2009; Lipstein *et al.*, 2012; Stacey *et al.*, 2014), acknowledging the significant role of parents in shaping the child's diet (Epstein *et al.*, 1994; Wardle, 1995; Warren *et al.*, 2008; Holsten *et al.*, 2012). This focus is potentially at odds with the rights of the child to

“take part in a clear and detailed exchange of the relevant information, to share in making decisions by expressing their views if they have them.” (Alderson and Montgomery, 1996, p. 66)

These rights are enshrined in the United Nations Convention on the Rights of the Child (UNICEF 1989). UK health policies have prioritised child involvement in medical decision-making (Department for Education and Skills (DfES), 2003; DoH, 2003; DoH, 2004) and have encouraged healthcare providers to engage with children and young people (National Health Service (NHS), 2009). Clinical recommendations do not reflect policy statements and children remain a lesser consideration in treatment discussions, with NICE (2013) implying that parents should be the focus of the consultation until the child is 12 years old.

Preadolescent children seem to want to be involved in matters affecting their health (Borland *et al.*, 1998; Boylan, 2004), and have an interest in decisions about food choices (Borland *et al.*, 1998; Savage and Callery, 2007; Coyne and Gallagher, 2011).

Furthermore, children are not always satisfied with the way in which clinicians communicate with them. Murtagh and his colleagues (2006) asked 8 to 14 year olds (n=20) for their opinions on the treatment they had received from dietitians. Comments such as

"Dieticians never listen." and

"They just tell you what to eat, what to do." (Murtagh *et al.*, 2006, p. 929)

suggest that children want to be more actively involved in consultations. Part of the challenge for the health sector in delivering effective treatment, is to find ways to achieve a child-centred approach (Pocock *et al.*, 2010). Parents need to facilitate and enable lifestyle change but, ultimately it is children themselves who need to change their behaviour (National Audit Office (NAO), 2006). Therefore, the preadolescent child should be included in treatment decisions.

This chapter will explore this child-centred approach for the preadolescent 7 to 11 year old and the challenges affecting communication with the consultation. To begin with, we will establish the extent of childhood obesity and current intervention approaches.

## **1.2 Defining the childhood obesity problem**

Body mass index (BMI) is a measure of body weight adjusted for height.

$$\text{Body mass index (BMI)} = \frac{\text{total body weight (kg)}}{\text{height (m)}^2}$$

Despite controversy over its sensitivity as a measure for adiposity, or body fat, in children (Mei *et al.*, 2002), BMI is the globally recognised means of classifying total body weight (WHO 1995, Speiser *et al.*, 2005; Barlow, 2007; SIGN, 2010; NICE, 2014a). It is also a useful gauge of changes in body fat, particularly among heavier children (Cole *et al.*, 2005; Freedman and Sherry, 2009).

BMI in children is affected by phases of growth, which cause changes in height and weight (Cole *et al.*, 1995). It fluctuates throughout childhood: rising steeply in infancy, falling during the preschool years and then increasing again in adolescence. Boys and girls also grow at different rates (Cole *et al.*, 1995). Therefore, defining childhood overweight using BMI requires age, gender and certain 'cut-off points' that separate normal weight from overweight and obesity (Bellizzi and Dietz, 1999; Rolland-Cachera, 2011). It is generally accepted that clinical definitions for overweight and obesity should be based on population specific data, reflecting the genetic and cultural differences of children in that country (Cole *et al.*, 2000; Kuczmarski *et al.*, 2000; Rosario *et al.*, 2010).

The UK 1990 Birth to 20 years BMI Charts for Boys and Girls (Cole *et al.*, 1995) were published in 1995, incorporating data from six surveys (n=30535) taken across the UK. Three sets of data were representative of England, Scotland and (for the most part) Wales.

Most of these data were cross-sectional, with one study contributing longitudinal data from between 1984 and 1990 (Cole *et al.*, 1995). The 91<sup>st</sup> and 98<sup>th</sup> centiles are taken as the respective clinical definitions for child overweight and obesity (SIGN, 2010), while the 85<sup>th</sup> and 95<sup>th</sup> are the corresponding classifications for population monitoring (National Obesity Observatory (NOO), 2011a; NICE, 2015).

The NCMP in England is a public health monitoring scheme that has been recording the weight, height and BMI of primary school-aged children since 2005. Every year, children in reception (4 and 5 year olds) and year six (10 and 11 year olds) are measured, providing a good source of data with which to track trends in overweight among preadolescents.

The number of children, who are either overweight or obese, is high and has been rising until fairly recently (Stamatakis *et al.*, 2005). Over the last decade, the overall figures in England have started to level off (HSCIC, 2013; HSCIC, 2014; HSCIC, 2015). This plateau effect seems to be a worldwide phenomenon (Olds *et al.*, 2011; Ogden *et al.*, 2014). However, closer examination of the NCMP data (HSCIC, 2015) reveals a concerning increase in very overweight or obese 10 and 11 year olds. During the six years of primary schooling, the obesity prevalence more than doubled, from 9.1 to 19.1% (Table 1).

**Table 1. Prevalence of overweight and obesity among girls and boys in England during 2014/2015 (n=1141859)**

Year group	Gender	Overweight (%)	Obesity (%)	Overweight and obesity combined (%)
Reception (4 to 5 years)	Boys	13.1	9.5	22.6
	Girls	12.5	8.7	21.2
	Boys and girls	12.8	9.1	21.9
Year six (10 to 11 years)	Boys	14.2	20.7	34.9
	Girls	14.1	17.4	31.5
	Boys and girls	14.2	19.1	33.5

(HSCIC, 2015, p. 10)

There is evidence to suggest that very overweight children become obese adults (Guo and Chumlea, 1999; Freedman *et al.*, 2005). Overweight and obesity amongst adults in England is even higher than in childhood, with a quarter (25.5%) who are obese and a further 35% in the overweight category (HSCIC, 2008). More recent WHO (2015b) data show that 23% of adults are obese in Europe (including the UK), second only to America, with a 26.8% prevalence. Additional weight in childhood has extensive consequences for health and wellbeing, affecting quality of life both in the short and long-term (Must *et al.*, 1992; Whitaker *et al.*, 1997; Friedlander *et al.*, 2003). It is therefore a priority that these children are helped towards a healthier weight.

### **1.3 Current approaches to CWM**

Numerous studies have investigated the most effective treatment strategies for childhood overweight and obesity. Three treatment strategies exist: lifestyle, pharmacological, and surgical interventions (Oude Luttikhuis *et al.*, 2009).



Lifestyle interventions include dietary, physical activity and behavioural approaches (e.g. Oude Luttikhuis *et al.*, 2009). Behavioural components (such as motivational interviewing, discussed in Chapter Four) help to change thinking patterns, particularly those relating to dietary intake, physical activity and sedentary behaviour, and include the family's food and environment. The higher risk pharmacology option (Whitlock *et al.*, 2010) should be limited to use in exceptional circumstances in the preadolescent (under 12 year old) child, and only when lifestyle interventions have been started and evaluated (NICE, 2014a). Bariatric surgery is even more rare in the UK, but sleeve gastrectomies have been performed on children as young as eight years (Aikenhead *et al.*, 2011) and even five years (Black *et al.*, 2013), in countries such as Israel, Germany, Austria and Saudi Arabia. Due to the significant risk of harmful consequences associated with these more invasive approaches (Aikenhead *et al.*, 2011; Black *et al.*, 2013), such procedures are only performed when the benefits of treatment outweigh the risks of withholding it (NICE, 2014a; Ells *et al.*, 2015).

Non-invasive lifestyle interventions have been found to be effective (Oude Luttikhuis *et al.*, 2009; Whitlock *et al.*, 2010; Ho *et al.*, 2012) and are considered best practice when treating the preadolescent overweight child (NICE, 2013). Fundamental principles are similar to that of adults: reduce energy intake and increase energy expenditure (Summerbell *et al.*, 2005; NICE, 2014a). The primary

aim of treatment may vary from reduced rate of weight gain to actual weight loss, depending on the child's age and weight classification. First line treatment for 7 to 11 year olds initially aims to halt further weight gain (SIGN, 2010).

Dietary treatment (Table 2) supports a nutritionally balanced healthy diet alongside suitable portion sizes (SIGN, 2010; NICE, 2014a). Having three regular meals, particularly breakfast (Duncan *et al.*, 2008; Deshmukh-Taskar *et al.*, 2010; Maddah and Nikooyeh, 2010; Duncan *et al.*, 2011), is important. High calorie snacks (Zizza *et al.*, 2001) and sugar-sweetened beverages should be limited (St-Onge *et al.*, 2003; James *et al.*, 2004, Scientific Advisory Committee on Nutrition (SACN), 2015). Minimising sedentary time (Leung *et al.*, 2012) and encouraging physical activity (aiming for 60 minutes of moderately intense physical activity) every day (NICE 2014a) helps to redress energy imbalance in the overweight child.

Alongside dietitians, a number of different health professionals may support these family-based lifestyle interventions, including medical practitioners (GPs, paediatricians, and endocrinologists), school nurses, and psychologists (British Dietetic Association (BDA), 1997; SIGN, 2010). These interventions are designed as either individual or group sessions, and take place in clinical settings (hospitals or health centres), or community venues (such as schools) (Oude Luttikhuis *et al.*, 2009).

**Table 2. Components of dietetic lifestyle and behavioural interventions to treat the overweight child**

<i>Height and weight measurements:</i> calculate BMI to classify the severity of the weight problem and to use this as a tool to assess knowledge about health risks and existing concerns <sup>1,2</sup>
<i>Determine genetic and environmental factors:</i> stature of close family relatives <sup>3</sup>
Enquire about signs or symptoms of possible <i>associated comorbidities that may require further medical investigation</i> , e.g. type 2 diabetes, hypertension, respiratory problems, psychological dysfunction <sup>3</sup>
As far as possible, <i>rule out possible underlying medical causes:</i> hypothyroidism, Cushing's syndrome, growth hormone deficiency, Prader-Willi syndrome <sup>3</sup>
<i>Weight history</i> <sup>1</sup> : identify circumstances or triggers that have led to weight gain <sup>2</sup>
<i>Discuss BMI goal</i> <sup>2</sup> and associated ideal weight range: use growth charts to illustrate realistic time frames for attaining a healthier weight
<i>Assess levels of motivation</i> <sup>1,2,3</sup> and ability to make lifestyle changes: explore beliefs or concerns about healthy eating, physical activity and weight gain that may be counterproductive to achieving weight loss <sup>1</sup>
<i>Explore current diet</i> <sup>1,2,3</sup> : take a diet history or review a food diary, identify eating habits, food choices, and existing eating patterns <sup>1</sup>
<i>Encourage child and parent(s) to identify realistic dietary changes</i> <sup>1,2,3</sup>
<i>Explore current levels of physical activity</i> <sup>1,2,3</sup> and <i>sedentary behaviours</i> <sup>2,3</sup>
<i>Encourage child and parent(s) to identify practical changes to exercise pattern</i> <sup>1,2,3</sup>
<i>Refer to other services as required</i> , to ensure all aspects of psychological, nutritional, physical activity and health needs are met <sup>2</sup>

<sup>1</sup> BDA (1997), <sup>2</sup> NICE (2006), <sup>3</sup> SIGN (2010)

There is limited evidence to recommend group interventions over individual sessions for CWM. A systematic review (Paul-Ebhohimhen and Avenell, 2009) of interventions for overweight adults found psychologist-led group sessions to be more effective than individual treatment<sup>1,2,3</sup>, with no statistical difference between dietitian-led group and individual sessions. No equivalent reviews have been done in children but the interim results from a Norwegian study (Kokkvoll *et al.* 2014) of 6 to 12 year olds (n=97) found no significant BMI difference at the end of a 12 month intervention period. The authors did find a small but notable change in waist circumference

( $p=0.036$ ) in favour of participants who attended groups. It is worthwhile pointing out that participants in the group sessions received 36 hours of contact time in the 12 month study period, versus the 8 hours given to children in the control group, alongside 38 hours of organised physical activity (not offered to control group participants).

Similar disparities exist in another study (Savoye *et al.*, 2011) that found improvements in BMI at 12 months post-intervention amongst participants who received family-based group treatment ( $-2.8 \text{ kg.m}^{-2}$  [95% confidence interval:  $-4.0$  to  $-1.6 \text{ kg.m}^{-2}$ ]).

Participants involved in the groups received 64 sessions during the 12 month intervention, while children in the control group received only three sessions. NICE (2013) recommends both group and individual sessions for CWM, emphasising that irrespective of the approach taken, the intervention should be tailored to meet the individual needs of the child and their family.

#### **1.4 Patient-centred care for the preadolescent child**

Tailored interventions and effective communication between clinician and patient are accepted as the basis for good clinical practice (Stewart, 1995; NICE, 2013). Over recent years, there has been a shift towards patient-centred care (Charnock, 1998; Epstein *et al.*, 2005; NICE, 2015), a treatment approach that prioritises listening to and informing patients. Active patient participation is encouraged

and includes information exchange, discussions and agreeing the best treatment for the patient (Charles *et al.*, 1999; NICE, 2015). Motivational interviewing (MI) is an example of a patient-centred approach that has been used in CWM interventions for 7 to 11 year olds (e.g. Wong and Cheng, 2013). MI has been found to empower patients and improve self-efficacy, motivation and self-management (Miller and Rollnick, 1991a). Moreover, there is evidence to suggest that it can lead to positive changes in child BMI and obesity-related behaviours (Borrello *et al.*, 2015) and is discussed further in Chapter Four.

The NHS has recently committed itself to this type of shared decision-making within the NHS Constitution (DoH, 2013a) and the NHS Mandate (DoH, 2013b). NHS England has started to develop patient decision aids to facilitate shared decision-making but, to date, the developed resources target adults, and not the child (NHS, 2014a). If the younger child is to participate in a relevant and meaningful way, information must be designed so that it is appropriate and accessible to them (Charnock, 1998).

It is essential to establish whether the 'patient' is the child or their parent(s). At the heart of the matter are two issues that are potentially at odds with each other: competence and responsibility. On the one hand, there is parental responsibility, and on the other; child competence and responsibility. To begin with, we will discuss the child's perspective.

#### **1.4.1 Child competence and responsibility CWM interventions**

In Section 1.1, we noted the NICE (2013) guidance that the child should only become the focus of the consultation when they reach 12 years of age. The evidence for this recommendation is not provided but may be linked to child competence and parental responsibility.

Alderson and Montgomery (1996) advocate that a child should be presumed competent from the age of five, and that incompetence should be proven, rather than the onus being on the child to demonstrate competence. Another study (Borland *et al.*, 1998), involving 4 to 12 year old children, sought to better understand the emotional ability of this age group. They found that children from the age of eight were more able to present their points of view and to influence parents' decisions.

Pyörälä (2004) explored 7 to 9 year old (n=26) Finnish diabetic children's participation in dietetic consultations. Children in this age group proved themselves competent to deal with treatment related questions. Children were unmistakably interested in the conversation between the dietitian and their parent(s), interrupting adult exchanges to correct inaccuracies. Moreover, these preadolescents were found to be particularly knowledgeable about timetables, and capable of detailed descriptions of eating habits, with minimal help from parents (Pyörälä, 2004).

The preadolescent child is still developing their capacity to communicate. Piaget maintained that cognition develops at various stages (Piaget, 1964). Most 7 to 11 year olds, for example, are able to talk about concrete items (such as food), but find the abstract nutritional constructs of 'balanced diet' and 'healthy eating' more challenging. Piagetian theory asserts that nutrition messages are often beyond the cognitive capacity of the preadolescent child (Contento, 1981). While these messages can be complex, young children may have the potential to understand far more about their health than was previously recognised (Rushforth, 1999).

Although the age of the child has some bearing on cognitive capacity and ability to solve problems independently, knowledge and skills can be acquired with appropriate guidance and support (Vygotsky, 1978). In her review, Rushforth (1999) points out that health practitioners can help the child to understand so that they can participate in the treatment process, concluding that

"it will be increasingly beholden on practitioners to apply these principles in practice, in order to ensure that children for whom they care are truly given a voice, and that voice is listened to and taken account of." (Rushforth, 1999, p. 690)

Health professionals also need to be aware that children exert substantial control over what they eat and drink from an early age. It would seem that, over recent years, children have been given greater responsibility over their own diets (Warren *et al.*, 2008),

with almost 9 out of 10 nine year olds indicating that they have some control over what they eat for breakfast, and two-thirds influencing decisions over snacks and lunch (Robinson, 2000). By 10 and 11 years of age, the child appears to have greater sway in food decisions and furthermore, they value this entitlement (Warren *et al.*, 2008). Children begin to make more independent food choices as they move into adolescence (Bargiota *et al.*, 2013). Concerningly, these choices are not necessarily healthful. Data from the National Diet and Nutrition Survey (Food Standards Agency (FSA), 2014) suggest that fruit and vegetable intake drops in 11 and 12 year olds and, over the four years that the study has collected dietary data, adolescents have progressively eaten less fruit and vegetables overall.

This decline in healthful food choices may partly be attributed to the food advertisers' more targeted approach (Cairns *et al.*, 2009), as they recognise young children as consumers in their own right. This WHO review suggests a link between food promotion and consumption. It is therefore fitting that the preadolescent child should be empowered to make responsible, informed food-related decisions. Sophisticated advertising techniques, such as including nutritional claims on packaging, can confuse 11 year olds into choosing energy dense but nutrient poor foods over healthier equivalents (Dixon *et al.*, 2013). Interpreting nutritional messages amidst distracting advertising claims is a challenge for the preadolescent child (Elliott and Brierley, 2012), often leading to



misunderstandings or misinterpretations (Hart *et al.*, 2002).

There is a legal, moral and social duty to ensure that the overweight child is recognised as a competent participant in their weight management, and helped to become actively involved in discussions about their treatment so that they can take responsibility for the dietary choices that they are already making.

#### **1.4.2 Parental responsibility in CWM interventions**

Parents have been defined as 'agents of change' for interventions targeted at the preadolescent child (Golan *et al.*, 2006), particularly in their role as food purchasers and preparers. It follows, therefore, that parents can have a beneficial effect on a child's diet. For example, Ogden *et al.* (2006) found a link between different forms of parenting control and snacking behaviour. Covert control reduced unhealthy snacking while overt restrictions and monitoring promoted more health snacking behaviour. Parents can also negatively influence eating habits by offering less healthy food options at home; associated with less healthy choices made away from the home and the child consuming fewer fruit and vegetables overall (Fraser *et al.*, 2011). Wansink (2006) calculated that parents influence approximately 72% of foods children eat, both within and beyond the home. Their influence also extends to child physical activity levels; parental encouragement and modelling behaviour being cited as facilitators for improvement (Gustafson and Rhodes, 2012).

Clinical practice guidelines and consensus statements (n=20) from around the world were analysed for recommendations on the role of the parent in CWM (Shrewsbury *et al.*, 2011). Documents were from America (n=7), the UK (n=2), and other developed nations such as France and Australia (one was from Malaysia). These documents acknowledged parental sway over lifestyle behaviours in the preadolescent child, with recommendations that CWM interventions involve the parent alongside the child, particularly for behavioural and lifestyle modification in the under 12s (n=5). However, the extent of parent involvement is left to the discretion of the health professional (Shrewsbury *et al.*, 2011) and there is a danger that the preadolescent child is not always adequately included in treatment conversations (Section 1.5.2).

Most children value the support and advice of parents (Alderson and Montgomery, 1996; Runeson *et al.*, 2007). Nevertheless, parental involvement should not come at the expense of engaging the child. Indeed, parental efficacy is likely to be enhanced by greater child involvement. Stewart *et al.* (2008) found that parents, along with the child, were motivated by a child-centred approach, and that this could unite efforts to change behaviour. Information therefore needs to be delivered to facilitate this partnership working between the child, parent(s) and health professional (Holzheimer *et al.*, 1998; Mikhailovich and Morrison, 2007).

Failing to engage the child could hamper treatment outcomes (McPherson and Thorne, 2000; Skelton and Beech, 2011). Similarly, Grimes-Robison and Evans (2008) emphasise the importance of the child's experience of the treatment process. Health professionals therefore need to communicate effectively, with the child and their parent(s), in the challenging task of lifestyle behaviour change.

### **1.5 Factors affecting the child's capacity to communicate**

Dietetic interventions for 7 to 11 year olds, usually involve at least three individuals – the child, one or both parent(s) and the dietitian (Pyörälä, 2004). Aside from the child's cognitive capacity and competence (Section 1.4.1), various other factors may affect child communication. These include the psychological and psychosocial impact of the condition, together with the permission afforded by parents and treating clinicians.

#### ***1.5.1 The psychological and psychosocial impact of excess weight***

Body weight is typically thought of as being under personal control. This often leads to the stereotype that an individual is obese because they lack self-discipline or willpower, and that they are lazy or greedy (Puhl and Latner, 2007). In the face of a cultural quest for thinness, it is unsurprising that those who are overweight begin to internalise negative thoughts and attitudes (Budd *et al.*, 2011).

It is this effect on the overweight child's mental development that can affect their ability to communicate thoughts, feelings and concerns.

#### *1.5.1.1 Stigmatisation*

Social isolation or peer rejection because of overweight or obesity can hinder a child's social and emotional development (Puhl and Latner, 2007). Obesity-related stigmatisation can be found in children as young as three years old (Hansson *et al.*, 2009). Cramer and Steinwert (1998) found that young children are more likely to associate hand drawn pictures of obese people as the 'mean' villain in a story, choosing pictures of a healthy weight person as the 'nice' character. Another study used drawings of average weight and obese children to ask 5 to 10 year olds whom they would choose as a friend. Girls, in particular, tended to be less inclined to select images depicting very overweight children (Penny and Haddock, 2007).

Prejudice against heavy children can lead to teasing and bullying (Murtagh *et al.*, 2006). Sixty focus groups (Dixey *et al.*, 2001), each consisting of five children (n=300) aged 9 to 10 years, captured some typical comments. Girls stated that:

"Some people don't like fat people."

"When I was really chubby, they all used to call me 'fatty'"  
(Dixey *et al.*, 2001, p. 210).

Obesity-related stigmatisation is not limited to child peers. Parents (Davison and Birch, 2004), teachers (Neumark-Sztainer *et al.*, 1999) and health professionals (Edmunds, 2005; Budd *et al.*, 2011) can be just as guilty. This can lead to lower child self-esteem, poor body dissatisfaction, depression, and even suicidal tendencies (Dave and Rashad, 2009).

#### *1.5.1.2 Self-esteem*

It would seem reasonable to assume that a victimised child would inevitably develop a poor self-image or a low self-esteem. The evidence in this area is less straightforward. A review (Wardle and Cooke 2005) among children and adolescents concluded that the effect of obesity on self-esteem is modest. In his 4 year longitudinal study (n=1090), Strauss (2000) tracked 9 to 10 year old American children. Data indicated that obesity and self-esteem may be unrelated during preadolescence. He suggests that a sense of self-worth may only begin to develop in adolescence.

Nowicka *et al.* (2009) also found age, not BMI, to be a factor in child self-esteem. Hesketh *et al.* (2004) collected self-esteem data on 5 to 10 year old (n=1157) Australian school children for four years, and also identified a drop in self-esteem towards adolescence. Furthermore, their data showed an association between increased body mass and lower self-esteem, and that the longer a child remained overweight, the greater their risk of a failing self-esteem.

Measuring psychological wellbeing depends largely on the validity and reliability of the assessment tool. Different tools have been used in different studies, making direct comparisons difficult. Additionally, some data were collected directly from children (Strauss, 2000; Nowicka *et al.*, 2009) and others via parents (Hesketh *et al.*, 2004). While the research is by no means definitive, certain groups may be more prone to developing a poor self-image (as a result of childhood obesity) than others, particularly white Caucasian children (Brown *et al.*, 1998), girls (Davison and Birch, 2001; Israel and Ivanova, 2002; Tiggemann, 2005; Nowicka *et al.*, 2009) and children approaching adolescence (Hesketh *et al.*, 2004, Nowicka *et al.*, 2009).

#### *1.5.1.3 Social skills*

Children who are very overweight and who have a lower self-esteem may be more lonely than their peers (Strauss, 2000). Phillips and Hill (1998) examined the effect of body weight on peer acceptance amongst preadolescent girls (n=313). Every child, in girls-only year five and six classes, was given four copies of the class list to mark off their answers to four questions. They were asked to choose any three girls they: most liked playing with, would like to sit next to in class or invite home for tea, and thought were the prettiest. Weight and height measurements for every girl were used to calculate and classify BMI. Overweight girls were not regarded as physically attractive as their normal weight peers, and obese girls even less so, but they were just as popular (Phillips and Hill, 1998).

While the overweight child may be just as popular in primary school, developing meaningful and sustainable friendships is important. Strauss and Pollack (2003) mapped adolescent social networks and found that overweight children tended to have fewer friends. The weight status of adolescents who nominated overweight peers as their friends was not reported but they tended to be less popular themselves, receiving fewer (mean[SE]) friendship nominations than friends of normal weight peers: 4.30[0.10] vs 4.84[0.09] ( $p < 0.001$ ). Instead of developing strong and cohesive friendships, relationships happened on the periphery with fewer reciprocal friendships.

Aside from social isolation, heavier children report feeling rejected socially in a general sense (Strauss, 2000). Children cite a number of reasons for feeling different. Girls, for example, are concerned about what they wear:

"I tried to lose weight, so I could fit into certain clothes."  
Year five or six girl (Dixey *et al.*, 2001, p. 210)

Stigmatism and prejudice can result in stereotyping that reaches beyond peer isolation, to societal isolation. Rejection from so many angles can lead to depression. Wardle and Cooke (2005) play down a possible connection, suggesting a modest or even negligible link between obesity and depression. But several papers have identified a significant association (Revah-Levy *et al.*, 2011), some indicating

that girls may be more susceptible (Erickson *et al.*, 2000; Cortese *et al.*, 2009), but boys are not immune (Mustillo *et al.*, 2003).

The psychological and psychosocial impact of being overweight are important factors in the child's ability and willingness to engage in conversation with a dietitian about the condition that may have affected lower self-esteem and confidence to express themselves within social settings.

### **1.5.2 Parental and health professional control**

While we have established that children generally want to be included in conversations about their health and lifestyle changes, parents and clinicians seem to set the tone for the consultation and largely control the extent to which the child can take part (van Dulmen, 1998; Wassmer *et al.*, 2004; Mårtenson and Fagerskiöld, 2008; Cox *et al.*, 2009; Coyne and Gallagher, 2011).

The child has traditionally held a subordinate role in consultations with health professionals, even when they themselves are the patient (Tates and Meeuwesen, 2000; Wassmer *et al.*, 2004; Cahill and Papageorgiou, 2007). In practice, consultations are often between parent(s) and health professional,

“...and their accounts of children's diets were privileged over those of children.” (Savage and Callery, 2007, p. 370)



Parental communication within the appointment also inevitably affects child communication (Wassmer *et al.*, 2004). Wassmer found that the more parent(s) spoke, the quieter the child was. Parents who actively questioned their child seemed to draw the child into the conversation. Parental encouragement and support can help the child to enter the communication exchange, providing more information as well as seeking more information (Wassmer *et al.*, 2004). However, it is not uncommon for parents to unwittingly sabotage the paediatric consultation, for example by answering questions intended for the child (van Dulmen, 1998; Coyne and Gallagher, 2011). Cahill and Papageorgiou (2007) found that parents were likely to interrupt the health professional-child dialogue if their own concerns had not been acknowledged.

Underlying this adult dominance is an intention to act in the best interest of the child. There is the question of perceived child competence (as opposed to actual competence dealt with in Section 1.4.1), and the time constraints of the CWM appointment. Both factors can curtail child communication.

#### *1.5.2.1 Time as a limiting factor for child participation*

Pressure to complete a consultation within the allocated time slot, whilst offering appropriate treatment, can jeopardise the extent to which children are involved in their own treatment (Tates *et al.*, 2002; Mårtensson and Fagerskiöld, 2008; Raaff *et al.*, 2015).

Clinicians may opt for the easiest and fastest means of

communication, resulting in a parent-centred approach, rather than a child-centred one. Children are sensitive to this time pressure and report being

“...unable to ask questions or volunteer information because of being rushed.” (Coyne and Gallagher, 2011, p. 2340)

Children do take longer to answer questions in a consultation (Cahill and Papageorgiou, 2007) but limiting child participation because of the time available for the appointment, undervalues the child’s contribution to the treatment process.

#### *1.5.2.2 Perceived competence as a constraint for child involvement*

Perceived competence is often judged according to the child’s age (Pantell *et al.*, 1982) but is usually not assumed from the age of five, as recommended by Alderson and Montgomery (1996). In a study by Tates *et al.* (2002), GPs communicated more with 10 to 12 year olds than they did with 7 to 9 year old or younger children. Similarly, Wassmer and colleagues found that children over seven years of age contributed almost twice as much (7%) to the conversation than their younger counterparts (4%) (Wassmer *et al.*, 2004). Some studies, investigating the role of age, have included inappropriately young children; children from the age of one (van Dulmen, 1998) or four week old babies (Wassmer *et al.*, 2004). Such age ranges compromise the validity of the research.

Gender is an interesting component of this discussion. van Dulmen's (1998) work, found that boys participated more, asking even more questions than older girls. Similarly, Pantell *et al.* (1982) observed that paediatricians tended to give boys more information than girls of the same age. It is worthwhile highlighting that parents generally deem girls more competent than boys (Taylor *et al.*, 2010), raising the issue of bias in parental assessment of child competence.

Parents of 7 to 16 year olds were asked to identify factors that influence their view of child involvement in the consultation (Taylor *et al.*, 2010). Answers varied from gender to cognitive ability and family dynamics. Children themselves agreed with their parents on three points: age, maturity and communication skills. Significantly, children identified that "feeling at ease" (Taylor *et al.*, 2010, p. 680) was essential if they were to contribute to the conversation.

The child's ability to communicate therefore depends on parents and health professionals who have the power to enable (or limit) their involvement. Appraising a child's communication potential based on factors such as age, cognitive development or verbalisation skills diminishes the validity of that child's contribution and may unfairly and unnecessarily restrict their involvement in treatment. Moreover, the effect of being overweight and its potential to affect the child's confidence to enter the adult conversation may further deter child participation in treatment. Access to suitable

information, such as the decision aids developed for adults (NHS, 2014a), may offer the scaffolding needed to facilitate this child-centred care (Charnock, 1998).

## **1.6 Resources to support child participation in weight management appointments**

Treatment strategies are more likely to be successful if they engage the target audience (Murtagh *et al.*, 2006). If the child is interested in the intervention, and it holds their attention, they are more likely to participate. Gabe *et al.* (2004) pointed out that the power differentials in a consultation should ideally be addressed, empowering the child to be included in the adult conversation. Using a communication tool is a potential solution (Coyne and Gallagher, 2011).

### **1.6.1 Visual aids as scaffolding for child communication**

Research suggests that health-related verbal and written communication to children has been poor (Boylan, 2004; Murtagh *et al.*, 2006; Runeson *et al.*, 2007; Savage and Callery, 2007).

Information should not only be made available, it should also be made accessible. In a study of the paediatric treatment of cystic fibrosis in 6 to 14 year olds (n=32) (Savage and Callery, 2007), clinicians failed to frame the information in a way that would have been meaningful to the child. The way the information is presented

must also be suited to the child's age and circumstances, in other words, what they already know and what they are able to understand (Alderson and Montgomery, 1996). Good communication of nutrition messages should be "relevant, realistic, meaningful and practical" (Buttriss, 1997, p. s1994). Contento (1981) clarified this by proposing "carefully designed, activity-based teaching strategies" that

"...include information and experiences from the real world which will help children distinguish between which foods and snacks to eat and which ones to avoid." (Contento, 1981, p. s90)

Appropriately and sensitively designed resources can serve as scaffolding (Vygotsky, 1978) that can enhance child understanding and provide an opportunity to become an active participant in discussions about treatment (Rushforth, 1999). Numerous recommendations have been made as to the nature of these resources (Alderson and Montgomery, 1996; Runeson *et al.*, 2007), all of which aim to involve children and families in more effective health communication and learning. Alderson and Montgomery (1996) proposed using books, dolls and puppets to discuss information simply and clearly. Runeson *et al.* (2007), on the other hand, recommended electronic media in the form of videos and online information. Without proper research and child engagement, however, there is a danger that technological advances could continue to produce media that is no more effective than traditional

resources at enabling children to participate in their treatment (user involvement is discussed further in Chapter Four).

### **1.6.2 Technology as a communication aid for CWM**

Clark and Mayer (2008a) assert that individuals are more likely to grasp concepts when they are active participants, which involves making sense of the information and integrating it into their existing understanding. Learning can be enhanced through the use of multimedia elements. Known as the multimedia principle:

“...adding graphics to words can be a powerful way to help learners *[to]* engage in active learning.” (Clark and Mayer, 2008a, p. 79)

Holzheimer, Mohay and Masters (1998) tested this principle when they compared the efficacy of several forms of educational presentations with 80 young children (aged two to five years). They found the picture book more effective than video when communicating messages about asthma, explained by the self-pacing nature of the written text. The book format also allowed parents to direct the child’s attention to specific areas of knowledge that may have been lacking, talk through relevant information and reinforce messages over time. However, using video alongside the book enabled children to acquire asthma-related knowledge quicker (Holzheimer *et al.* 1998). The value of controlled pace of interaction and discussion, was enhanced by adding a different dimension: moving pictures alongside words.

In their work, Clark and Mayer (2008a) suggest that combining images with written or spoken words is particularly helpful for those with less knowledge in a domain (such as a child acquiring new health-related information). Experts in a field are usually able to create their own mental images of the words they read or hear (Clark and Mayer, 2008a).

The multimedia principle has been applied to various health conditions, confirming some benefit to child-patient care (Irvine *et al.*, 2004, Kroeze *et al.*, 2006, Baranowski *et al.*, 2008), demonstrating increased knowledge and improved self-efficacy (Murray *et al.*, 2009). Many of these interventions take the form of interactive animated games (McPherson *et al.*, 2002; Baranowski *et al.*, 2003a; Cullen *et al.*, 2005; Lu *et al.*, 2012), that may integrate video images (Irvine *et al.*, 2004), and require the child to work through various scenarios that model healthy behaviour changes in the hope that virtual decisions eventually translate into lifestyle choices. More recently, exergaming, or active video gaming, have been introduced (Christison and Khan, 2012), requiring immediate physical involvement from the child to improve activity levels. These various different multimedia formats may exist as standalone applications (Irvine *et al.*, 2004; McPherson *et al.*, 2006), or can be designed to support more comprehensive face-to-face interventions (Baranowski *et al.*, 2003a).

Rather than studying ways of using technology to reinforce face-to-face decisions that have taken place in another setting, the purpose of this thesis is to further explore the multimedia principle as an adjunct to face-to-face care, translating paper-based visual aids into interactive electronic animations and using the visual references to provide context to the words spoken by the health professional. In 1999, Dijkstra and De Vries discovered that technology allowed for the tailoring of information, and suggested that technology could deliver material to mimic that of the clinician. Furthermore, Mohr *et al.* (2011) argued that human support can enhance adherence to eHealth interventions. It is evident that interactive electronic animations could be used alongside face-to-face encounters to strengthen treatment discussions that take place with the child.

Such electronic resources (e-resources) with multimedia content have an added entertainment value, with potential to engage the child in treatment (Ngo-Metzger *et al.*, 2010; Skelton and Beech, 2011). Improved information exchanges and more meaningful involvement in treatment discussions could encourage active child-centred participation.

## **1.7 Background to digital health**

eHealth is a widely used term that has been used to describe the convergence of health and technology (Oh *et al.*, 2005). The WHO defines eHealth as:



“...the use of information and communication technologies for health” (WHO, 2016b)

By definition, mobile health (or mHealth) technology is a branch of eHealth in which healthcare delivery is “supported by mobile devices, such as mobile phones” (WHO, 2011, p. 6) and tablet devices. An app is widely understood to be a software application designed for use on small mobile computing devices such as smartphones and tablets.

The original vision for how information technology (IT) could improve the way clinicians work in the NHS (Burns, 1998) was as a cost-effective investment that would improve the efficiency of the health service. Integrated systems such as electronic patient records and an online NHS booking service have improved administration (Liddell *et al.*, 2008) but more recently, the focus of eHealth has turned to improvements in quality of care and the patient experience (NHS, 2014a). Patient access to information and shared decision-making with the clinician (NHS, 2014b) is becoming an increasing priority.

eHealth is one of the most rapidly developing fields in healthcare (WHO, 2016b) and health app development, in particular, is thriving. Several papers have sought to review apps developed for CWM (Schoffman *et al.*, 2013; Brannon and Cushing, 2015; Burrows *et al.*, 2015). Few CWM apps used expert-recommended strategies or behavioural targets (such as to reduce sugar-sweetened

beverages and to eat breakfast everyday) (Barlow, 2007) in their approach to promote healthy eating and physical activity. Schoffman *et al.* (2013) identified 57 apps for the assessment, prevention and treatment of childhood obesity. Of the 15 expert-recommended strategies and behavioural targets identified by the authors, the mean(SD) number found in each app was 1.1(1.6). More than half (n=35) of the apps did not make use of any of these strategies or targets and only six combined a healthy eating and physical activity approach. None supported motivational interviewing techniques (Chapter Four). Brannon and Cushing (2015) advocated that commercially available apps should pay attention to clinical guidelines and effective behaviour change techniques. If they are designed to support clinical recommendations and approaches, they are more likely to be used by health professionals. Efficacy of these apps could then be explored as either standalone or adjunctive behaviour change interventions.

Health-related apps and e-resources, that fall under the eHealth umbrella, have sought to provide complementary patient care that reduces face-to-face time with the clinician. Examples include telemedicine, or remote diagnosis and/or treatment of patients using IT, and text messaging. A recent review for CWM (Smith *et al.*, 2013) suggested that eHealth used in this way may improve access to obesity treatment but has shown little or no impact on health outcomes – behaviour change and BMI. They propose that

more interactive eHealth interventions, may enhance the clinical effectiveness of eHealth in CWM. This thesis is one of the first to explore the potential of an e-resource as a within-appointment adjunct to a face-to-face behaviour change approach to dietetic care, to enhance (rather than replace) preadolescent overweight child-dietitian treatment conversations, and in so doing improve the quality of patient-centred care.

Ambitiously large eHealth projects like the national electronic records programme have been fraught with costly delays, overspend and even abandonment (DoH, 2010). The emphasis has shifted to smaller, more locally relevant solutions (NHS, 2014b). This may in part be due to the inherent need for eHealth to reflect clinicians' existing working practices, that may differ from one area to another. van der Vaart *et al.* (2016) explored the use of online patient self-management tools, often based on cognitive behavioural therapy principles, amongst mental health counsellors and primary care psychologists (n=771) in the Netherlands. Clinicians in their study stated that they were more likely, and able, to integrate an e-resource into their practice if the intervention matched their current way of working. Design of the *Feed-back* e-resource seeks to match current dietetic approaches to CWM.

## **1.8 Summary**

With the number of very overweight 11 year olds in England rising, efforts are needed to improve treatment for overweight 7 to 11 year olds, in order to prevent obesity in adolescence and to protect mental health. There is a case to empower children to ask questions and to be included more in healthcare decisions, alongside a growing body of evidence to suggest that a child-centred approach to weight management interventions may improve treatment outcomes. With appropriate guidance and support, the preadolescent child may be able to better understand their weight-related problem and factors that may have contributed to weight gain, and even play a role in finding solutions.

Combining multimedia elements with the text and audio may help to engage children in active learning and several studies have confirmed that this multimedia principle can benefit child-patient care in terms of knowledge and self-efficacy. It is also known that eHealth benefits from human intervention but it is unclear whether these types of e-resources have been used as scaffolding for child communication and whether they can support treatment-related discussions with healthcare professionals about long-term conditions (such as childhood overweight). In this thesis, the systematic review will seek to identify how multimedia technology has been used to support face-to-face communication within the healthcare setting and, specifically, its impact on child communication.

The findings of the systematic used will be used to inform the development of a prototype e-resource that seeks to support child-dietitian communication within the appointment setting. Before development begins, the views of dietitians and dietetic assistants (working in CWM) will be sought. The role of the dietetic assistant is varied. All assistants are supervised by the dietitian and carry out specific duties, according to their training and expertise (BDA, 2012). These duties may include CWM treatment interventions.

Following usability testing of the e-resource, a feasibility study will measure child and parent satisfaction with the e-resource when it is introduced into the dietetic weight management appointment. In the absence of existing instruments, the study will also develop measures for child communication that could be used in a larger randomised controlled trial to assess the effect of the e-resource on clinical outcomes.



## **Chapter Two: A systematic review of e-resource interventions to promote child communication with health professionals**

### **2.1 Introduction**

An important component of effective communication with the child about healthcare treatment choices is the provision of information that enables shared understanding. Information must be conveyed in a way that is clear and engaging, supporting both the health professional and enabling the child, and their family, to become competent partners in the consultation (Holzheimer *et al.*, 1998; Mikhailovich and Morrison, 2007).

Presentation of information must suit the child's existing knowledge and level of comprehension (Alderson and Montgomery, 1996).

Historically, health professionals have used leaflets (Krishna *et al.*, 2003; Redsell *et al.*, 2003; McPherson *et al.*, 2006), and some use diagrams and three-dimensional visual aids (Eckler, 1998).

Technology-based resources are also being explored. However, simply making information available does not necessarily make it accessible. Unfortunately, children do not always understand aspects of their treatment and have raised concerns over the way information is conveyed by health professionals in clinical settings (Boylan, 2004).

Information contained in traditional resources can be reorganised

within interactive multimedia in a variety of non-linear and interesting formats conducive to introducing a topic of conversation, or providing more detailed explanations. This might prove particularly useful to the health professional delivering information on a sensitive or complex topic, such as dietary and behaviour change discussions during child weight management (CWM) consultations. For many young children, the concept of energy balance and aspects of dietary management are beyond their cognitive capacity (Ward-Begnoche and Thompson, 2008). For their part, health professionals can misunderstand the child's priorities and therefore fail to frame information in a meaningful way (Savage and Callery, 2007). Greater child participation may be entirely feasible from about seven years of age, when children are cognitively more able to engage in conversations, particularly where there is structure and a concrete basis for discussion (Chapter One). A communication tool that uses interactive multimedia could act as scaffolding to facilitate these more complex and sensitive child-clinician conversations.

This review was undertaken to inform the development of an electronic resource (e-resource) to communicate within the context of weight management consultations with preadolescent children (Chapter Four). The target age range for the proposed e-resource and the systematic review was 7 to 11 years. This review aimed to evaluate the impact of e-resources, delivering health information to children in a clinical context, on the quality of child-clinician



communication. Although diet-related communication was of particular interest, communication about all health conditions was considered. A secondary objective was to evaluate the effectiveness of e-resources to improve satisfaction and indicators of self-management including knowledge, self-efficacy, healthcare utilisation, behaviour change and health outcomes.

## **2.2 Methods**

### ***2.2.1 Inclusion criteria***

This systematic review included papers that evaluated the effectiveness of e-resources used in a clinical context to provide information about a health condition and/or treatment. For the purpose of this review, e-resources refer to educational multimedia software using images, animation and sound to engage the user (Najjar, 1996). Papers were considered if at least one child participant was between 7 and 11 years old at commencement of the study. Child-participants were required to have a medical diagnosis (such as overweight, asthma, diabetes, cystic fibrosis or cancer). Studies where child-patients were recruited from active clinical treatment lists were included (in order to increase the likelihood of face-to-face child-clinician communication at the time of the study), while those identified through discharge records or schools, and not explicitly in receipt of on-going treatment or monitoring of the medical condition in question at the time of the study, were excluded. Only studies with both an intervention and a

comparison group were retained; these included clinical trials, randomised controlled trials, and prospective studies.

There was no restriction on the setting within which the intervention was delivered. Interventions that took place within the community, at a healthcare setting (general practitioner (GP) surgery, community clinic or hospital), at a school or in the child's home were all eligible.

Studies had to report one or more of the following primary or secondary outcome measures to be included in the review. Of primary concern was the effect of the e-resource, if any, on the quantity and quality of face-to-face communication between health professional and child, and level of child-engagement in treatment. Attrition rates (appointment non-attendance and dropout rates) were therefore analysed. Stakeholders' satisfaction and views of the intervention were also considered. Other secondary outcomes were measures of health change. They included a wide range of possible treatment outcomes: knowledge acquisition, changes in self-efficacy, attitude to health or motivation to make the desired health change, changes in health outcomes or symptoms, and a reduction in emergency appointments or hospitalisation.

### ***2.2.2 Search strategy***

The literature search to identify studies for inclusion was conducted during the third week of April 2012. The search strategy was

designed to capture published research, grey literature and on-going or recently completed clinical trials.

Several papers (Murray *et al.*, 2009; Gentles *et al.*, 2010; Lau *et al.*, 2011) discussing interactive health communication interventions were used to generate an initial list of thesaurus and text word search terms that was then tailored to the scope of the systematic review. The search approach combined terms relating to four search sets: health communication; multimedia or interactive technology; paediatrics; and diet, health behaviour change or education. To begin with, search terms were developed in MEDLINE (Appendix 8) as it offered a comprehensive thesaurus. The search strategy was then tailored to each database by adapting search syntax and terms, and identifying appropriate field codes. An extensive list of free text words with wild-card truncations supplemented the subject headings to further enhance the sensitivity of the search strategy. A validated methodology filter (Greenhalgh, 1997), designed to capture clinical trials, randomised controlled trials and prospective studies was added as a fourth search set. Several databases (OpenGrey, the International Standard Randomised Controlled Trial Number (ISRCTN) Register and the National Research Register (NRR) Archive) did not allow for a sophisticated set-based search strategy. Line-by-line searching was necessary in these cases.

The final searches were run on all 12 databases. Two of these (SciVerse SCOPUS and Reuters Web of Knowledge) yielded more than 500 papers each. In both cases, research categories on the search results page were used to further limit the searches. Tick boxes to exclude research areas deemed unrelated to the scope of the review (such as engineering, chemical engineering and mathematics), were selected. As a relatively new field of research, studies dating from before 1990 were not considered. No language filter was applied.

Having identified potentially relevant papers through database searches, the search results were collated and duplicates removed. The search strategy involved a further four stages. At each stage, citations were evaluated against an exclusion hierarchy that is listed in (Table 3). Where a definitive decision could not be made, the citation was retained and carried through to the next stage of the search process. The two research supervisors (C.G. and H.W.) checked the final stage of the search strategy for accuracy.

### ***2.2.3 Data extraction***

Data from the included studies were extracted by the researcher (C.R.), and synthesised into a database developed for the review. An overall lack of robust studies and heterogeneity precluded the amalgamation of data into a meta-analysis. Data were therefore summarised qualitatively and checked by two supervisors (C.G. and H.W.).

**Table 3. Exclusion hierarchy<sup>1</sup> for elimination of full text papers at Stage 5 of the systematic search process (Figure 1)**

Exclusion criterion	No. of studies	and references
No children 7 to 11 years	0 <sup>2</sup>	
No interactive e-resource	3	Bloomfield <i>et al.</i> , (1990); Guendelman <i>et al.</i> , (2004); Graue <i>et al.</i> , (2005)
Not recruited from active clinical treatment lists	11	Shegog <i>et al.</i> , (2001); Baranowski <i>et al.</i> , (2003b); Huss <i>et al.</i> , (2003); Cullen <i>et al.</i> , (2005); Frenn <i>et al.</i> , (2005); Goran and Reynolds (2005); Williamson <i>et al.</i> , (2005); Thompson <i>et al.</i> , (2007); Thompson <i>et al.</i> , (2008); Maddison <i>et al.</i> , (2009); Baranowski <i>et al.</i> , (2011a)
Participants have no diagnosed health condition	2	Patrick <i>et al.</i> , (2001); Baranowski <i>et al.</i> , (2003a)
No comparison group	8	Petersen (1996); Evans <i>et al.</i> , (1998); McPherson <i>et al.</i> , (2002); Ritterband <i>et al.</i> , (2006); Ritterband <i>et al.</i> , (2008); Marciel <i>et al.</i> , (2010); Wylie-Rosett <i>et al.</i> , (2010); Christison and Khan (2012)
Descriptive paper, not an intervention study	5	Engvall (1994); Morse <i>et al.</i> , (1997); Baranowski <i>et al.</i> , (2010); Thompson <i>et al.</i> , (2010); Baranowski <i>et al.</i> , (2011b)
Abstract/summary article	1	Fan <i>et al.</i> , (1996)

<sup>1</sup> Used throughout the search strategy, <sup>2</sup> papers not including participants from the specified age range were systematically excluded through Stages 1 to 4

#### **2.2.4 Quality appraisal**

The quality of the studies was determined by applying the risk of bias assessment outlined by Higgins and Altman (2008). Due to the behavioural nature of the studies and the type of interventions under investigation, it would have been virtually impossible for the researchers to eradicate all potential investigator bias in gathering their data. Strategies to limit such bias – blinding or masking – are important considerations even for behavioural studies, and are recommended in the CONSORT Statement (Moher *et al.*, 2010, p. 11). However, in recognition of the inherent difficulty facing

researchers in this area, data pertaining to other study quality features were also analysed.

The design and development of the e-resource is inextricably linked to the success of the intervention as a whole. Tools exist to evaluate internet-based interventions (Ritterband *et al.*, 2009; Proudfoot *et al.*, 2011), and e-learning resources (Leacock and Nesbit, 2007). Some are specifically directed at children's computer games (Baauw *et al.*, 2005) and child e-learning applications (Alsumait and Al-Osaimi, 2010). These guidelines recommend the assessment of a number of attributes, including: screen appearance (such as colour, design, and content); interactivity; appeal; motivation; engagement; as well as the pedagogical appropriateness of these elements. Nevertheless, such tools could not be applied to the e-resources in this review, largely because so few were available for this type of evaluation. Four quality features that could be applied to the included e-resources, were extracted from a variety of sources. The relevant features were; the evidence base and/or theoretical underpinning of the e-resource design (Eng *et al.*, 1999; Proudfoot *et al.*, 2011), e-resource piloting or testing prior to study commencement (Robinson *et al.*, 1998), ensuring that the tool matched the developmental age of the children recruited to the study (Eng *et al.*, 1999; Ngo-Metzger *et al.*, 2010; Proudfoot *et al.*, 2011), and the time study participants had (during the research period) to explore and familiarise themselves with the content of the

e-resource. Table 4 expands on each quality and defines the scoring criteria.

## **2.3 Results**

### **2.3.1 Studies retrieved**

The database search produced 2409 citations. After removing duplicates for published papers, 1536 titles and abstracts were screened for relevance. Main reasons for exclusion were:

- Age: participants fell beyond the target 7 to 11 year age group (such as studies with exclusively preschool, adolescent or adult subjects);
- No diagnosed health condition;
- Participants not recruited from active clinical treatment lists;
- No comparison or control group

Figure 1 details the five stages used to identify the citations for this review. Of the 16 papers selected, five (Eckler, 1998; Homer *et al.*, 2000; Hazzard *et al.*, 2002; Redsell *et al.*, 2003; McPherson *et al.*, 2006) came from Stages 1 and 2, six (Brown *et al.*, 1997; Bartholomew *et al.*, 2000; Dragone *et al.*, 2002; Krishna *et al.*, 2003; Ritterband *et al.*, 2003; Bartholomew *et al.*, 2006) were identified at Stage 3 and a further five (Davis *et al.*, 2004; Connelly *et al.*, 2006; Runge *et al.*, 2006) (two of which (Krishna *et al.*, 2000; Krishna *et al.*, 2006) document all or part of a study already added at Stage 3) were found in Stage 4. In other words,

approximately one-third of papers were found through database searches; the remaining papers emerged through reference lists and as citing papers.

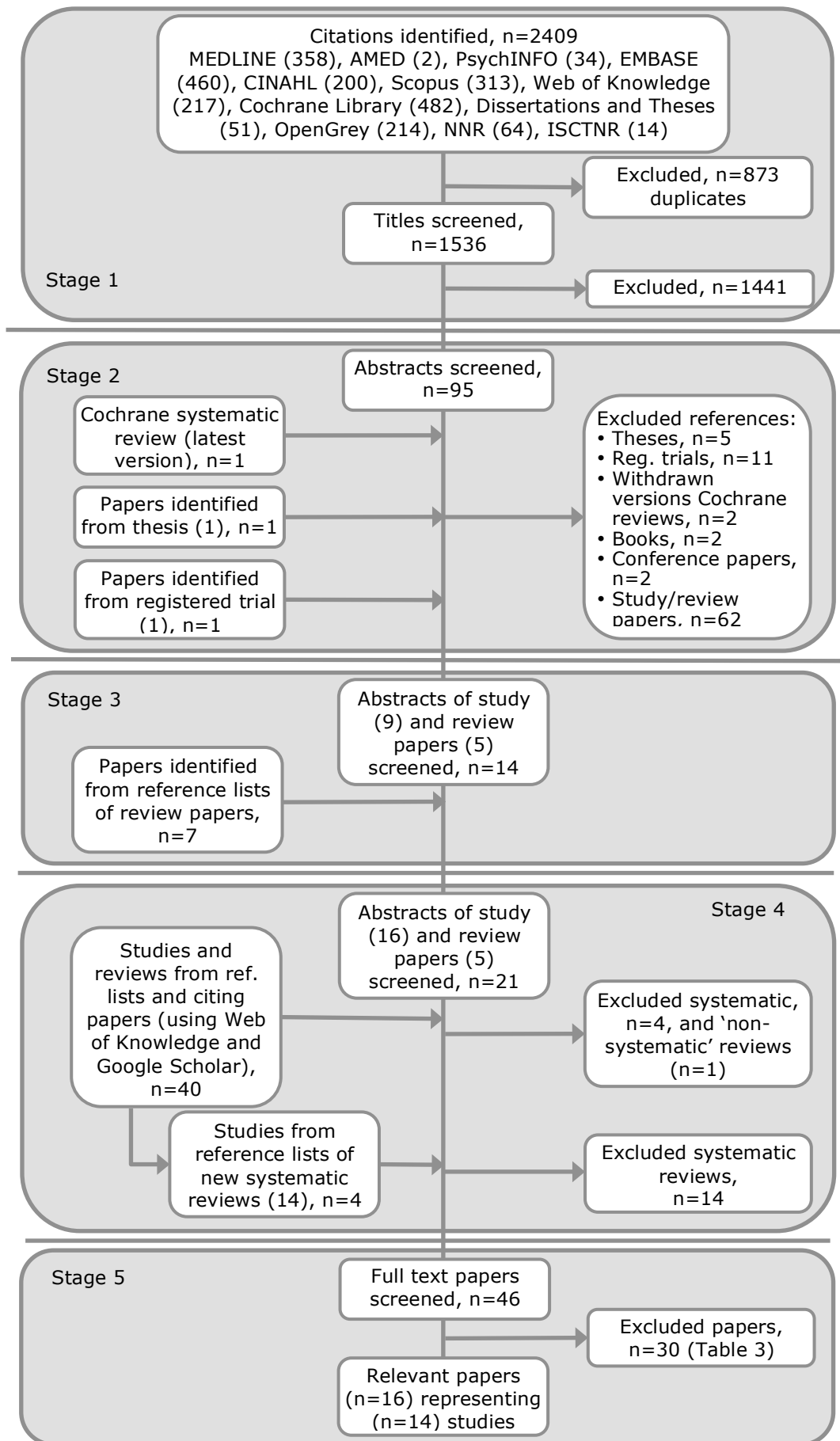
### **2.3.2 Study characteristics**

All of the 14 included studies were randomised controlled trials, with the exception of one (Runge *et al.*, 2006) that was non-randomised. Most of the studies were from the United States, with only three from Europe; two originated from the United Kingdom (Redsell *et al.*, 2003; McPherson *et al.*, 2006) and one from Germany (Runge *et al.*, 2006). Ethnic groupings of study participants were poorly reported in five papers (Brown *et al.*, 1997; Eckler, 1998; Redsell *et al.*, 2003; Davis *et al.*, 2004; Runge *et al.*, 2006). Of the eight studies that provided a breakdown of the ethnic origin of participants, most children were classed as white (Krishna *et al.*, 2003; Ritterband *et al.*, 2003; McPherson *et al.*, 2006) or 'Caucasian' (Dragone *et al.*, 2002; Connelly *et al.*, 2006).



**Table 4. Systematic review study quality coding criteria**

Category	Quality item	Scoring criteria
E-resource development	Evidence-basis and theoretical underpinning of intervention design	<p>Was the e-resource developed according to cited evidence-based guidelines related to the health condition? And/or was mention made of theoretical constructs used in the development of the e-resource?</p> <ul style="list-style-type: none"> <li>• If either or both of these aspects were mentioned, the quality is coded <i>YES</i>, otherwise it is <i>NO</i></li> <li>• <i>PARTIAL YES</i> (<math>\frac{1}{2}</math>) is given to interventions that only invite health professionals to be involved in the design and/or development, i.e. no reference to clinical guidelines or theoretical underpinning</li> </ul>
E-resource development	Intervention piloting/testing prior to study commencement	<p>Was the e-resource piloted during or after the development phase with children of the appropriate age range? Was the e-resource developed, and then piloted, for children of a specified age range, prior to undertaking the study?</p> <ul style="list-style-type: none"> <li>• The quality is coded <i>YES</i> if piloting, or iterative child involvement, has been integral to the e-resource design and/or development or post development piloting has taken place that may have led to amendments</li> <li>• Where piloting or testing has been mentioned, without details about the rigour of the process (e.g. age of children, number of children involved, outcome of the piloting process, etc.), the quality is coded <i>PARTIAL YES</i> (<math>\frac{1}{2}</math>)</li> <li>• The quality is coded <i>NO</i> if no mention is made of child involvement during development, piloting or testing</li> </ul>
Study design	Appropriately selected age ranges for potential research participants	<p>If the e-resource was piloted or developed in conjunction with children, are study subjects of a similar age range? Could the e-resource design be appropriate for both the youngest and the oldest study subjects?</p> <ul style="list-style-type: none"> <li>• The quality is coded <i>YES</i> where the e-resource has been piloted or tested with children of a similar age to those recruited as study subjects, and the age range is <math>\leq 7</math> years</li> <li>• <i>YES</i> is also given to e-resources designed for a range of ages, e.g. different levels or difficulties, and study data have been analysed and presented within narrower age ranges</li> <li>• <i>PARTIAL YES</i> (<math>\frac{1}{2}</math>) is given to studies where the age range is 7 to 8 years, and the above conditions have not been met</li> <li>• The quality is coded <i>NO</i> if piloting of the e-resource took place with a different age group of children to those recruited to the study, without valid reason or explanation, or the age range of study participants was <math>&gt;8</math> years with no stated strategy to deal with differences in developmental abilities</li> </ul>
Data collection	Amount of time children viewed the e-resource	<p>How much time did children have to familiarise themselves with the content of the e-resource? Was the number of sessions reported? Was the length of these sessions stated?</p> <ul style="list-style-type: none"> <li>• In order to be coded <i>YES</i>, the paper must indicate (even if a calculated estimate) the amount of time children spent using the intervention. This may be stated as a total time, or length of time for each session</li> <li>• A <i>PARTIAL YES</i> (<math>\frac{1}{2}</math>) is given if the total number of sessions is stated, with no indication of time spent viewing the e-resource</li> <li>• The quality is coded <i>NO</i> if no data, data is unclear, or only partial data is provided (e.g. length of first session but not subsequent sessions)</li> </ul>



**Figure 1. Systematic review search strategy**

None of the studies aimed to recruit overweight or obese children, but three studies featured health conditions with a dietary element; type 1 diabetes (Brown *et al.*, 1997), cystic fibrosis (Davis *et al.*, 2004), and encopresis (Ritterband *et al.*, 2003). In each of these, dietary information was a component of the communicated message but not reported as a specific health outcome. Asthma was the focus of six studies (Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Krishna *et al.*, 2003; Bartholomew *et al.*, 2006; McPherson *et al.*, 2006; Runge *et al.*, 2006), with one paper investigating both asthma and sickle cell disease (Hazzard *et al.*, 2002). Other conditions included; non-malignant recurrent headache (Connelly *et al.*, 2006), leukemia (in remission) (Dragone *et al.*, 2002), nocturnal enuresis (Redsell *et al.*, 2003), and dental malocclusion (Eckler, 1998). The study characteristics, summarised in Table 5, reflect the diversity of the studies themselves.

### **2.3.3 Risk of bias**

The risk of bias in a number of the included studies was either 'unclear' or 'high risk'. Three exceptions to this generalisation were Davis *et al.* (2004), Connelly *et al.* (2006) and McPherson *et al.* (2006) that presented a comparatively low risk of bias. Figure 2 shows the relatively high risk of attrition bias, reporting bias, and 'other bias'.

Sequence generation proved inadequate in several studies; one used children's medical record numbers (Krishna *et al.*, 2003), two others randomised according to period of hospital admission (Hazzard *et al.*, 2002) and clinic allocation (Redsell *et al.*, 2003), and one allowed children (and parents) to self-select either the intervention or comparison group (Runge *et al.*, 2006). As would be expected, studies that demonstrated a potential risk of bias in ensuring random sequence generation, posed a similar risk of lack of allocation concealment (Eckler, 1998; Hazzard *et al.*, 2002; Redsell *et al.*, 2003; Runge *et al.*, 2006).

In addition to the relative risk of bias in how study subjects were assigned to either the comparison or intervention group, some studies (Eckler, 1998; Bartholomew *et al.*, 2000; Krishna *et al.*, 2003) lacked rigour, and balance in their data reporting and discussion. One paper made unfounded deductions about findings, concluding that children in the intervention group

“...experienced significantly improved communication with parents about diabetes” (Brown *et al.*, 1997, p. 87)

without acknowledging that the measure for this outcome data was biased. Another (Runge *et al.*, 2006) failed to adequately explain why 45% (n=66) participants in the intervention group did not use the e-resource. This study also deviated from the original protocol, transferring children allocated to the intervention group to the comparison group.

Study	Randomisation bias	Allocation bias	Performance bias	Attrition bias	Reporting bias	Other bias
Brown <i>et al.</i> (1997)	?	?	-	?	-	+
Eckler (1998)	?	?	+	-	-	-
Redsell <i>et al.</i> (2003)	-	-	?	-	+	-
Dragone <i>et al.</i> (2002)	?	?	+	-	+	+
Bartholomew <i>et al.</i> (2000)	?	?	?	-	-	-
Bartholomew <i>et al.</i> (2006)	?	?	?	-	?	?
Homer <i>et al.</i> (2000)	+	+	?	-	?	-
Krishna <i>et al.</i> (2003)	-	?	?	-	-	-
McPherson <i>et al.</i> (2006)	+	+	?	+	+	+
Runge <i>et al.</i> (2006)	-	-	-	-	-	-
Hazzard <i>et al.</i> (2002)	-	-	?	-	?	-
Davis <i>et al.</i> (2004)	+	+	+	+	+	+
Ritterband <i>et al.</i> (2003)	?	?	?	-	-	+
Connelly <i>et al.</i> (2006)	+	+	+	+	+	+

+ Criterion met – low risk of bias      ? Evidence unclear      - Criterion not met – high risk of bias

**Figure 2. Individual risk of bias ratings for studies included in the systematic review**

The 'other bias' varies from a potential conflict of interest (Runge *et al.*, 2006) to lack of clarity on study protocol such as the number of the different leaflets distributed to comparison group participants (Redsell *et al.*, 2003), possible treatment bias (with intervention group children having more appointments (Bartholomew *et al.*, 2000)) the time of year children were recruited to the intervention and comparison groups, and whether there was any seasonal effect on the chronic health conditions under investigation (Hazzard *et al.*, 2002). One study (Krishna *et al.*, 2003) published some of the results in a second paper (Krishna *et al.*, 2006) using different age groups and slightly altered descriptors of user satisfaction questions.

At their outset, most of the included studies were underpowered (Brown *et al.*, 1997; Dragone *et al.*, 2002; Hazzard *et al.*, 2002; Ritterband *et al.*, 2003; Davis *et al.*, 2004; Connelly *et al.*, 2006; McPherson *et al.*, 2006) and could more accurately be described as feasibility studies. Two studies reported a sample size calculation. In the first of these, Krishna *et al.* (2003) had a 22% completion rate, which translated into one quarter of the calculated desired number of children completing the 12 month study. The second, a study by Redsell *et al.* (2003), had better retention figures (92% of the intervention and 87% of the comparison group) at discharge (not stated, but estimated to be at approximately six months). At the six-month post-discharge follow-up however, data for only 24%

and 31% of the intervention and comparison group, respectively, were available.

Studies with more than the conventionally accepted 20% study drop out rate (SIGN, 2011) were classed as high risk for attrition bias. Attrition rates in many of the studies were difficult to quantify; two studies (Brown *et al.*, 1997; Ritterband *et al.*, 2003) neglected to address children lost to follow-up and a further three papers (Bartholomew *et al.*, 2000; Dragone *et al.*, 2002; Hazzard *et al.*, 2002) provided insufficient detail on non-completers, the point at which children dropped out, whether they belonged to the intervention or comparison group and/or the reasons for their attrition. These three studies, together with Runge *et al.* (2006), Homer *et al.* (2000) and Eckler (1998) had relatively high drop out rates. The work by Bartholomew *et al.* (2006) could also be placed in this category, however their higher drop out numbers should be balanced with the fact that their study spanned three years.

The included papers are mostly unclear about the potential for performance bias. Several researchers took steps to limit subjective outcomes: interviewers in the study by Dragone *et al.* (2002) were taught to avoid biasing subjective outcomes during training sessions, neurologists in the paper by Connelly *et al.* (2006) were blinded to the child's group allocation, and interim phone contacts (relating to medical issues) were handled by nursing staff not directly affiliated with the research. A number of papers

(Brown *et al.*, 1997; Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Redsell *et al.*, 2003; Ritterband *et al.*, 2003; Davis *et al.*, 2004; Bartholomew *et al.*, 2006; Runge *et al.*, 2006) overlooked the potential impact lack of blinding may have had on study outcomes.

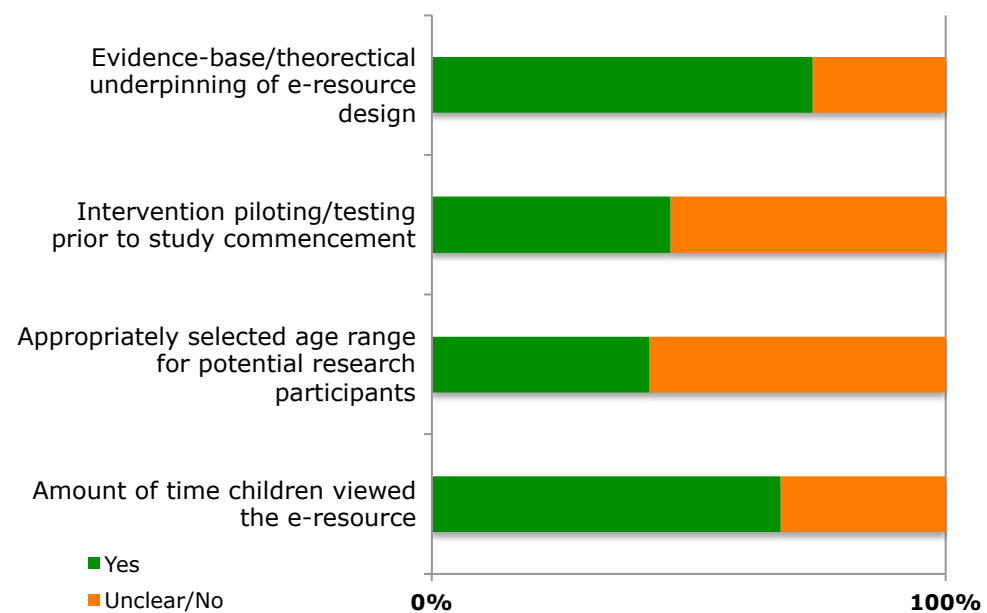
#### **2.3.4 Quality assessment**

Aside from the risk of bias, the quality of this type of research also relies on the design of the e-resource itself. Assessing the papers in this way enabled an important cross-referencing of the extent to which the evidence they hold was potentially valid. The results of the quality assessment, Table 4, confirmed the strength of the research by (Connelly *et al.*, 2006) and (McPherson *et al.*, 2006). However, it also rated 9 out of the 14 included studies as 'medium' quality, with Davis *et al.* (2004) the poorest of these. This study omitted details on the development and age-appropriateness of the *STARBRIGHT World* website (used in the research), raising questions over the suitability of the e-resource and therefore the validity of the study findings.

A number of the other papers struggled to demonstrate sufficient detail in these areas. Figure 3 combines the quality assessments for the included studies. The two main difficulties were: a lack of e-resource piloting or testing before undertaking the research, and the age range amongst the child participants. This second quality, the gap in age between the youngest and oldest study participants, is critical to the success of the study. Resources, and e-resources,



should be designed with a particular audience in mind (Ngo-Metzger *et al.*, 2010), aiming to appeal to the senses and cognitive ability of that age group (Ritterband *et al.*, 2009). Where the age gap of the recruited children is too wide, the e-resource cannot successfully engage all of the children in the study, having a potentially detrimental effect on study findings.



**Figure 3. Overall quality assessment summary of included studies (using the coding criteria outlined in Table 4)**

One of the more extreme examples of not achieving this quality indicator was found in an asthma study by Krishna *et al.* (2003), that included infants, toddlers, preadolescents, and teenagers. Children below the age of seven were deemed too young for the *Interactive Multimedia Program for Asthma Control (IMPACT)*, their parents effectively becoming the study participants and using the e-resource on the child's behalf. Those aged between 7 and 17 years used the same e-resource under similar conditions. It is unlikely

that a single e-resource would be appropriate, or indeed engaging, for such a wide age range. Disparities may include; visual presentation and design, use of language and text, navigation, and content presentation (Leacock and Nesbit, 2007; Ngo-Metzger *et al.*, 2010). Aspects of an e-resource that appeals to the child may not necessarily hold the attention of the parent. For example:

"We had anticipated that parents of younger children with asthma would actually use the program themselves, but we found that the program did not consistently engage parents – except the more didactic video elements" (Homer *et al.*, 2000, p. 214)

which children found interfered with the game aspects of the e-resource. Several others (Eckler, 1998; Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Hazzard *et al.*, 2002; Redsell *et al.*, 2003; Runge *et al.*, 2006) chose to recruit children of significant age differences (Figure 4); 9 to 12 years older than the youngest in the same study. Of these, Bartholomew *et al.* (2000) and Hazzard *et al.* (2002) took steps to account for the pedagogical needs of the more mature children by introducing alternative coaching character roles and more advanced levels within the e-resource, respectively. Dragone *et al.* (2002) demonstrated good quality e-resource design in their multi-levelled *Kidz with Leukemia: A Space Adventure*, ensuring that the differing presentation and information needs of the younger (four to six year olds) and older (7 to 11 year old) children were accommodated through extensive piloting.

Studies were generally better at their measurement of the time children spent using the e-resource, their reporting thereof, or both. Nevertheless, four (Bartholomew *et al.*, 2000; Dragone *et al.*, 2002; Redsell *et al.*, 2003; Bartholomew *et al.*, 2006) of the 14 studies failed to provide adequate detail. Of the studies that did provide data, two (Brown *et al.*, 1997; Krishna *et al.*, 2003) offered self-reported estimates of duration and frequency of use, with no apparent means of validating the data. Runge *et al.* (2006) used the time children were logged onto the server as the time they spent using the e-resource. Six studies demonstrated greater reliability in their data tracking methods through built in intervention monitoring (Hazzard *et al.*, 2002), researcher monitoring (Eckler, 1998, Homer *et al.*, 2000), and required activities and assignments (Ritterband *et al.*, 2003; Davis *et al.*, 2004; Connelly *et al.*, 2006).

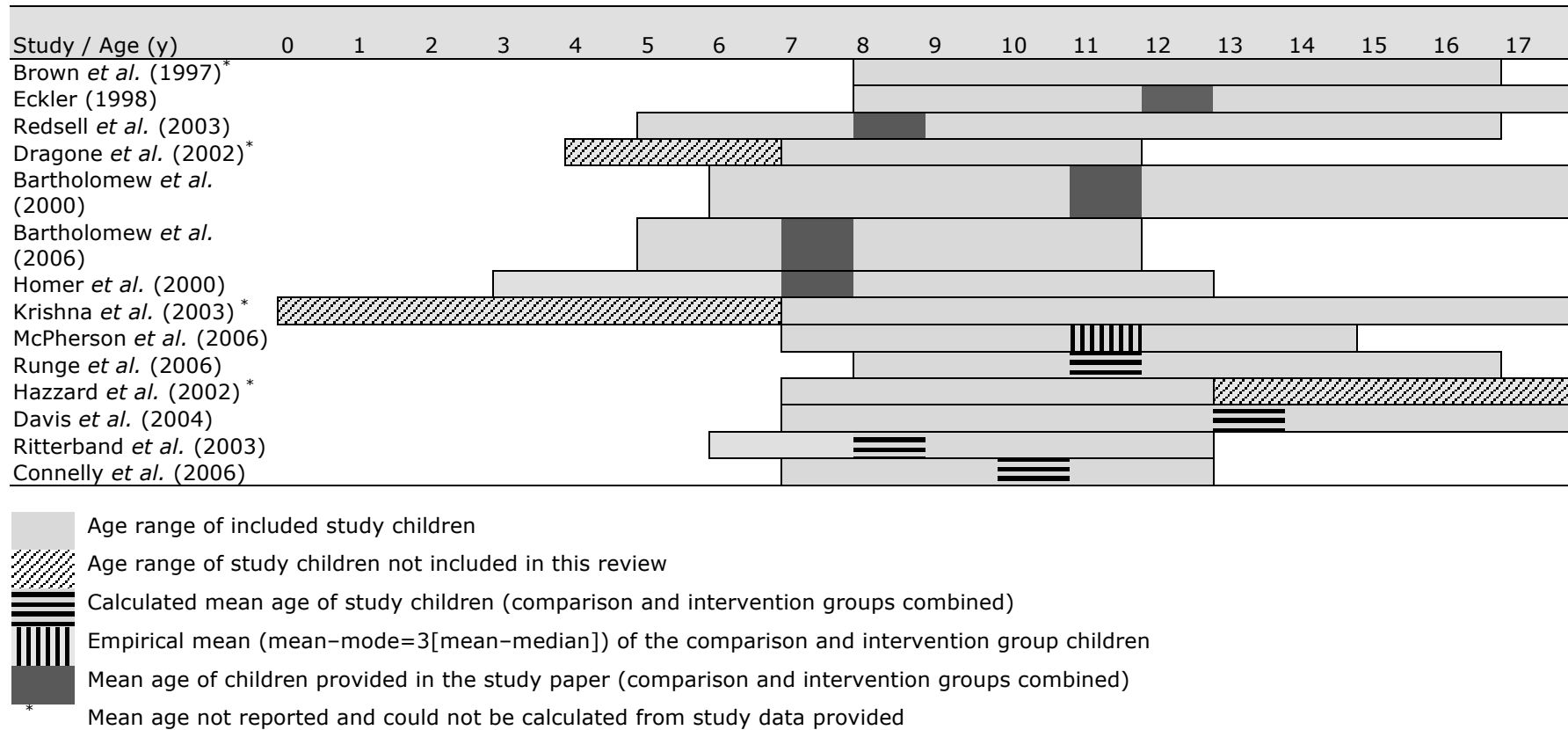
In evaluating its effect on knowledge, self-efficacy and health behaviour change, the time children are exposed to an e-resource has a bearing on the extent to which it had the opportunity to affect attitudes and motivation to change (Ritterband *et al.*, 2009; Proudfoot *et al.*, 2011). The ten studies that reported on this quality indicator differed significantly in the time children spent using the intervention, from less than 30 minutes to 34 hours).

### **2.3.5 Heterogeneity**

The included studies differed on many levels including: participant mean ages; the purpose and design of the e-resource; comparative intervention (such as leaflets, books, or non-health-related multimedia) used; setting and conditions under which children used the e-resource (Table 5), and the extent to which health professionals engaged in intervention delivery. These and other differences made comparing data and study outcomes difficult.

#### *2.3.5.1 Participant age*

While there was a wide age variation amongst study participants, several papers (Dragone *et al.*, 2002; Hazzard *et al.*, 2002; Krishna *et al.*, 2003) analysed data within narrower age groups. Data relating to the age category closest to, and incorporating 7 to 11 year olds, were selected for inclusion. Only two studies focussed on 7 to 11, or 7 to 12 year olds: either as the total study population (Connelly *et al.*, 2006), or analysed as a subgroup (Dragone *et al.*, 2002). Differing age ranges in turn affected the mean ages of recruited children.



**Figure 4. Age range and mean age of included study participants**

The ability to compare mean ages was compromised by a lack of data. With the exception of five studies (Eckler, 1998; Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Redsell *et al.*, 2003; Bartholomew *et al.*, 2006), papers failed to provide the mean age of recruited children. One paper reported the median age of the comparison and intervention group (McPherson *et al.*, 2006) instead of the mean. This study reported a significant age difference ( $p=0.012$ ) between the two groups. Five studies (Brown *et al.*, 1997; Dragone *et al.*, 2002; Hazzard *et al.*, 2002; Krishna *et al.*, 2003; Bartholomew *et al.*, 2006) offered no indication as to group similarity or differences in participants' mean ages. Where necessary, and feasible, the mean age of participants was calculated from study data (Ritterband *et al.*, 2003; Davis *et al.*, 2004; Connelly *et al.*, 2006; McPherson *et al.*, 2006; Runge *et al.*, 2006) (Figure 4). Within the ten studies, the mean age of children was  $10.11 \pm 2.13$  with the mean range from 7.40 to 13.05 years.

#### *2.3.5.2 E-resource intervention*

The heterogeneity evident in the age ranges of child participants was further apparent in the e-resources themselves (Table 5). Diversity existed on a number levels; including platform delivery (CD-ROM, web-based, etc.) and the setting in which child-participants accessed the e-resource (medical settings, school, home, etc.).

**Table 5. Intervention and comparison group characteristics of included studies**

Criterion	Category	No. of studies	and references
E-resource type	Nintendo® game console	1	Brown <i>et al.</i> (1997)
	CD-ROM	9	Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Dragone <i>et al.</i> (2002), Redsell <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Bartholomew <i>et al.</i> (2006), Connelly <i>et al.</i> (2006), McPherson <i>et al.</i> (2006)
	Web-based	4	Hazzard <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Runge <i>et al.</i> (2006)
Intervention group <sup>1</sup>	Multimedia only	13	Brown <i>et al.</i> (1997), Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Redsell <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Bartholomew <i>et al.</i> (2006), Connelly <i>et al.</i> (2006), McPherson <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
	Multimedia and written information	1	Krishna <i>et al.</i> (2003)
Comparison group <sup>1</sup>	None <sup>&amp;*</sup>	7	Brown <i>et al.</i> (1997), Bartholomew <i>et al.</i> (2000), Hazzard <i>et al.</i> (2002), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Connelly <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
	Written information, e.g. leaflets <sup>*</sup>	5	Homer <i>et al.</i> (2000), Dragone <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Redsell <i>et al.</i> (2003), McPherson <i>et al.</i> (2006)
	Conventional aids, i.e. dental models, radiographs <sup>*</sup>	1	Eckler (1998)
	Not reported	1	Bartholomew <i>et al.</i> (2006)
Study setting	Outpatient clinic	6	Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Krishna <i>et al.</i> (2003), Redsell <i>et al.</i> (2003), Davis <i>et al.</i> (2004)
	During hospitalisation	1	Hazzard <i>et al.</i> (2002)
	At home	6	Brown <i>et al.</i> (1997), Dragone <i>et al.</i> (2002), Ritterband <i>et al.</i> (2003), Connelly <i>et al.</i> (2006), McPherson <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
	At school (school nurse office)	1	Bartholomew <i>et al.</i> (2006)

<sup>1</sup> In addition to verbal treatment, \* Eckler (1998), Redsell *et al.* (2003) and Runge *et al.* (2006) included more than one comparison group. Wait-list groups (receiving no treatment) were disregarded for the purpose of this review. Comparison group children in the study by Homer *et al.* (2000) were given an asthma book and played a non-health-related computer game, & Brown *et al.* (1997) provided a non-health-related Nintendo® game to children in the comparison group

**Table 5 cont. Intervention and comparison group characteristics of included studies**

Criterion	Category	No. of studies	and references
Time e-resource used	<60 min	2	Eckler (1998), Davis <i>et al.</i> (2004)
	1-2 h	4	Hazzard <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), McPherson <i>et al.</i> (2006)
	≥2 h	4	Brown <i>et al.</i> (1997), Homer <i>et al.</i> (2000), Connelly <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
	Unclear	2	Bartholomew <i>et al.</i> (2000), Dragone <i>et al.</i> (2002)
	Not reported	2	Redsell <i>et al.</i> (2003), Bartholomew <i>et al.</i> (2006)
Intervention length	<6 mth	7	Eckler (1998), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Redsell <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Connelly <i>et al.</i> (2006)
	≥6 mth	7	Brown <i>et al.</i> (1997), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Krishna <i>et al.</i> (2003), Bartholomew <i>et al.</i> (2006), McPherson <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
Follow-up (post-intervention)	None	10	Brown <i>et al.</i> (1997), Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), McPherson <i>et al.</i> (2006)
	<6 mth	1	Connelly <i>et al.</i> (2006)
	≥6 mth	3	Redsell <i>et al.</i> (2003), Bartholomew <i>et al.</i> (2006), Runge <i>et al.</i> (2006)

Min – minute(s)

H – hour(s)

Mth – month(s)



Perhaps the most obvious difference between the selected studies was what the e-resources were designed to achieve. Most of the interventions had either stated or implied aims of educating children about their health-related condition: and improving skills and confidence to manage symptoms, triggers and medication. Some e-resources (Brown *et al.*, 1997; Dragone *et al.*, 2002; Hazzard *et al.*, 2002; Runge *et al.*, 2006) had an additional dimension: to improve social support. *Kidz with Leukemia: A Space Adventure* provided a short video clip on "*siblings views on leukemia*" (Dragone *et al.*, 2002, p. 299). *Packy and Marlon* (Brown *et al.*, 1997) had a two player option, in which children needed to help one another to succeed in the game, encouraging children to communicate with others about their diabetes. The interventions used by Hazzard *et al.* (2002) and Runge *et al.* (2006) both offered chatroom facilities; Hazzard *et al.* featured video-conferencing, and Runge *et al.* enabled email contact with other children. Social networking and peer-to-peer communication opportunities may have affected study outcomes, such as self-efficacy and motivation to change, to a greater or lesser degree, thereby confounding the effect of the e-resources that relied solely on animation design elements.

Outcomes may also have been influenced by the extent to which health professionals were engaged in the e-resource. Clinicians were more involved in e-resource delivery in three studies (Eckler, 1998; Redsell *et al.*, 2003; Runge *et al.*, 2006), although clinicians were only consistently involved with each child (and their family) in

the Eckler (1998) study; orthodontists actively using the e-resource to deliver information within the consultation. In contrast, Redsell *et al.* (2003) mentions a 'passport' given to children to indicate the e-resource modules they had worked through and record comments for later discussion with the school nurse, but omits to report on whether this resulted in children and school nurses discussing the e-resource. Similarly, asthma experts (not the children's health professionals) in Runge *et al.* (2006) were available online for scheduled chatroom chats and via email but it is unclear the extent to which these facilities were used. In an attempt to prevent performance bias, two studies (Krishna *et al.*, 2003; Connelly *et al.*, 2006) aimed to avert child-clinician communication about the intervention through blinding. Bartholomew *et al.* (2000) and Bartholomew *et al.* (2006) actively encouraged physicians to become more involved in the care of children using the e-resource. Researchers encountered a general resistance to engaging with the e-resource; health professionals cited lack of time (Bartholomew *et al.*, 2006) and a mismatch between e-resource content and their institution's clinical procedures (Dragone *et al.*, 2002).

In addition to the e-resource, some studies provided further information to intervention group children. Children in nine of the included studies (Brown *et al.*, 1997; Eckler, 1998; Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Dragone *et al.*, 2002; Ritterband *et al.*, 2003; Davis *et al.*, 2004; Bartholomew *et al.*, 2006; McPherson *et al.*, 2006) were given the e-resource only. Others were given the

e-resource as well as education sessions (Runge *et al.*, 2006) or more frequent face-to-face consultations (Hazzard *et al.*, 2002; Redsell *et al.*, 2003; Connelly *et al.*, 2006). One study (Krishna *et al.*, 2003) provided written information as well as periodic contact with a health professional. Other papers failed to clarify whether or not health information was given to children in the comparison group (Bartholomew *et al.*, 2006) or what form this may have taken (Eckler, 1998). Inequality in study intervention approaches hinders comparison of results. One might argue that these anomalies could be accounted for by the choice of comparison treatment.

A number of e-resources (Eckler, 1998; Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Redsell *et al.*, 2003; Davis *et al.*, 2004; Krishna *et al.*, 2006) were designed for use at outpatient clinic settings. There was variation within these studies; one researcher demonstrated the e-resource (Eckler, 1998), others offered researcher assistance, as required (Homer *et al.*, 2000; Davis *et al.*, 2004), and another did not state the level of support available (Redsell *et al.*, 2003). Five-studies required children to work independently, at home (Brown *et al.*, 1997; Dragone *et al.*, 2002; Connelly *et al.*, 2006; McPherson *et al.*, 2006; Runge *et al.*, 2006). Again, not all had a similar experience; Connelly *et al.* (2006) posted the e-resource to the child's home, while McPherson *et al.* (2006) and Ritterband *et al.* (2003) visited children in their homes to offer initial support. Some children used the e-resource in the nurse's office at school (Bartholomew *et al.*, 2006) and others

during a period of hospitalisation (Hazzard *et al.*, 2002). The setting and level of researcher involvement will have affected children's experiences of the e-resource, particularly for younger or less confident children, thereby creating discrepancies between study findings.

#### *2.3.5.3 E-resource use, study duration and follow-up*

There were significant differences of e-resource use, both within and between studies. Some studies (Eckler, 1998; Redsell *et al.*, 2003; Connelly *et al.*, 2006) controlled the order in which interactive modules were viewed, or offered a limited time in which children were able to use the e-resource (Davis *et al.*, 2004). Other studies (Brown *et al.*, 1997; Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Dragone *et al.*, 2002; Hazzard *et al.*, 2002; Ritterband *et al.*, 2003; Runge *et al.*, 2006) allowed children freedom over how they chose to use the e-resource, if at all. Consequently, reported e-resource usage also varied greatly. Some children (Eckler, 1998; Davis *et al.*, 2004) had a total of 30 minutes or less, and others (Brown *et al.*, 1997) were reported to have used the interventions for up to 34 hours.

Study periods for half of the interventions were for less than six months; one (Eckler, 1998) was used within a half hour consultation, another (Hazzard *et al.*, 2002) spanned three days, while the majority of shorter studies were for three (Dragone *et al.*, 2002; Davis *et al.*, 2004) or four months (Redsell *et al.*, 2003). Of

those lasting six months or more, three (Brown *et al.*, 1997; McPherson *et al.*, 2006; Runge *et al.*, 2006) ended at six months, two (Krishna *et al.*, 2003; Bartholomew *et al.*, 2006) were for 12 months and one study (Bartholomew *et al.*, 2000) had a mean duration of 7.6 months, with participant involvement ranging from 4 to 15.6 months. Most (10 of the 14) studies had no follow-up period (Table 6). Connelly *et al.* (2006) tracked outcomes for three months post-intervention and two studies (Redsell *et al.*, 2003; Runge *et al.*, 2006) had a six-month follow-up period. One school-based study (Bartholomew *et al.*, 2006) continued to collect data for two years post-intervention.

Variations in intervention usage, study duration and follow-up period all would have influenced the opportunities children had to familiarise themselves with the e-resource content, and subsequently make behavioural changes.

**Table 6. Included systematic review study characteristics**

Criterion	Category	No. of studies	and references
Country	United States	11	Brown <i>et al.</i> (1997), Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Bartholomew <i>et al.</i> (2006), Connelly <i>et al.</i> (2006)
	United Kingdom	2	Redsell <i>et al.</i> (2003), McPherson <i>et al.</i> (2006)
	Germany	1	Runge <i>et al.</i> (2006)
Ethnic majority	White and 'Caucasian'	5	Dragone <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Connelly <i>et al.</i> (2006), McPherson <i>et al.</i> (2006)
	African-American	2	Bartholomew <i>et al.</i> (2000), Hazzard <i>et al.</i> (2002)
	Hispanic-American	2	Homer <i>et al.</i> (2000), Bartholomew <i>et al.</i> (2006)
	Not reported	5	Brown <i>et al.</i> (1997), Eckler (1998), Redsell <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Runge <i>et al.</i> (2006)
Health condition	Type 1 diabetes	1	Brown <i>et al.</i> (1997)
	Dental malocclusion	1	Eckler (1998)
	Leukemia (remission)	1	Dragone <i>et al.</i> (2002)
	Nocturnal enuresis	1	Redsell <i>et al.</i> (2003)
	Asthma	7	Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Hazzard <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Bartholomew <i>et al.</i> (2006), McPherson <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
	Cystic fibrosis	1	Davis <i>et al.</i> (2004)
	Encopresis	1	Ritterband <i>et al.</i> (2003)
	Sickle cell disease	1	Hazzard <i>et al.</i> (2002)
	Recurrent headache (non-malignant)	1	Connelly <i>et al.</i> (2006)
Sample size	Reported sample size calculation	3	Krishna <i>et al.</i> (2003), Redsell <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003)
	No sample size calculation; total participants n<120	6	Brown <i>et al.</i> (1997), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Davis <i>et al.</i> (2004), Connelly <i>et al.</i> (2006), McPherson <i>et al.</i> (2006)
	No sample size calculation; total participants n≥120	5	Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Bartholomew <i>et al.</i> (2006), Runge <i>et al.</i> (2006)

**Table 6 cont. Included systematic review study characteristics**

Criterion	Category	No. of studies	and references
Intervention length	<6 mth	7	Eckler (1998), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Redsell <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), Connelly <i>et al.</i> (2006)
	≥6 mth	7	Brown <i>et al.</i> (1997), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Krishna <i>et al.</i> (2003), Bartholomew <i>et al.</i> (2006), McPherson <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
Follow-up (post-intervention)	None	10	Brown <i>et al.</i> (1997), Eckler (1998), Bartholomew <i>et al.</i> (2000), Homer <i>et al.</i> (2000), Dragone <i>et al.</i> (2002), Hazzard <i>et al.</i> (2002), Krishna <i>et al.</i> (2003), Ritterband <i>et al.</i> (2003), Davis <i>et al.</i> (2004), McPherson <i>et al.</i> (2006)
	<6 mth	1	Connelly <i>et al.</i> (2006)
	≥6 mth	3	Redsell <i>et al.</i> (2003), Bartholomew <i>et al.</i> (2006), Runge <i>et al.</i> (2006)
Quality assessment ratings	0		
	½		
	1	1	Eckler (1998)
	1½	1	Davis <i>et al.</i> (2004)
	2	5	Brown <i>et al.</i> (1997), Bartholomew <i>et al.</i> (2000), Krishna <i>et al.</i> (2003), Redsell <i>et al.</i> (2003), Runge <i>et al.</i> (2006)
	2½	3	Homer <i>et al.</i> (2000), Hazzard <i>et al.</i> (2002), Ritterband <i>et al.</i> (2003)
	3	3	Dragone <i>et al.</i> (2002), Bartholomew <i>et al.</i> (2006), Connelly <i>et al.</i> (2006)
	3½	1	McPherson <i>et al.</i> (2006)
	4		

#### 2.3.5.4 Outcome measures

Prior to exploring the potential health outcomes, the measures used to determine these outcomes should be examined. Of the 14 included studies, all but two (Bartholomew *et al.*, 2000; Bartholomew *et al.*, 2006) use the same measures for knowledge acquisition, changes in self-efficacy and health outcomes. Dragone *et al.* (2002) and McPherson *et al.* (2006) derive their self-efficacy 'Health Locus of Control' measure from the same source (Table 7). Measures used to evaluate knowledge gain and differences in self-efficacy were validated prior to their use in most studies reporting these outcomes.

There was less certainty over the reliability of instruments used to measure changes in specified health conditions, or specific health symptoms such as HbA1c (glycated haemoglobin, an indicator of long term blood glucose control in diabetes) or FEV<sub>1</sub> (forced expiratory volume, used as a measure of lung function in asthma management). With the exception of Bartholomew *et al.* (2000), Bartholomew *et al.* (2006), and Connelly *et al.* (2006), the included papers neglected to provide adequate information about the instruments used to measure health outcomes. In one study (Brown *et al.*, 1997), children were recruited from two paediatric diabetic clinics that sent blood samples to different pathology laboratories, each using different HbA1c normative reference ranges.



A number of health outcomes depended on parent recall. These included episodes of emergency medical care and hospitalisation for the chronic condition under investigation. Timescales for recollecting these episodes of emergency care varied from one month (McPherson *et al.*, 2006) to three months (Brown *et al.*, 1997), six months (Runge *et al.*, 2006), nine months (Krishna *et al.*, 2003) and even 12 months (Bartholomew *et al.*, 2000). Memory is inherently unreliable. Only Runge *et al.* (2006) attempted to validate the reliability of the data obtained through parent recall, by using GP electronic records.

Despite the diversity of the research presented in these papers, and their associated methodological differences and limitations, there is value in reflecting on individual study outcomes.

### **2.3.6 Study outcomes**

#### **2.3.6.1 Communication**

The stated aim of this review was to evaluate the effectiveness of e-resources in promoting the quality of face-to-face communication between health professionals and children, within a health context. One paper (Eckler, 1998) aimed to facilitate child-clinician communication. In this study, orthodontists used an e-resource to clarify treatment options with children and parents. Children who viewed the e-resource felt more involved in the consultation

( $p < 0.05$ ) but did not report to feel more understood by the orthodontist ( $p = \text{ns}$ ). Another study considered the effect of a e-resource on a different type of face-to-face interaction; Brown *et al.* (1997) considered its effect on children talking to parents about diabetes. The study found the effect to be statistically significant ( $p = 0.025$ ).

#### 2.3.6.2 Satisfaction

Of further interest, was the extent to which e-resources affected the child's (and family's) involvement in their healthcare or treatment. Outcomes connected to this aim are attendance rates and relative satisfaction with the e-resource. However, for both outcomes, minimal comparison data were available.

Three studies reported on appointment attendance. Bartholomew *et al.* (2000) cited significantly greater attendance rates among intervention group children. In contrast, Homer *et al.* (2000) found no significant difference between the intervention and comparison groups in this regard. However, data from Redsell *et al.* (2003) are less clear. The paper reports no difference in attendance rates. Isolating the data of children who failed to attend two consecutive appointments: 26 (24.1%) of the intervention group versus 12 (13.8%) of the comparison group, implying better appointment attendance amongst children who did not use the e-resource (Redsell *et al.*, 2003). This leads to an inconclusive assessment of the effect of e-resources on attendance rates.

Another proxy for evaluating the quality of communication should be satisfaction with care. However, data were extracted from only three papers (Brown *et al.*, 1997; Eckler, 1998; Dragone *et al.*, 2002). Outcomes from several of the included studies (Bartholomew *et al.*, 2000; Hazzard *et al.*, 2002; Krishna *et al.*, 2003; Ritterband *et al.*, 2003; McPherson *et al.*, 2006) were discounted because of a lack of comparison group data. Davis *et al.* (2004) designed a crossover trial, having no comparison group for this outcome measure. Homer *et al.* (2000) reported no significant group differences for parental satisfaction on physician communication, physician involvement or overall care. The study reported that healthcare professionals were not engaged in the e-resource and neither were parents, with some parents choosing to sit in a separate room, away from where their child was using the e-resource, potentially explaining this finding.

The 'not significant' outcome of Brown *et al.* (1997) could be interpreted as the e-resource was no more engaging than the alternative treatment. In this case, however, the comparison group received a non-health-related e-resource. These data could therefore equally be interpreted that the health-related e-resource was as enjoyable as the entertainment game. In fact, children in this study used the tool for an average of 18 hours in the first three months and 16 hours in the second three months. Likewise, Eckler (1998) found no significant difference in preference for either the e-

resource or traditional visual aids – dental models, radiographs and photographs – all of which could conceivably be interesting and informative to children within a consultation setting. Data from Dragone *et al.* (2002) implied that the e-resource was equally as useable as the book, but potentially more engaging (as more children used the e-resource more often and for longer).

Of the three studies, Dragone *et al.* (2002) was rated 'high' quality and at lower risk of bias. However, it would be unreasonable to judge the extent to which e-resources encourage 7 to 11 year old child engagement with health-related treatment, based on 17 children.

#### *2.3.6.3 Knowledge acquisition*

The findings for the effect of e-resources on knowledge gained are mixed. Six e-resources (Brown *et al.*, 1997; Bartholomew *et al.*, 2000; Hazzard *et al.*, 2002; Krishna *et al.*, 2003; Ritterband *et al.*, 2003) were found to be no more helpful than comparative interventions. The other six e-resources were found to be effective (Eckler, 1998; Dragone *et al.*, 2002) or very effective (Homer *et al.*, 2000; Davis *et al.*, 2004; Bartholomew *et al.*, 2006; McPherson *et al.*, 2006) education devices. Three (Dragone *et al.*, 2002; Davis *et al.*, 2004; McPherson *et al.*, 2006) of these studies had a comparatively more robust research strategy, lending more weight to the suggestion that multimedia may be a worthwhile health education tool. Moreover, being equipped with greater knowledge

about a health condition, and its treatment, may enable children to understand health-related conversation in a more meaningful way, thereby facilitating their future involvement in consultations-settings with health professionals (Charnock, 1998).

#### *2.3.6.4 Changes in self-efficacy*

The identified papers used differing terminology when discussing self-efficacy. Some, such as Dragone *et al.* (2002) and McPherson *et al.* (2006), described self-efficacy as a child's sense of control over their condition and others describe it as feelings of coping (Hazzard *et al.*, 2002). In this section, self-efficacy has been used to encompass all aspects relating to a child's self-belief to manage their health condition and is used interchangeably with self-belief.

Apart from Hazzard *et al.* (2002) and Homer *et al.* (2000), all studies reporting on self-efficacy, presented data pointing towards a significant link between e-resources and enhanced self-belief (Brown *et al.*, 1997; Bartholomew *et al.*, 2000; Redsell *et al.*, 2003; McPherson *et al.*, 2006), a number of which were highly significant (Dragone *et al.*, 2002; Davis *et al.*, 2004; Bartholomew *et al.*, 2006). Although intervention children in the Eckler (1998) study were no more confident about their treatment than their counterparts in the comparison group, they were clearer about the problems associated with the proposed orthodontic treatment. These data echo those reported for knowledge acquisition.

Self-belief is affected by the time spent learning and practising new behaviours, as confirmed by Bartholomew *et al.* (2000) who found a correlation between time using the e-resource, and self-efficacy.

Children using the *STARBRIGHT: Fitting Cystic Fibrosis into your Everyday Life* e-resource, only used it for 30 minutes (Davis *et al.*, 2004), arguably insufficient time to influence self-belief in a meaningful way. Children in the McPherson *et al.* (2006) study typically used the *Asthma Files* once, for 60 to 90 minutes.

Care must be taken when quantifying the variable and subjective nature of self-efficacy. However, children who feel more able to manage their health condition have a degree of self-control that may afford them greater self-confidence when communicating with clinicians. Parental involvement in the education activity will likely also play a role in a child's ability to improve self-management (Homer *et al.*, 2000).

#### *2.3.6.5 Health outcomes*

The litmus test of someone's ability to cope with, or manage, a health condition is how this translates into physical health and wellbeing. Likewise, the ultimate goal of many of these e-resources is to change health behaviour and improve disease-related symptoms.

Of the four studies (Bartholomew *et al.*, 2000; Krishna *et al.*, 2003; Ritterband *et al.*, 2003; Connelly *et al.*, 2006) that described e-

resources as having made a significant improvement to symptoms: three (Bartholomew *et al.*, 2000; Krishna *et al.*, 2003; Connelly *et al.*, 2006) demonstrated inconsistencies. Krishna *et al.* (2003) found a correlation between use of the *IMPACT* e-resource and fewer days of asthma symptoms. However, this outcome was not confirmed by an improvement in lung function (FEV<sub>1</sub>). Bartholomew *et al.* (2000) reported fewer asthma symptoms, but only in children with mild asthma. Connelly *et al.* (2006) too had mixed results. The *Headache Index Composite* score (derived from data collected through headache diaries) was lower in children who used the e-resource. However, the *Pediatric Migraine Disability Assessment* questionnaire showed no significant difference between the intervention and comparison group children. The authors pointed out that, following the one-month intervention, children were tracked only for a further three months but their data points towards a gradual decline in *Migraine Disability* scores amongst children who used the e-resource.

One of the major limitations for many of the identified studies (Bartholomew *et al.*, 2000; Krishna *et al.*, 2003; Ritterband *et al.*, 2003) was the brief length of post-intervention follow-up. Despite these, some e-resources have played some role in improving health outcomes for some children.

**Table 7. Systematic review e-resource outcome measures and effects**

Study outcome	No. of studies	Study	Outcome measures/scale <sup>1</sup>	Reliability tested <sup>2</sup>	p-value <sup>3</sup>	ES(d)
Communication	2	Brown <i>et al.</i> (1997)	No. child initiated diabetes discussions: parent recall (one mth)	No	0.0025	
		Eckler (1998)	Child Satisfaction Survey: felt involved in the consultation orthodontist understands me	No	<0.05 ns	
Satisfaction	3 <sup>5</sup>	Brown <i>et al.</i> (1997)	<i>User satisfaction</i> : instrument not described	No	ns	
		Eckler (1998)	Liked the explanation: satisfaction survey <sup>4</sup>	No	ns	
		Dragone <i>et al.</i> (2002)	Satisfaction and Use Questionnaire: used assigned intervention ≥ once used intervention 'for a long time' found intervention 'easy to use'	No	0.001 0.0006 ns	
DNA rate	3	Redsell <i>et al.</i> (2003)	DNA at least 1 appt DNA two consecutive appt	N/A N/A	ns N/K <sup>6</sup>	
		Bartholomew <i>et al.</i> (2000)	Appt kept out of total planned appointments	N/A	0.04	
		Homer <i>et al.</i> (2000)	Appt kept out of total planned appointments	N/A	ns	
Knowledge acquisition	12	Brown <i>et al.</i> (1997)	Interview questions, blood glucose logbook, food exchange chart	No	ns	
		Eckler (1998)	Child Short Answer Knowledge Questionnaire <sup>4</sup> : three major orthodontic problems two orthodontic appliances/devices used three risks two instructions followed total recall and retention of information	No	<0.05 ns ns ns <0.05	
		Dragone <i>et al.</i> (2002)	Leukemia Event Knowledge Interview (Bearison and Pacifici 1989)	Yes	0.039	
		Davis <i>et al.</i> (2004)	Cystic Fibrosis Knowledge Questionnaire (adapted Quittner and Drotar (1997)) <sup>7</sup>	Yes	<0.001	
		Bartholomew <i>et al.</i> (2000)	Child Knowledge of Asthma Management Questionnaire	Yes		0.17



**Table 7 cont. Systematic review e-resource outcome measures and effects**

Study outcome	No. of studies	Study	Outcome measures/scale <sup>1</sup>	Reliability tested <sup>2</sup>	p-value <sup>3</sup>	ES(d)
Knowledge acquisition	10	Homer <i>et al.</i> (2000)	Child Knowledge of Asthma Questionnaire	No	<0.001	0.06
		Krishna <i>et al.</i> (2003)	Pediatric Asthma Care Knowledge Survey	No	ns	
		Bartholomew <i>et al.</i> (2006)	Child Knowledge of Asthma Management Questionnaire (Bartholomew <i>et al.</i> , 2000)	Yes	<0.0001	
		McPherson <i>et al.</i> (2006)	Asthma Knowledge Assessment	Yes	0.001	
		Hazzard <i>et al.</i> (2002) <sup>8</sup>	Asthma Knowledge Scale (modified (Fitzclarence and Henry, 1990))	Yes	ns	
			How Much Do I Know About Sickle Cell Disease? Questionnaire (shortened (Kaslow <i>et al.</i> , 2000))	Yes	ns	
		Ritterband <i>et al.</i> (2003)	Encopresis Knowledge Questionnaire	No	ns	
			Virginia Encopresis/Constipation Apperception Test (Cox <i>et al.</i> , 2003)	Yes	ns	
		Brown <i>et al.</i> (1997)	Interview questions	No	0.025	
		Eckler (1998)	Child Satisfaction Survey <sup>4</sup> : 'satisfied that I know the causes' 'satisfied that I know the treatment' 'satisfied that I know the expected outcome' 'satisfied that I know the risks' 'satisfied with the explanation of the problems' 'confidence in the orthodontist' 'not afraid of the treatment'	No	ns ns ns ns <0.05 ns ns	
Changes in self-efficacy	10	Dragone <i>et al.</i> (2002)	Leukemia Children's Health Locus of Control (Parcel and Meyer, 1978)	Yes	0.005	0.06
		Davis <i>et al.</i> (2004)	Role Play Inventory of Situations and Copy Skills (DiGirolamo <i>et al.</i> , 1997)	Yes	<0.001	
		Redsell <i>et al.</i> (2003)	Self-esteem Scale (shortened (Coopersmith, 1967))	No	0.02	
		Bartholomew <i>et al.</i> (2000)	Child Self-efficacy Expectations Questionnaire	Yes		

**Table 7 cont. Systematic review e-resource outcome measures and effects**

Study outcome	No. of studies	Study	Outcome measures/scale <sup>1</sup>	Reliability tested <sup>2</sup>	p-value <sup>3</sup>	ES(d)
Health outcomes /symptoms	10	Bartholomew <i>et al.</i> (2006)	Child Self-efficacy Expectations Questionnaire (Bartholomew <i>et al.</i> , 2000)	Yes	<0.0001	0.5
		Homer <i>et al.</i> (2000)	Parent recall: <i>child attitude toward asthma care</i>	No	ns	
			Parent recall: <i>behaviours related to asthma care</i>	No	ns	
		McPherson <i>et al.</i> (2006)	Children's Asthma Locus of Control ((Glazebrook <i>et al.</i> , 2004), derived from Parcel and Meyer (1978))	Yes	0.007	
		Hazzard <i>et al.</i> (2002) <sup>8</sup>	Kidcope (Spirito <i>et al.</i> , 1988)	Yes	ns	0.5
			Kidcope (Spirito <i>et al.</i> , 1988)	Yes	ns	
		Brown <i>et al.</i> (1997)	Long-term <i>blood glucose control</i> : HbA1c measurements	No	ns	0.5
		Redsell <i>et al.</i> (2003)	<i>Time to dry (Length of time to achieve 14 consecutive dry nights)</i> : not described	Not stated	ns	
			<i>Dry on discharge</i> : not described	Not stated	ns	
			<i>Dry 6 mth post-discharge</i> : questionnaire not described	Not stated	ns	
		Connelly <i>et al.</i> (2006)	<i>Headache activity</i> : Headache Index Composite calculated from Headache Diary (Blanchard and Andrasik, 1985)	Yes	0.04	0.5
			<i>Headache frequency, duration and severity</i> : Pediatric Migraine Disability Assessment (Hershey <i>et al.</i> , 2001)	Yes	ns	
		Bartholomew <i>et al.</i> (2000)	<i>Asthma symptoms</i> : Usherwood Symptom Questionnaire (Usherwood <i>et al.</i> , 1990)	Yes	0.02 <sup>9</sup>	0.5
		Homer <i>et al.</i> (2000)	<i>Asthma severity</i> : parent recall	No	ns	
		Krishna <i>et al.</i> (2003)	<i>Lung function (FEV<sub>1</sub>)</i> : instrument not described	Not stated	ns	0.5
			<i>Days of asthma symptoms</i> since last visit: parent recall	No	<0.01	

**Table 7 cont. Systematic review e-resource outcome measures and effects**

Study outcome	No. of studies	Study	Outcome measures/scale <sup>1</sup>	Reliability tested <sup>2</sup>	p-value <sup>3</sup>	ES(d)
Emergency medical visits	6	Bartholomew <i>et al.</i> (2006)	<i>Asthma symptoms</i> : Usherwood Symptom Questionnaire (Usherwood <i>et al.</i> , 1990)	Yes	ns	0.03
		Bartholomew <i>et al.</i> (2006)	<i>Asthma symptoms</i> : Usherwood Symptom Questionnaire (Usherwood <i>et al.</i> , 1990)	Yes	ns	
		McPherson <i>et al.</i> (2006)	<i>Lung function (FEV<sub>1</sub>)</i> : Micromedical Super-Spiro spirometer	Not stated	ns	
		Runge <i>et al.</i> (2006)	<i>Lung function (PEF)</i> : Mini-Wright Peak Flow Meter	Not stated	ns	
			<i>Lung function (FEV<sub>1</sub>)</i> : instrument not described	Not stated	ns	
			<i>Lung function (PEF)</i> : instrument not described	Not stated	ns	
		Ritterband <i>et al.</i> (2003)	Child Information Form:	No		
			<i>trips to toilet without parental prompt</i>		0.109	
			<i>bowel movements in the toilet</i>		0.001	
			<i>overall encopresis symptom improvement</i>		0.018	
		Brown <i>et al.</i> (1997)	<i>Emergency room/GP visits over past 3 mth<sup>10</sup></i> : parent recall	No	ns	
		Bartholomew <i>et al.</i> (2000)	<i>Number of visits over past year</i> : parent recall	No		
		Homer <i>et al.</i> (2000)	<i>Emergency room visits</i> : parent recall	No	ns	
		Krishna <i>et al.</i> (2003)	<i>Acute GP visits</i> : parent recall	No	ns	
			<i>Asthma Summary Since Last Visit Questionnaire</i> : <i>urgent medical visits</i> <i>emergency room visits</i>	No	<0.0001 0.0219	
Hospitalisation	6	McPherson <i>et al.</i> (2006)	<i>Unscheduled visits to the GP over past month</i> : parent recall	No	ns	-0.14
		Runge <i>et al.</i> (2006)	<i>Emergency room visits over past 6 mth</i> : parent questionnaire and GP electronic record	Not stated	ns	
		Brown <i>et al.</i> (1997)	<i>Hospitalisation over past 3 mth<sup>10</sup></i> : parent recall	No	ns	
		Bartholomew <i>et al.</i> (2000)	<i>Hospitalisation over past year</i> : parent recall	No		

**Table 7 cont. Systematic review e-resource outcome measures and effects**

Study outcome	No. of studies	Study	Outcome measures/scale <sup>1</sup>	Reliability tested <sup>2</sup>	p-value <sup>3</sup>	ES(d)
		Krishna <i>et al.</i> (2003)	Asthma Summary Since Last Visit Questionnaire: <i>hospitalisation days of stay in hospital</i>	No	0.0313 ns	
		Bartholomew <i>et al.</i> (2006)	<i>Hospitalisation over past year: parent recall</i>	No	ns	
		McPherson <i>et al.</i> (2006)	<i>Hospitalisation over past month: parent recall</i>	No	ns	
		Runge <i>et al.</i> (2006)	<i>Days of stay in hospital over past 6 mth: parent questionnaire and GP electronic record</i>	Not stated	ns	

Note: Shading has been applied consistently to data sets, grouping data from similar conditions, e.g. asthma

ES – effect size    ns – not significant    DNA – did not attend    Appt – appointment(s)    N/A – not applicable    No. – number of  
FEV<sub>1</sub> – forced expiratory volume    PEV – peak expiratory volume    GP – general practitioner    HbA1c – glycated haemoglobin    Mth – month(s)

<sup>1</sup> Instruments or scales were developed by the authors, unless referenced, <sup>2</sup> Reliability of outcome measure/scale tested using Cronbach's alpha,

<sup>3</sup>  $p \leq 0.05$ , <sup>4</sup> Several questions could equally be categorised as 'communication', 'satisfaction' or 'self-efficacy'. The most appropriate have been included,

<sup>5</sup> Homer *et al.* (2000) lacked comparison group satisfaction data, and have therefore not been included, <sup>6</sup> Not known – a Chi-square test revealed no statistical significance between the three groups (which included a wait-list group) but no subanalysis of the intervention and comparison group was provided, <sup>7</sup> *Unable to find reference*: Quittner, A.L. and Drotar, D. Controlled trial of family interventions for cystic fibrosis (research grant) National Institute of Health (October 1997 to August 2003), <sup>8</sup> Hazzard *et al.* (2002) utilised the STARBRIGHT World e-resource to explore it's effect on children with asthma and sickle cell disease. These data sets are dealt with separately, <sup>9</sup> Significant only for those children with milder asthma symptoms,

<sup>10</sup> Measured together, as emergency room/GP visits and hospitalisation

#### *2.3.6.6 Need for emergency medical treatment or hospitalisation*

The evidence analysed thus far suggest that e-resources are less beneficial for severe medical conditions. Based on this assumption, emergency medical care and hospitalisation rates would not benefit from e-resources. Data presented in Table 7 confirms that only one (Krishna *et al.*, 2003) out of the handful studies reporting on this area, found e-resources to be effective to this end.

### **2.4 Limitations of the review**

As with any investigation of this kind, these results should be interpreted mindful of the limitations, not only of the research literature but also of the methods used to identify the research. To begin with, identification of potentially relevant papers was hindered by the researcher's use of keywords, and keywords definitions offered by database thesauri. Only 5 of the 14 included studies were found through a systematic search of 12 databases. This is in part due to technology advancements and the changing terms then used to describe them (Oh *et al.*, 2005). Secondly, relatively few papers met the inclusion criteria and the evidence presented by most of these studies evaluated poorly on a variety of levels. The third limitation was that heterogeneity between studies prohibited meta-analysis of data. Lastly, the research presented in this review could be more appropriately described as pilot studies. Focus needs

to be placed on undertaking better quality studies that adequately investigate the role of technology in health communication.

## **2.5 Discussion**

The aim of this systematic review was to evaluate the impact of health-related e-resources, used within a clinical context, on the quality of child-clinician communication. Also of interest was the impact of such tools on satisfaction and indicators of self-management. Most of the identified papers were published between 2000 and 2006, representing studies that took place at the end of the 1990s and the first few years of the 21<sup>st</sup> century. Interestingly, no more recent research was found, despite the apparent usefulness of e-resources.

This review was undertaken to inform the development of a diet-related e-resource (Chapter Four) for use with overweight children. It should be noted that none of the included e-resources were designed for overweight children. The one study (Christison and Khan, 2012), that did aim to engage preadolescent overweight children by integrating an activity-promoting e-resource into an obesity programme did not meet the inclusion criteria for this review (see Table 3). Post-intervention scores showed a significant reduction in BMI, screen time and carbonated drink intake, with increased physical activity levels at the end of the 10 week programme but in common with included studies, impact on communication was not evaluated. This highlights how the capacity

for e-resources to support health-related communication in the area of CWM, has been neglected.

Research has tended to define e-resources as efficient aids to improve knowledge and promote self-efficacy independently of health professionals, seeking to exploit their cost-benefit in providing alternative healthcare rather than understanding their role in enhancing existing clinical practice. Some studies (Eckler, 1998; Redsell *et al.*, 2003; Runge *et al.*, 2006) encouraged health professionals to interact with the children using the e-resources, but the level of engagement was not reported, raising doubts over its emphasis and importance within the research. Bartholomew *et al.* (2000) implied that clinician involvement might have improved asthma symptoms for those children with more complex health needs. The potential role of e-resources alongside health professional involvement has not been explored.

Studies (Bartholomew *et al.*, 2006) had difficulty finding support for e-resources among clinicians, with Dragone *et al.* (2002) achieving a 30% response rate from health professionals asked to feedback on the e-resource. All but two studies (Brown *et al.*, 1997; Connelly *et al.*, 2006) involved clinicians in the e-resource development phases (one study (Runge *et al.*, 2006) was unclear). Nevertheless, it is difficult to assess the extent and nature of their involvement. Approaching health experts for suitable content is vastly different to exploring how clinicians provide information to children and families,

and providing the opportunity to settle on an agreed format for the e-resource. These papers are also unclear as to whether health professionals were involved throughout the multimedia development process, or merely at the beginning or endpoint.

Tellingly, the majority of the included e-resources are not in use and are likely never to have entered mainstream clinical treatment (Table 8). Twelve different e-resources appeared in this systematic review. Only four of are available for use with children and families, either directly or through clinicians. Resources, including e-resources, deemed irrelevant by health professionals, are generally left unused and are not integrated into clinical practice. This review confirms the importance of ensuring that e-resources complement health professional practice. The task is therefore to involve health professionals in design from the outset, ensuring that developed e-resources are clinically relevant.

Proudfoot *et al.* (2011) have proposed a series of guidelines to support internet interventions. This review suggests that greater emphasis should be placed on the context within which these technologies will be used, and the communication requirements of health professionals. A development methodology that advocates participatory involvement, peer review and evaluation at different stages of e-resource production needs to be addressed (Chapter Four). Investing in the production of useful e-resources may help to



clarify the potential for this type of technology to realise behaviour change and improve health outcomes (Atienza *et al.*, 2007).

Although some of the studies were not of the highest quality, and e-resources lacked focus in their design and development (a problem not unique to this review (Cooper *et al.*, 2009; Gentles *et al.*, 2010)) the study outcomes themselves are promising: e-resources have the capacity to improve child-clinician communication, 7 to 11 year old children seem to enjoy using technology, e-resources may be useful in educating children about their health, e-resources show promise in improving self-efficacy among children of this age, and these types of interventions have the potential to improve health outcomes.

**Table 8. Included e-resources and their ongoing availability**

Study	E-resource intervention	E-resource description	Available/ in use	Comments
Eckler (1998)	<i>Interactive Consult 2.0</i>	Stationary and moveable graphics used to illustrate orthodontic diagnosis and treatment (36 treatment plans)	No	
Brown <i>et al.</i> (1997)	<i>Packy and Marlon</i>	One or two player game to save the diabetes summer camp from the rats and mice that have scattered the food and diabetes supplies (24 levels)	No	Extract available at <a href="http://www.youtube.com/watch?v=oWcPf_n8BgM">http://www.youtube.com/watch?v=oWcPf_n8BgM</a> [Accessed 7 February 2013]
Redsell <i>et al.</i> (2003)	<i>All About Nocturnal Enuresis</i>	Animated, interactive tutorials based on paper-based pamphlet (7 tutorials)	No	
Dragone <i>et al.</i> (2002)	<i>Kidz with Leukemia: A Space Adventure</i>	A themed e-resource, providing leukemia information using interactive media, e.g. games and puzzles; and video (such as a hospital tour)	Yes	
Bartholomew <i>et al.</i> (2000) Bartholomew <i>et al.</i> (2006)	<i>Watch, Discover, Think and Act</i>	An adventure game to make decisions about managing the game character's asthma and provide tailored treatment asthma plan	No	
Homer <i>et al.</i> (2000)	<i>Asthma Control</i>	Game simulation of daily events, while managing the superhero game character's asthma, including brief video clips about specific objects, e.g. triggers or medication	No	
Krishna <i>et al.</i> (2003)	Interactive Multimedia Program for Asthma Control: <i>IMPACT Asthma Kids</i>	Animated interactive tutorials about asthma symptoms and medication use, and real-life scenarios to practice decision-making (44 modules)	Yes, in adapted format	E-resource content has been converted into a series of interactive educational resources
McPherson <i>et al.</i> (2006)	<i>The Asthma Files</i>	Animated interactive secret-agent themed modules (n=8) with games and quizzes, providing a tailored self-management asthma plan	No	
Runge <i>et al.</i> (2006)	Not stated	Adventure game to encourage management of asthma-related situations, with asthma quizzes and material from group education sessions, as well as scheduled chat sessions with asthma experts, and online social networking with peers	No	

**Table 8 cont. Included e-resources and their ongoing availability**

Study	E-resource intervention	E-resource description	Available/ in use	Comments
Hazzard <i>et al.</i> (2002)	<i>STARBRIGHT World</i>	Intranet for hospitalised children with interactive games, arts and crafts projects, and opportunities to contact children in other hospitals online	Yes	Website is recommended for 13 to 20 year olds
Davis <i>et al.</i> (2004)	<i>STARBRIGHT World: Fitting Cystic Fibrosis into your Everyday Life</i>	Animated interactive tutorials about eating, breathing and cystic fibrosis questions and answers (3 modules)	Yes	
Ritterband <i>et al.</i> (2003)	<i>U-Can-Poop-Too</i>	Interactive tutorials and quizzes with illustrations about aspects of encopresis management (27 modules)	Yes	
Connelly <i>et al.</i> (2006)	<i>Headstrong</i>	Interactive narrated tutorials and quizzes about headache management, e.g. deep breathing and imagery, and a tailored active pain-coping plan (4 modules)	No	Available only from authors

## 2.6 Conclusion

Despite calls to investigate the use of health-related e-resources with face-to-face communication (Portnoy *et al.*, 2008; Murray *et al.*, 2009), the findings of this review have established this as an area of research yet to be charted, specifically within the 7 to 11 year age group. Further research is needed to understand the role for clinically relevant e-resources to support child-clinician communication.

The review suggests that e-resources can lead to health-related improvements, and they hold the potential to support communication between young children and health professionals. Health professionals may need to be convinced of their benefit, and persuaded to integrate such e-resources into routine healthcare. It is therefore critical that these technologies not only meet the requirements and expectations of clinicians who might use them, but that the evidence to support (or refute) their use is robust. This conclusion has informed the decision to prioritise the requirements of dietitians (Chapter Three) over the needs of children in the formative stages of e-resource development. While child involvement is essential, ensuring that design concepts meet the needs of dietitians may encourage uptake of the e-resource within clinical settings at a later stage.

## **Chapter Three: Dietitians' perceptions of communication with the preadolescent overweight child in the appointment setting**

### **3.1 Introduction**

Given the widespread prevalence of childhood overweight and obesity (Chapter One), there are calls for research to enhance existing interventions and to develop other approaches to treatment (e.g. Epstein and Wrotniak, 2010). As part of this drive to improve efficacy, NICE (2013) has recommended an evaluation of services using qualitative research, considering the views and experiences of health professionals, delivering child weight management (CWM) interventions, and their clients. To date, most studies in this field have investigated parent and child perspectives (Turner *et al.*, 2011; Hester *et al.*, 2010; Stewart *et al.*, 2008; Edmunds, 2005). Those that have explored the insights of health professionals have tended to include general practitioners (GPs), practice nurses, and school nurses, but not dietitians (Visram *et al.*, 2013; Turner *et al.*, 2009; Walker *et al.*, 2007).

Staniford *et al.* (2011) has called for innovations in weight management interventions, suggesting introducing technology-based strategies to tailor treatment according to factors such as the child's age and readiness to change, in addition to the regular support of weight management clinicians that families in other

studies (Stewart *et al.*, 2008; Murtagh *et al.*, 2006) report as invaluable. While the concept of tailoring information through computer-based solutions is not new (Dijkstra and De Vries, 1999), using technology to enhance face-to-face consultations with dietitians may offer a fresh perspective. Chapter Two identified 14 interventions that had used multimedia technology within a clinical service in order to improve health outcomes amongst 7 to 11 year old children. None had adequately investigated the potential for such technologies to enhance health professionals' communication with preadolescent children.

This study was undertaken to inform the development of a dietetic e-resource for weight management appointments with 7 to 11 year old children. Towards this end, this study aimed to explore dietetic views, attitudes and approaches to weight management appointments with preadolescent children. In addition, the study sought to gauge dietetic opinion on the use of e-resources to support patient-dietitian communication.

## **3.2 Methods**

### **3.2.1 Design**

With no identified studies that explore dietetic views on communicating with children about weight management, it was decided that dialogue would yield richer data, and semi-structured discussion was chosen over questionnaire. It was anticipated that

participants would be from a diverse geographical area. As a result, this study opted for a cross-sectional, qualitative study, using semi-structured telephone interviews (Appendix 9). The target sample size was 20 participants.

### **3.2.2 Recruitment**

Purposive sampling intended to recruit dietitians and dietetic assistants (with experience of providing weight management advice to overweight 7 to 11 year olds) through two British Dietetic Association (BDA, 2012) specialist interest groups in the UK: the Obesity Group and the Paediatric Group. An e-flier (Appendix 10) invited interest from member and non-member dietitian and dietetic assistant colleagues. Potential participants were asked to read an online information sheet (Appendix 11), and submit a consent form via the SurveyMonkey® website. Alternatively, those interested in taking part were able to contact the researcher to receive the information sheet and consent form by post or email. Following submission of consent forms, the researcher contacted the participants to arrange a telephone interview.

### **3.2.3 Participants**

No dietetic assistants responded to the study invitation. Almost all of the 18 dietitians who took part in the study were female and worked in the NHS. Most (n=14) practised in England, across 13 geographical English counties, with further representation in Wales,

Northern Ireland and the Republic of Ireland. Participant characteristics have been summarised in Table 9. Seven were full-time paediatric dietitians; the remainder provided dietetic treatment to children on a part-time basis.

**Table 9. Qualitative research participant characteristics**

Characteristic	Range/measure	No. of dietitians (n=18)
Current paediatric dietetic employment (h/wk)	≤7.5 h	3
	7.6 to 15 h	1
	15.1 to 22.5h	3
	22.6 to 30 h	2
	30.1 to 37.5 h	9
	Range:	2.00–37.50
	Mean(SD):	25.90(13.34)
Experience in child weight management (y)	≤2 y	6
	>2 to 5 y	5
	>5 to 10 y	2
	>10 to 15 y	4
	>15 to 20 y	1
	Range:	0.25–16.00
	Mean(SD):	6.25(5.35)
Estimated patient (overweight 7 to 11 year old children) contact (children/wk) <sup>1</sup>	0 to 2 children	9
	3 to 5 children	6
	6 to 7 children	0
	8 to 10 children	3 <sup>1</sup>
	Range:	<1–10
	Mean(SD):	3.31(3.11)
Length of initial consultations (n=16) (min/appt)	60 min	2
	40 to 45 min	5
	30 min	10
Length of review consultations (n=14) (min/appt)	Flexible (40 to 60 min)	3
	30 min	6
	15 min	6

Y – year(s) Wk – week(s) H – hour(s) Min – minute(s)

Appt – appointment(s)

<sup>1</sup> One dietitian only saw 7 to 11 year old children and their families within group settings, i.e. no individual initial or follow-up appointments

A range of different CWM services were represented by the participants. Some dietitians treated overweight children within general paediatric consultations, half (n=9) were commissioned to provide a specialist CWM service either as the sole dietitian or in



partnership with other dietitians, or as part of a multidisciplinary team (n=4). Non-dietitian team members varied from health promotion advisors and dietetic assistants, school nurses, physiotherapists, and occupational therapists, to a consultant paediatrician, and a physical activity advisor.

The time allocated for dietitians to spend with each overweight child varied considerably (Table 9). All but one dietitian offered individual appointments.

### **3.2.4 Analysis**

Interviews averaged  $31.24 \pm 7.51$  minutes. The recording equipment failed during one interview, resulting in an inaudible data file. In this instance, data were summarised within four hours of the interview, from researcher memory and detailed interview notes, and separated from the main data set, used only to comment on emerging themes. The remaining 17 interviews were transcribed verbatim by the researcher (C.R.). A code was assigned to each participant to preserve confidentiality and anonymity. Participant identifiers were stored separately and all data were stored in password-protected files.

Data were analysed using inductive theme analysis (Braun and Clarke 2006). This process involved identifying interesting features and patterns in the transcripts. Significant topics, as well as

recurring views or concepts were provisionally coded and organised into potential related categories. A systematic and iterative approach was taken in which transcripts and coded data were read and re-read several times until a rough structure to the data began to emerge. During the fourth and fifth cycles, a theme structure developed, along with a codebook as described by Boyatzis (1998). Each theme was described by a meaningful label, descriptors, indicators of the theme, an example excerpt, and relevant exclusions. The codebook (Appendix 12) was subsequently reapplied to the dataset; previously coded data were checked and themes were refined. No new themes were identified during the final interviews suggesting that saturation was achieved. The number of interviews that contained each theme was measured to provide some indication of the strength of the theme.

In order to gauge the consistency with which concepts were applied to the data (Pilnick and Swift, 2011), the reliability of the codebook was tested. The codebook was given to two independent researchers (C.B. and H.Q.), together with a brief overview of the research and a randomly selected (Haahr, 2012) sample of 26 excerpts; two from each of the larger themes and one from smaller themes. The researchers were asked to code the excerpts into themes using the codebook descriptors. Percentage agreement between the study researcher and each of the independent

researchers was used to measure reliability of the codebook (Boyatzis, 1998).

Three aspects of data were explored through content analysis. Firstly, dietitians who use, or have used, e-resources to support CWM consultations were noted. Next, unprompted dietitian suggestions for the potential of e-resources within consultations were extracted. Finally, dietitian response to the proposed idea of an interactive e-resource to facilitate child-dietitian communication was analysed.

### ***3.2.5 Ethical approval***

The study was approved by the Faculty of Medicine and Health Sciences Ethics Committee at the University of Nottingham (ref: G15112012 CHS Diet) (Appendix 13).

## **3.3 Results**

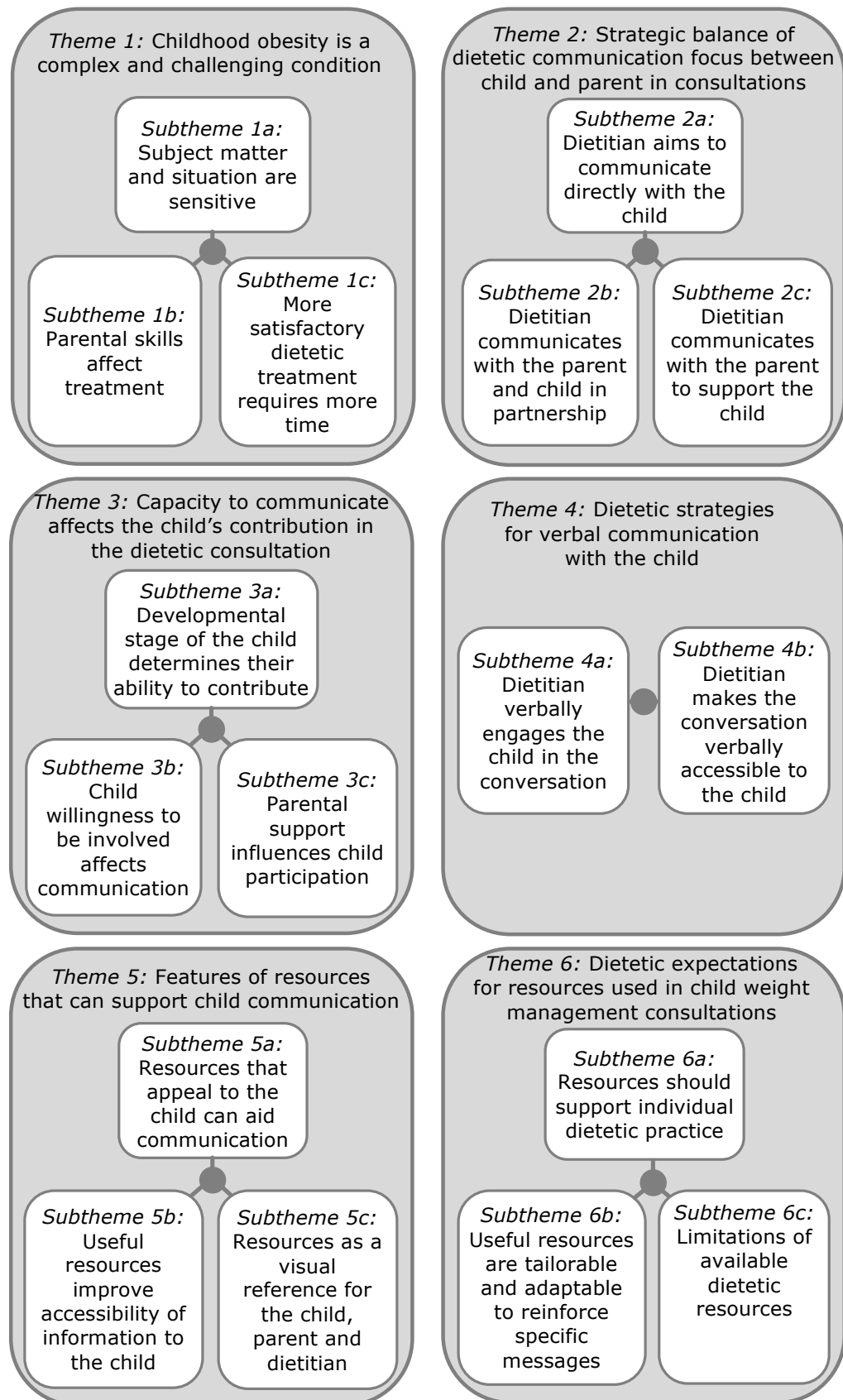
Six overarching themes were identified, each with two or three associated subthemes (17 in total), and these are shown in Figure 5. Inter-rater agreement was 76.9% and 73.1%, which met the required 70% threshold recommended by Boyatzis (1998).

Although each theme has been presented and expanded on separately, it is important to note that there are strong links between themes. The intricate interplay between themes demonstrates the broad nature of the research question and

complexity of the resulting data. The extracts cited for the purpose of this study include a representative sample intended to provide a coherent sense of current dietetic views and approaches on communicating with overweight 7 to 11 year old children and their parents. Verbatim quotes were edited to remove nonfluencies in order to improve readability without altering meaning (Corden and Sainsbury, 2006).

### ***3.3.1 Theme 1: Childhood obesity is a complex and challenging condition to treat***

This theme captures aspects of the consultation that can make CWM both challenging and complex. The child may be feeling awkward or embarrassed because they know they are overweight and it is difficult to talk about. Parental guilt that their child is overweight, and a lack of skills and knowledge may leave parents unsure of their role in the child's treatment. Dietitians are presented with, and expected to deal with these complex issues within the time constraints of an appointment.



**Figure 5. Themes and subthemes from interview data exploring dietitians' views of communicating with the preadolescent overweight child and their family**

*Subtheme 1a: Subject matter and situation are sensitive (n=14)*

Simply attending the appointment may be difficult for the child:

"I think sometimes [*the child*] can be quite embarrassed about...if they... know that they are sort of overweight...they can be quite embarrassed coming and talking to you . And maybe a bit intimidated..." [P06]

Some dietitians acknowledged that they found it difficult to communicate openly and honestly with the child about their weight problem without upsetting them:

"...I probably would like to be a little bit more confident in how [*I*] talk to the child and how much to push it, because [*I*] don't want to upset them, but at the same time, [*I*] don't want to be ignoring their involvement either." [P16]

Others were concerned about whether frank discussions about weight would lead to psychological harm. Several dietitians (n=3) thought that this could be overcome through additional specialist guidance or training. Dietitians were acutely aware of the terminology they used with children and families. There was a general consensus that the words 'obese' and 'obesity' should be avoided. There was lack of agreement about 'overweight' and 'excess weight'. Some dietitians preferred to avoid categorising the child's current weight in favour of focussing on working towards a 'healthier weight':

"I always try to put things in a positive perspective anyway, so not scare them but: 'just try and think, this is going to be really good for you and you will get fitter and healthier.'"  
[P04]

A third of the dietitians who took part also said that they tried to be encouraging and optimistic about how they framed the child's weight status when measurements were taken.

*Subtheme 1b: Parental skills affect treatment (n=8)*

Parenting skills, education and general life skills affected the information given to families during a CWM consultation. Parental knowledge and understanding of the situation was important, as was a parent's awareness of the part they have played in their child becoming overweight and therefore their role in helping their child to achieve a healthier weight. Many of the dietitians addressed parenting in some way, as described in the following extract:

"Setting boundaries, challenging them [*the parent*] a little bit, in a nice gentle way about [*the*] sort of behaviours are they doing that aren't helpful for the child's weight... Um, so you know helping them to know that's it's OK to say 'no'... They feel guilty about saying 'no' ...loads of praise... spending time with their kids so that their kids feel able to talk to them if things are worrying them]. Um, so really the parenting things...we try to... reflect what might be said on a parenting course, I guess." [P08]

A lack of cooking skills amongst parents was mentioned a number of times, with dietitians having to tailor recommendations to improve family meals accordingly. Of further significance were parental education and literacy skills. Dietitians treated children with non-English-speaking parents, and parents with learning difficulties. More commonly:

"...there are some parents who can't read as well, or can't write as well..." [P04]

*Subtheme 1c: More satisfactory dietetic treatment requires more time (n=7)*

Dietitians who had shorter (30 minute initial and 15 minute subsequent) appointments described their time with children and parents as rushed, frustrating and ineffectual. An extract by [P02] describes the perception that more could be done to help children and families if more appointment time was available:

"...I suppose have a bit more time to talk, rather than feel that you've got to rush it in 30 minutes, and being able to spend a little bit more time looking at resources and thinking about ideas rather than thinking, 'Gosh we are coming to the end of 30 minutes, got to round it up here.' And giving the child time to think a little bit more for themselves rather than trying to rush them on." [P02]

Some services acknowledged that certain families needed additional dietetic support and offered individualised 'education' appointments in which dietitians were able to spend more time providing advice on specific lifestyle-related problems:

"We do some education with some of the families ...well, most of the families are offered the education and those slots are longer, so we would maybe offer three-quarters of an hour..." [P14]



### ***3.3.2 Theme 2: Strategic balance of dietetic communication focus between child and parent in weight management consultations***

The essence of this theme is the balance of dietetic views on parent and child roles in CWM. These underlying philosophies affect dietetic communication within the consultation, whether the focus of the conversation is the child, the parent or both. The strategies they mentioned were not mutually exclusive and several dietitians referred to using more than one. Two of the 17 dietitians identified with all three strategies.

#### *Subtheme 2a: Dietitian aims to communicate directly with the child (n=11)*

Dietitians felt it important to focus on involving the child in the conversation, but not to the exclusion of their parents:

“...I do try and focus on the child as much as possible. I try and run everything past the parent if they are there and then if I set some sort of goals, or if the young person has come up with some sort of targets. I then ask the parent, ‘what do you think of these? Do they sound all right?’ I do it that way, really.” [P07]

“...because although it’s important to give the information to the parents, at the end of the day, it’s the child that’s got to do it [*make lifestyle changes*].” [P06]

*Subtheme 2b: Dietitian communicates with the parent and child in partnership (n=9)*

Six of the dietitians who prioritised communicating directly with the child also evidence a degree of partnership working with the parent. Four of these dietitians talked about this triadic conversation in the context of goal setting only. The remainder (n=5) conveyed a more pervasive ethos of working to engage the parent together with the child throughout the consultation.

"And, get the parents involved as much as possible as well. So, if they are overweight and they're not eating healthy, they need to say well...'OK, well why not do it all together?' And they look at their parents and go, 'see?' and you see that interaction and you can see that, 'well, if you want to do it, then do the reward chart together.' And they do it all together. You can see a difference, when the parents go, 'Well, we don't do as much physical activity as we could.' And then they make that difference too. I find that really rewarding when I see the parents look at the children...and like, 'Oooh, maybe we should do it too?'" [P04]

*Subtheme 2c: Dietitian communicates with the parent to support the child (n=5)*

An emphasis on parental involvement characterised the third approach. Dietitians described supporting the parent to make the necessary changes that would in turn help the child to achieve a healthier weight.

"...I would probably spend the majority of the conversation, in this age group, um, understanding the issues with the parent but including the child in that conversation where it

was relevant. But I really feel, in this age group, that um very often it's the parent that needs to be supported to help the child to make changes. They haven't really reached the age, you know, a child doesn't want to do it...etcetera, etcetera... It's more about engaging the parents in change and them supporting the child to change." [P08]

These dietitians viewed their role as one of equipping and empowering parents in some way. Two dietitians invited only parents to most of their appointments. A third participant preferred parent-only consultations when a younger overweight child (seven year olds) had been referred.

### ***3.3.3 Theme 3: Capacity to communicate affects the child's contribution in the dietetic consultation***

Various child and parent dynamics affected how dietitians talked to the child within an appointment. This theme describes these factors as the degree to which the parent encouraged or hampered the child's communication, as well as child factors: maturity, and interest in the conversation.

#### *Subtheme 3a: Developmental stage of the child determines their ability to contribute (n=10)*

Cognitive development and ability, as well as emotional maturity, were seen to affect the preadolescent child's ability to communicate with the dietitian within an appointment setting. Younger children tended to need more help from their parents, purely because of their developmental ability. Younger patients were said to have

limited communication skills, shorter attention spans, and there were concerns over the accuracy of the information they were able to provide. However, the point was made that age does not always reflect ability.

"I think it depends on *[the child's]* maturity because you can have a seven year old that is very able to chat and you can get an 11 year old that...that isn't. So I think it completely depends on the child." [P09]

*Subtheme 3b: Child willingness to be involved affects communication (n=9)*

Irrespective of their emotional, cognitive and communication capacity, the child would not to take part in the conversation if they were unwilling.

"I suppose it depends on the engagement of the child, if that makes sense. So if there is a child that has been dragged along who doesn't really want to be there...it might be largely aimed at the parent. But if it's a child whose come there... I had *[a patient]* yesterday for example...a little girl...who was fully engaged and was really open, telling us why she was keen to change her weight and her lifestyle." [P02]

This theme was supported primarily by dietitians conscious of communicating with the child during an appointment (Subthemes 2a and 2b). The role of parental support was another area highlighted by these dietitians (n=7).

*Subtheme 3c: Parental support influences child participation (n=8)*

Dietitians pointed out that parents could affect the degree to which the child takes part in the conversation. Parental perception of responsibilities in addressing the child's weight plays a significant role in a parent's approach to the consultation. Some parents fail to recognise or acknowledge that their child is overweight, which affects their endorsement of the treatment process.

"...some parents...if the child's a bit overweight, they just think it's puppy-fat, don't they? And they'll grow out of it..."  
[P13]

Appointment time may be needed to talk to parents about this lack of concern in order to help gain their support for treatment.

Exchanges about a parent who no longer lives in the family home but who has regular contact with the child, and who is responsible for providing some of their meals can take up minutes in the appointment. The child may also be left with less space in the conversation if the parent dominates the discussion:

"...I think if the parents talk over the child quite a lot...I think it can affect the younger children..." [P03]

**3.3.4 Theme 4: Dietetic strategies for verbal communication with the child**

This theme identifies the two main verbal strategies, used by dietitians, to include the young child into the conversation about their diet and physical activity levels. Dietitians described how they tried to use verbal discourse to first capture the child's attention,

and then to make the content of the conversation both age-appropriate and relevant.

*Subtheme 4a: Dietitian verbally engages the child in the conversation (n=14)*

Dietitians described how they tried to draw the child into conversation by finding topics that would interest them. To begin with, many dietitians pointed to the importance of initial greetings and introductions, of trying to talk to the child from the outset, building rapport with them and trying to alleviate some of the child's nervousness and apprehension:

"...'What have you been doing?' 'How is school?' [Yeah.] 'What was your holiday like?' I usually put little things on my cards to say...if they've said they're going on holiday or they're going away for the weekend or something, I'll always make a note of that... It's building that rapport and that relationship with the kids that's the most important thing. And if you don't have that, then you're on a hiding to nothing, really." [P14]

The data evidenced dietetic value in the child's perspective to ensure a common treatment agenda, particularly exploring the child's understanding of what the appointment was about.

Dietitians also sought to make dialogue and explanations relevant to the child by establishing their overall goals, motivators and interests early on in the appointment.

"...I tend to pick out reasons that [*the child*] will particularly like to focus on as reasons for wanting to... change their lifestyle or change their appearance or looks. So we think

about sports and clothes and... just sort of general fitness...how they would like to be in the future.” [P02]

*Subtheme 4b: Dietitian makes the conversation verbally accessible to the child (n=15)*

Many dietitians were aware that adult conversations about diet and lifestyle choices were largely inaccessible and irrelevant to preadolescent children. They were mindful of the words they used to communicate information and concepts to young children; they mirrored the child’s use of language, adopting simpler age-appropriate words. Some dietitians also used familiar analogies:

“...specifically if I don’t need them [*the child*] to lose weight...I just need them to not gain any more...I use my analogy of the stretchy man. You know the little man in their party bags? I keep meaning to buy one actually, I just keep forgetting, but they all know what I mean...I say to them, ‘You know when you get your stretchy man in your party bag, and you...and he’s short and he’s quite wide...then you pull him up and he gets really tall...and much thinner.’ And I say, ‘that’s what I want you to do, so if you keep your weight the same, you’re going to be like the stretchy man...you’ll grow taller and your weight will redistribute’.” [P12]

Dietitians were specific about the information they asked of the child and provided to them, giving key messages that were ‘simple’ or ‘basic’, and talking to the child about aspects that were in their ability and control:

“I think if you can, rather than being vague about things...  
...if you can pinpoint, rather than just saying, ‘what do you

tend to eat?' or, 'what things do you like?' I tend to say [*to the child*] 'what have you eaten today?'" [P03]

"...when we're talking about going to school and their [*the child's*] class, I might ask them ...'do they have much time for lunch?'... And, 'do they eat lunch with their friends?'... And maybe, 'what do they like to eat?' I might kind of say, 'do they sometimes share things with their friends?' Sometimes their friend might bring in something and they might have a bit of it..." [P16]

### ***3.3.5 Theme 5: Features of resources that can support child communication***

This theme brings together the characteristics of educational resources that supported dietetic communication with the preadolescent child. Two subthemes related to the appearance and content of resources. The third described how resources could be used as scaffolding for verbal exchanges between the child, the parent and the dietitian, forming the concrete basis for a conversation.

#### *Subtheme 5a: Resources that appeal to the child can aid communication (n=16)*

Child appeal was prioritised when describing useful resources. Certain design features were considered attractive to the preadolescent child. Fundamentally, most dietitians favoured picture-based over text-based resources, and suggested that text should be kept to a minimum. They described images as needing to be bright, colourful, and age-appropriate:



"But I think you have to be really careful with the graphics as well, so what you would give to an 11 year old...a young 11 year old, I wouldn't give to an old 12 year old... Anything with cartoons on for a 12 year old...heading on 13...is starting to get a bit baby-ish, I think." [P08]

Elements of interactivity (n=11) such as drawing, writing, and touching (referring to three-dimensional food-related models) were highlighted as being of interest to the 7 to 11 year old child in dietetic appointments:

"...[a good resource for children is] something that's quite hands-on for the kids because they do like to engage in quite a visual and hands-on way." [P02]

A variety of interactive games were mentioned by five dietitians who used them in group situations with preadolescent overweight children. The majority of them involved physical activity.

"...the [resource] I find more useful is a game which has got... fats and sugars in foods. And we do that with like, uh, a packet of [sweets], and some [cola], and some crisps and things. ...So, it's kind of still playing a game related to food. [Children] love that because they can guess, then they get to work it out, and they get to see that they are doing it right. It's just good fun, really." [P07]

*Subtheme 5b: Useful resources help to make information more accessible to the child (n=16)*

As dietitians had attempted to make information verbally accessible to the child (Subtheme 4b), useful dietetic resources aimed to make information available in other ways. Familiar imagery, for example, was more likely to be identifiable and memorable:

"...and for the children to know the food and recognise it, just something identifiable so they could see it again and recognise it, like the Eatwell Plate<sup>1</sup> is identifiable...and people can see it again. And something that's going to hold in their brain, they remember." [P04]

Although, not all dietitians felt that the Eatwell Plate or other well-known resources were equally useful to the child:

"I just think that the Balance of Good Health and the Eatwell Plate Model for kids is complicated...it's complicated for us, as adults." [P09]

The dietitians explained that messages should be conveyed in an age and ability-appropriate way:

"Yeah, [*the resource is*] meant to be aimed for the children to read themselves...there is a lot of text in there and I think that probably it is only suitable for children who are...the older end of your age group... to be looking at really." [P13]

For 7 to 11 year olds, resource content and text needed to be simple, clear and specific. It was pointed out several times that messages should be meaningful and relevant:

"...and there [*are*] enough similar things. You know, there's a recipe for a pizza on [*the Change4Life Meal Planner resource*], which I think it's made out of French bread, but you know it's simple and it's close enough to something that children might like." [P12]

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<sup>1</sup> The Eatwell Plate was a pictorial representation of the main food groups and their recommended proportions for a general healthy diet. It was developed by the Department of Health (FSA 2007), and widely used by health professionals across the United Kingdom. Since this research, the Eatwell Plate has been updated by Public Health England (PHE 2016) and has been renamed the Eatwell Guide.

*Subtheme 5c: Resources can serve as a visual reference for the child, parent and dietitian (n=17)*

Resources were frequently referred to as scaffolding for the conversation, visually supporting verbal discourse. They were portrayed as a visual prompt or a point of reference that assisted the child, parent and dietitian in the communication process.

"...the resource I use all the time...no matter what...is the BMI Chart... ..and...it actually shows if parents are like, 'my child's not overweight,' you can show: 'Well this is a healthy weight. This is where your child is.' And they are like, 'woaw'." [P11]

Dietitians also talked about using information leaflets, or visual aids to illustrate more abstract points.

"...it's things really, that people can relate to ...that are visual... What I do sometimes take along to the one-to-one [appointments]... ..[are] the bean bags that say if you eat 2 biscuits a day...this is how much weight you will gain in a month... ..this is how [extra weight] creeps on and, you know, small [dietary] changes [can be significant]." [P17]

Others used list options that served as an educational tool to discuss specific changes, such as agreeing alternative main meal ideas or changes to school packed lunches. There was evidence that dietitians made use of simple diagrams and hand-drawn sketches to illustrate messages that they were communicate, or to clarify information:

"...sometimes I do sketches on my notepad , when we're [dietitian and child are] talking about portion sizes and I'll refer to the palm of my hand or the palm of their hand,

when we're talking about slices...pieces of ham. 'How much meat do you have?' and fruit and veg... ..and on my [note]pad I'm [drawing] the...the [Eatwell Plate]...or a plate, as it shouldn't be , trying to gauge whether I've interpreted what they're saying about their meals correctly . You know, 'is it that you're having half your plate covered in potato and the other half, ...your chicken, or meat and virtually no vegetables?' And, ...just trying to...you know...use something other than just words..." [P13]

Several dietitians felt that a child-specific resource and handing it to the child conferred child ownership and acknowledged their role in treatment.

### ***3.3.6 Theme 6: Dietetic expectations for resources used in CWM consultations***

This theme highlights that resources also need to be useful to the dietitian, and captures the features that dietitians value in a resource as well as the fact that currently available educational resources could be improved.

#### *Subtheme 6a: Resources should support individual dietetic practice (n=11)*

Dietitians looked for resources that complemented and supported their philosophy or approach to consultations of this sort. There were statements referring to needing to feel 'comfortable using' them.

"...I wish that they could have that portion resource without all of that other writing in it that's talking about losing

weight because that doesn't go along with my message."  
[P09]

*Subtheme 6b: Useful resources are tailorable and adaptable to reinforce specific messages (n=11)*

Dietitians valued flexibility within a resource; the ability to tailor a resource to the individual child (and their family), with a unique set of circumstances and in need of specific advice. Some dietitians appreciated a range of possibilities, presenting options that families could choose from:

"...the fact is that there *[are]* lots of suggestions ...on the Meal Planners, you know. ...And there's bound to be something, there's always something that...that the child would like and they go, 'oh yeah, I'll try that, yeah.'" [P16]

Others preferred the freedom to provide information 'proportionate to change', in other words; specific information that supported those changes that had been agreed:

"...tailored to the individual. That's why I don't give out a lot of booklets because the nugget that that family needs is lost amongst all the other information..." [P08]

Many dietitians endorsed this theme when they referred to writing reminders of discussion in the form of agreed goals, tips and plans.

*Subtheme 6c: Limitations of available dietetic resources (n=10)*

There was a general dissatisfaction with quality and range of dietetic resources currently available for CWM.

"...I feel that we lack in our resources. I haven't really come across a resource that is amazing. I feel that we're kind of making do with resources...we use some of the Change4Life...well I try to use some Change4Life but even...that from a child weight management point of view, is quite limited." [P18]

This dissatisfaction has led to dietitians developing their own resources. Drawbacks associated with producing materials in-house were the initial time and costs involved, and the ongoing need for the content to be reviewed and updated as necessary. A number of dietitians felt that these sorts of leaflets and visual aids looked less attractive and "not half as professional..." [P14].

### ***3.3.7 Dietetic attitude to the use of e-resources within CWM consultations***

Content analysis of responses to the question on the use of e-resources showed that only two dietitians made use of technology in children's outpatient appointments; one used computer-based images and another talked children and parents through an electronic presentation (although the latter was not used for treating childhood obesity). Another dietitian had been involved in piloting a healthy lunchbox e-resource in a school setting (also not specifically for overweight children). Five dietitians usually recommended that children and/or parents access certain websites for further relevant information following their appointment; three of these dietitians had not mentioned using technology in any other way. Two

dietitians<sup>2</sup> suggested the idea of using electronic resources to facilitate communication in the appointment, prior to the interviewer prompting for views on this.

Overall, dietitians (13/17) positively endorsed the concept of e-resources to facilitate face-to-face communication between child and dietitian using words such as 'great', 'fantastic', 'amazing', 'good' and:

"Yeah, no definitely, I think that would definitely be something that would be worth trying." [P06]

Reactions from three dietitians were categorised as neutral as they did not respond to the concept, either positively or negatively. However, two of these participants were interested in being involved in the resource design process. The response from one dietitian pointed out the logistical constraints.

"I suppose it's possibly more suited to somebody who's doing weight management all of the time because... ..I *[have appointments with 4 or 5 children in a clinic]* and they're not all...they're certainly not all weight management and they're certainly not all that age group either. So, by the time I've got my iPod out...iPad out and set it up, they probably wouldn't turn up..." [P12]

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<sup>2</sup> The author had previously worked with one of these dietitians, during which time the idea of integrating technology into dietetic practice was discussed.

### 3.4 Discussion

The purpose of this study was to inform the development of a dietetic e-resource to support CWM appointments (Chapter Four). Specifically, the study aimed to explore dietitians' attitudes and experiences of talking directly to the 7 to 11 year old in CWM consultations and to gauge dietetic opinion on using of e-resources to support communication with the child. By exploring the resources used to support face-to-face dietetic conversations, this study sheds light on how dietitians approach communication in these appointments. There is consensus over dietetic strategies used to manage conversations with the preadolescent child, and resource features that can support these conversations. These are important findings given the paucity of information currently available on the views of dietitians working with young overweight children and their families. Where dietitians differ is their view of the parent and child role in CWM and therefore the extent to which the child should be involved in the consultation.

There is growing support for dietitians to adopt a patient-centred approach to CWM consultations (Resnicow *et al.*, 2006; Stewart *et al.*, 2008). As raised in Chapter One, there is less clarity over who the 'patient' is. NICE implies that the parent should be the focus of the consultation until the child reaches 12 years of age (NICE, 2013). This is interesting, given that the majority of dietitians in this study prioritised communication with the child. It is possible



that some of the participants may have considered the interviewer to be 'an expert' in the field and their opinions influenced by questions being weighted towards child involvement. However, there was also a partnership style of working, in which dietitians valued the differing but complementary roles of child and parent in the treatment process, an approach that also enables the preadolescent child to take on some of the role of 'patient'. Stewart *et al.* (2008) concluded that a child-centred approach to behavioural change could result in a type of partnership working between parent and child. Nevertheless, parents have a role to play in their own right, particularly amongst children of this age group where parents usually have greater control over the child's dietary habits. The impact of parental confidence and motivation to facilitate weight management in the preadolescent child should not be underestimated (Gunnarsdottir *et al.*, 2011). Indeed, some advocate for the parent to be the 'patient', because of their position to constructively influence and shape the child's eating patterns and other lifestyle behaviours (Golan and Weizman, 2001). In this model, the parent is supported to, in turn, support the child (Golan *et al.*, 2006). While relatively few dietitians in this study (n=5) identified with this approach, there was an underlying recognition that parents are integral to the child's treatment (Chapter One).

Dietitians in this study mentioned parental support as a factor that can affect the child's participation in the consultation. Considerable time can be spent helping parents to recognise that their child is

indeed overweight, and their parental responsibility for facilitating behaviour change, as well as dealing with the complexities of a split family. The potential for parents to dominate the conversation and inadvertently discourage the less confident or less able child is a fairly well documented (Chapter One). Unlike Wassmer *et al.* (2004), who found that some parents were able to draw the child into the conversation by encouraging and supporting them to provide information, clinicians who took part in this research tended to talk about seeking to engage the child without parental support, possibly because these data came from dietitians who approached the consultation with the intention of involving the child in the conversation.

Dietitians evidenced a variety of strategies to include the preadolescent child in verbal discourse, many of which appear in an assessment tool used to assess dietetic behaviour change skills (Whitehead *et al.*, 2013). These data describe dietitians establishing rapport with the child from the beginning of the consultation, during the greetings and introductions, to exploring the child's interpretation of the reason for the referral, their motivators for achieving a healthier BMI, and checking understanding of the agreed goals. A two-fold approach emerged: dietitians first tried to engage the child in the conversation by talking about aspects of treatment that might interest them, and then made discussions accessible to them inasmuch as using simpler age-appropriate language, asking focussed questions,

talking about familiar and relevant concepts, and delivering key messages.

The design of helpful dietetic resources complemented these verbal tactics. Furthermore, all dietitians talked about how they routinely used leaflets, diagrams and other resources as visual scaffolding for the verbal discourse. Visual aids have been described as adding an extra layer of meaning (Piaget, 1964) to otherwise abstract concepts such as 'portion size' and 'a balanced diet' (Ward-Begnoche and Thompson, 2008). Resources were mentioned as a way of not only supporting the child, but dietitian and parent exchanges as well. Remarkably, many key information features of resources highlighted as important for the child – simplicity, clarity, memorability, and relevance – were considered equally essential for parent communication aids. There is therefore a need for resources to support triadic communication so as to promote effective parent-child partnership.

Interactivity was mentioned as a design feature to attract the child and hold their attention. Drawing, colouring and touching, were mentioned most often. Beyond the appointment setting, games were the favoured option. In one example, this game was a relay race with the aim of putting cereal boxes in order from lowest to highest sugar content. Typically these activities weave specific nutrition and physical activity concepts into traditional children's game formats, reinforcing verbal dietetic messages. However, there

was general agreement that these types of activities were not suited to the confines of an individual appointment environment.

There is an argument for bringing greater interactivity, in the form of play, into individual appointments with the preadolescent overweight child, which may enhance communication of concepts, learning and adherence. Technology can offer this type of virtual learning environment (Rieber, 1996). Dietitians (n=13) were interested in this concept and there were references to this type of resource encapsulating features that could support child-dietitian communication. Aside from the practical cost of software and equipment, the cost of changing clinical practice will be high. It will also take time for resources that suit all patient groups to be developed. However, it is important that a defined group is identified as a starting point, children with the same health condition and of a similar age. This is to ensure that information and written resources are designed to be relevant, to suit the child's developmental age (Alderson and Montgomery, 1996; Mårtenson and Fagerskiöld, 2008), and the needs of their parents (Hancock *et al.*, 2012; Mikhailovich and Morrison, 2007).

Many dietitians were acutely aware of their role in facilitating effective patient-centred communication within the constraints afforded by the allocated appointment and, as reported by Whitehead *et al.* (2009), most dietitians felt that longer appointments were needed. In particular, dietitians in this study

perceived greater child involvement in these appointments took additional time.

### **3.5 Strengths and limitations**

The author, who conducted and analysed the interviews, trained as a dietitian and worked in a CWM service at the time of the study.

The author's clinical knowledge and experience may have improved the richness of the data, enabling a greater depth of understanding of the issues encountered by participants. Nevertheless over involvement in the interview can threaten validity, and incorrect assumptions can lead to misinterpretation of data (Jootun *et al.*, 2009).

This study set out to analyse dietetic attitudes and approaches to communication with 7 to 11 year old overweight children. Although the study attracted dietitians with differing professional experience, practising in a range of different CWM services across the UK and Ireland, no dietetic assistants or dietetic practitioners contributed to these data. With dietetic support workers playing a greater role in dietetic care (NHS, undated; BDA, 2012), their views would have provided a more holistic perspective.

Moreover, the study was ambitious, setting out to understand the extent to which dietitians involved preadolescent children in weight management consultations, and the suitability of educational

resources used to support behaviour change among children. To the best of the authors' knowledge, this is the first study to begin to explore this area, with no starting point from which to work and no scoping guidance.

Coding is determined by the researcher's interpretation of the data (Braun and Clarke, 2006). Each researcher brings his or her own perspective and understanding to qualitative research (Draper and Swift, 2011). It follows that another researcher will inevitably interpret coded data from a different starting point. Examining the discrepancy in agreement for the first coder further, it became apparent that percentage agreement for the Themes 1 to 3 was 91.7%, but only 57.1% for Themes 4 to 6 (the latter arguably requiring more specialised dietetic knowledge to identify). Codebook revisions to Themes 4 to 6 descriptors led to a small increase in agreement (64.3%) from the second coder.

Further research is needed to verify these themes. Repeating this study from two separate approaches: one to look at child participation in the conversation and how visual aids complement verbal interactions; and the other to explore the suitability of visual aids used within consultations and how they support behaviour change discussions. The exact nature and extent to which dietitians enable child involvement, and facilitate parental involvement in particular, was beyond the scope of this study but warrants further investigation.

### 3.6 Conclusion

Several strong themes emerged from this study, the most fundamental of which was the complex and sensitive nature of treating childhood obesity. In addition to focussing on communicating with preadolescent children, dietitians in this study viewed parental support as integral to the preadolescent child's treatment. Emphasis on partnership working is needed to engage the child and parent in a non-threatening way. Furthermore, helpful dietetic resources were described as those that complemented the verbal strategy of seeking to appeal to the child and then making information accessible to them. Therefore, perhaps unsurprisingly, these dietetic visual aids served as scaffolding for verbal exchanges between the child, the dietitian and the parent (Chapter One).

There is a need to facilitate triadic communication within the CWM consultation. E-resources have the potential for greater interactivity between the dietitian, the overweight child and their parent within such an appointment. By its very nature, technology can be adapted to individual needs and circumstances necessary for health behaviour change (Krebs *et al.*, 2010), flexibility that dietitians in this study expressed a need for. Dietitians need to be involved in the development of e-resources if they are to be integrated into routine dietetic care (Chapter Two). Design would equally need to consider the communication requirements of the child and parent.





## **Chapter Four: Design and development of an e-resource to support child communication with the weight management appointment**

### **4.1 Introduction**

“To improve weight-related outcomes, health professionals may consider designing bespoke, innovative and flexible treatment interventions to match the complexity of the condition.” (Staniford *et al.*, 2011, p. 239)

Technology-based resources have been shown to improve knowledge, self-efficacy, and health outcomes (Chapter Two) and offer an innovative dimension to child weight management (CWM) interventions. Health information resources, including those that are technology-based (Mohr *et al.*, 2011), seem to be most effective when used to supplement, rather than replace the usual care provided by health professionals (Coulter and Ellins, 2007).

Chapter Three sought to understand how dietitians approach the CWM appointment. Data suggests that they endeavour to use visual aids and resources to enhance treatment discussions with the child and their parent(s), as scaffolding for communication (Chapter One). However, dietitians were dissatisfied with existing resources, and were receptive to the potential for e-resources to better meet professional expectations.

To ensure that an e-resource can be integrated into existing dietetic care, it should reflect current practice (Chapter Two). Current

practice has moved towards enabling patients to become active participants in the decision-making process, or patient-centred care (Chapter One). This chapter starts by discussing motivational interviewing (MI) as a patient-centred approach, and its use within CWM interventions. We then outline the framework used to design an e-resource to support child-centred dietetic interventions, before describing the development process and the e-resource itself.

## **4.2 Motivational interviewing (MI): the theory**

Patient-centredness has been distilled to the concept of partnership working (Dow *et al.* 2006). The clinician collaborates with the patient, acknowledging that they each bring their own expertise to the treatment process, an approach first described by Rogers (1951) called the therapeutic relationship. The patient-centred ethos recognises the shared responsibility (Cribb, 1999), of the clinician and patient, to contribute to health outcomes (Dow *et al.*, 2006) and the clinician's role in providing care that empowers the patient to take an active role in their treatment (de Silva, 2014).

MI grew out of this Rogerian principle and is based on the premise that patient-involvement is fundamental to behaviour change (Miller and Rollnick, 1991a). In MI, the role of the clinician is not just to involve the patient but also to direct the patient (Rollnick *et al.*, 2008). In other words, the clinician steers the patient to consider a specific behaviour change goal and then actively seeks to elicit and strengthen the patient's own reasons for change. The guiding

principles of MI (Table 10) recognise that the clinician collaborates with the patient in a partnership that incorporates the patient's perspective, knowledge and expectations (Miller and Rollnick, 2002). The focus of MI is to enable the patient to build a sense of control over the situation, and to provide timely information, tailored to their situation so as to improve self-management (Miller and Rollnick, 1991a; Rollnick *et al.*, 2008).

**Table 10. Key principles of MI** (developed from Miller and Rollnick (2002))

MI principle	Rationale and explanation
Express empathy	Acceptance facilitates change Skilful reflective listening is fundamental Ambivalence is normal
Develop discrepancy	The patient rather than the clinician should present the arguments for change Change is motivated by a perceived discrepancy between present behaviour and important personal goals or values
Roll with resistance	Avoid arguing for change Resistance is not directly opposed New perspectives are invited but not imposed The patient is a primary resource in finding answers and solutions Resistance is a signal to respond differently
Support self-efficacy	A person's belief in the possibility of change is an important motivator The patient (not the clinician) is responsible for choosing and carrying out change The clinician's own belief in the patient's ability to change becomes a self-fulfilling prophecy

How or why this approach works remains unclear. MI has been criticised for lacking a coherent theoretical framework (Draycott and Dabbs, 1998), but Miller and Rollnick (2002) credit a number of theories that have contributed to the development of MI. For the purposes of this thesis, we will consider two of the key contributors: the Stages of Change model (Prochaska and DiClemente, 1983) and Bandura's self-efficacy concept (Bandura, 1977).

#### 4.2.1 MI and Stages of Change

The Stages of Change or Transtheoretical model was developed by Prochaska and DiClemente (1983). It is compatible with MI because it conceptualises behaviour change as an ongoing process (rather than a single event) from precontemplation, or not thinking about change, to action and maintenance (Prochaska *et al.*, 1988; Miller and Rollnick, 1991b). The model acknowledges that the child and their family can move between the various stages of change and that different types of information are needed at different stages (Skinner and Kreuter, 1997). MI strategies are matched to the patient's stage of change (Table 11).

**Table 11. Stages of Change and MI clinician tasks** (Miller and Rollnick, 1991b, p. 18)

Patient stage	Clinician's motivational task
Precontemplation	Raise doubt – increase the patient's perception of the risks and problems with current behaviour
Contemplation	Tip the balance – evoke reasons to change, risks of not changing; strengthen the patient's self-efficacy for change of current behaviour
Determination	Help the patient to determine the best course of action to take in seeking change
Action	Help the patient to take steps toward change
Maintenance	Help the patient to identify and use strategies to prevent relapse
Relapse	Help the patient to renew the processes of contemplation, determination, and action, without becoming stuck or demoralised because of relapse

It is not uncommon for health professionals that use MI techniques for CWM to first assess readiness to change before providing the appropriately matched treatment information (Taveras *et al.*, 2011; Davoli *et al.*, 2013; Wong and Cheng, 2013). By definition the MI approach tailors the intervention to the stage of change, which in

turn strengthens self-efficacy and motivation (Miller and Rollnick, 1991a; Rollnick *et al.*, 1999a). Motivation provides the momentum needed to move the patient through the process of change, helping the individual transition from the precontemplation stage to the maintenance stage (Miller and Rollnick, 1991b), or self-management.

#### **4.2.2 MI and self-efficacy**

Self-efficacy, within the context of behaviour change, was first described by Bandura (1977) when he suggested that someone is more likely to change their behaviour if they believe that they can. This belief in one's own capacity to execute change is influenced by four main information sources: previous performance achievements; vicarious experiences of observing the performance of others; verbal persuasion that encourages belief in one's own capabilities; and physiological state that provides confidence in the ability to cope in the situation (Bandura, 1986). Health professionals may be able to influence a patient's self-efficacy through the process of verbal persuasion.

While some studies (Bernier and Avard, 1986; Wingo *et al.*, 2013) have demonstrated a significant positive relationship between self-efficacy and chronic health conditions in adults, others (Fontaine and Cheskin, 1997; Martin *et al.*, 2004) have not. A key difference between these studies is the level of attention paid to teaching patients self-monitoring skills and techniques associated with

maintaining motivation during challenging situations. Interventions that focus on equipping patients with these self-management skills seem to be associated with improved outcomes. This is true of both the Bernier and Avaré (1986) and Wingo *et al.* (2013) studies. Wingo and her team followed the procedures described in the study protocol (Svetkey *et al.*, 2003). Throughout the 20 treatment sessions (over 28 weeks), there was an emphasis on the adult participant's ability to regulate their own behaviour by setting goals and monitoring progress using self-monitoring tools, such as food and physical activity diaries, to help participants to track progress and provide individual feedback. Participants in the Martin *et al.* (2004) study only received one teaching session (of the six appointments) on how to resist eating in high-risk situations. The task of the health professional is to build the child and parent's confidence and belief in their ability to succeed. Exploring foreseeable difficulties can become an important enabler in MI, particularly during difficult times or setbacks (Rollnick *et al.*, 1999a; Pearson and Grace, 2012a).

### **4.3 Social Cognitive Theory and child weight management (CWM)**

Social Cognitive Theory explains the reciprocal interaction between the child (including cognition, knowledge, attitude, and self-efficacy), their behaviour, and their environment, which includes the media, school, peers and parents (Bandura, 1989). Parental knowledge, attitudes, self-efficacy and behaviours can affect the

child and their weight management efforts. Within this model, others can act as facilitators of child behaviour change (Bandura, 2001). For example, during the clinical appointment the health professional can build motivation for behaviour change, providing appropriately timed and relevant information to the child and their parent(s). At home, parents continue to shape the child's health choices through meal planning and food provision, as well as ongoing behaviour modelling and support.

#### **4.4 MI and CWM**

MI can be applied in the treatment of overweight and obese children, but research in this area is in its infancy. The recent review by Borrello *et al.* (2015) identified six papers that have considered MI for preadolescent CWM. Table 12 details each of these together with two more recent publications (Resnicow *et al.*, 2015; Taylor *et al.*, 2015). Some studies (n=3) with preadolescent children have found no significant effect of MI interventions on weight (Schwartz *et al.*, 2007; Taveras *et al.*, 2011; Small *et al.*, 2014). Others (n=4) (Davoli *et al.*, 2013; Wong and Cheng, 2013; Resnicow *et al.*, 2015; Taylor *et al.*, 2015), on the other hand, have demonstrated substantial baseline to post-intervention improvements in BMI (compared to control groups).

Limited conclusions can be drawn from the eight MI studies (Table 12), because of the extent of their heterogeneity both in design and methodology. Indicators for greater success in MI may include an

emphasis on building motivation and fostering self-management skills, regular contact time (with at least five contacts, some of which may be non face-to-face, e.g. by telephone), tailored educational and self-management resources, as well as ensuring comprehensive MI training for the health professionals involved (Resnicow *et al.*, 2015; Taylor *et al.*, 2015). As Borrello *et al.* (2015) concluded, it is unclear whether the MI should be directed at children, their parents or both.

Resnicow *et al.* (2015) targeted parents of overweight two to eight year old children, Davoli *et al.* (2013) and Taylor *et al.* (2015) used a family-based approach (children were aged four to seven and four to eight years, respectively), while Wong and Cheng (2013) treated 9 to 11 year olds directly, providing parents with telephone support between child sessions. BMI centile difference between post-intervention treatment and control groups was significant ( $t=3.32$ ,  $p<0.01$ ) (no standard error or effect size were reported) (Wong and Cheng, 2013). However, the intervention only lasted 14 weeks, with no post-intervention follow-up.



**Table 12. Summary of studies using MI to prevent or treat overweight in preadolescent children, including study design, target group (child or parent), intervention description and frequency, study period and outcomes**

Study	Study objective (design)	Target group, child age	Deliverers of MI (number involved)	MI training provided	Intervention description (number of MI sessions, length of sessions)	Comparison group	Study period (follow-up period)	Data analysis	Study outcomes
van Grieken <i>et al.</i> (2013)	To measure the effects of an MI on 5 y olds (RCT)	Parents, 5 y olds (n=617)	Primary care paediatricians and school nurses (9 teams, clinician numbers not specified)	Unclear. According to document referred to (Bulk-Bunschoten <i>et al.</i> , 2005), clinicians are routinely expected to have at least 2 h of MI training. No study-related training stated	3xMI sessions at 3 mth, 6 mth and 12 mth (length unknown). Areas addressed: 4 lifestyle behaviours: playing outdoors, eating breakfast, reducing sugar-sweetened beverages, reducing sedentary, screentime (1 or 2 behaviours addressed per session)	Usual care	12 mth, 12 mth f/up	Intention to treat	No significant change in BMI difference between control and intervention groups (-0.16, 95% CI: -0.60 to 0.27, $p=0.46$ )
Small <i>et al.</i> (2014)	To determine the feasibility of a primary care-based MI intervention and the preliminary effects on health outcomes (RCT)	Parents, 4 to 8 y olds (n=67)	Research assistants (number not specified)	Training given but no details provided. Training focussed on collaborating with parents to identify realistic healthy lifestyle goals, to develop clear steps to reach goals, encouraging parents to self-monitor and identify new goals as needed, as well as problem-solving	MI group: 4x30 to 60 min sessions (on weight management) Information provided by audio: Establishment of health habits in children, nutritional and physical activity information (increasing activity and decreasing sedentary time), age-specific information regarding the child's behaviour in response to change Bags of toys were given to children in both groups, to facilitate activities that parents would be encouraged to complete with their child	Control: 4x30 to 60 min sessions (on other health topics) Audio-taped information given on non-weight-related subjects, e.g. sun protection	16 wk, 3 mth and 6 mth f/up	Not stated	No significant differences between BMI change. Intervention group reduced waist circumference, which persisted for 3 mth and 6 mth

**Table 12 cont. Summary of studies using MI to prevent or treat overweight in preadolescent children, including study design, target group (child or parent), intervention description and frequency, study period and outcomes**

Study	Study objective (design)	Target group, child age	Deliverers of MI (number involved)	MI training provided	Intervention description (number of MI sessions, length of sessions)	Comparison group	Study period (follow-up period)	Data analysis	Study outcomes
Schwartz <i>et al.</i> (2007)	To implement an appointment-based BMI prevention programme (non-randomised study)	Parents, 3 to 7 y olds (n=91)	Primary care paediatricians (n=15), dietitians (number unknown) (15 practices)	2 d MI training plus another 2 d training session 12 mth later. 1 or 2 of the MI sessions provided by each clinician were audio-taped for clinical supervision and quality control. Feedback on these were provided by tel along with MI coaching	<i>MI group:</i> 1x10 to 15 min paediatrician session <i>MI+ group:</i> as for MI group, and 1x45 to 50 min session dietitian Various eating, physical activity and TV viewing behaviours were optional MI topics. Resources were tips sheets on health eating and physical activity, a video that modelled parental behaviour around feeding issues	Usual care	3 mth study period, 3 mth f/up	Per protocol analysis	Decreases in mean BMI across all three groups, but not significant ( $p=0.85$ ): Control group mean BMI: -0.6 <i>MI group:</i> -1.9 <i>MI+ group:</i> -2.6
Resnicow <i>et al.</i> (2015)	To test the efficacy of MI delivered by paediatricians and dietitians to parents of overweight children	Parents, 2 to 8 y olds (n=645)	Primary care paediatricians (n=unknown), dietitians (involved in MI+ sessions) (n≥7) (30 practices involved)	2 d of MI and behaviour therapy training All clinicians were videoed counselling a standard patient, and rated using a standardised MI fidelity scale. Tel feedback about counselling technique provided, along with offer of an additional tel supervision session	<i>MI group:</i> 4xpaediatrician MI sessions (3 sessions in y 1 and 1 session in y 2) <i>MI+ group:</i> as for MI group + 6xdietitian MI sessions (scheduling flexibility across study period, weight to y 1) Patient-centred, building motivation, goal-setting. Topics covered: snack foods, fruit and vegetables, sugar-sweetened beverages, TV/screen time, physical activity/exercise. Tailored educational behaviour change resources and self-monitoring logs provided (as required)	Usual care	24 mth, no f/up	Per protocol analysis	Significant difference in mean change in BMI: Control group: -1.8 <i>MI group:</i> -3.8 <i>MI+ group:</i> -4.9 MI+ group was significant lower than control group ( $p=0.02$ ). MI 'dose' was positively and significant associated with BMI centile difference (SE) (4.8 (0.99), $p<0.05$ )

**Table 12 cont. Summary of studies using MI to prevent or treat overweight in preadolescent children, including study design, target group (child or parent), intervention description and frequency, study period and outcomes**

Study	Study objective (design)	Target group, child age	Deliverers of MI (numbers involved)	MI training provided	Intervention description (number of MI sessions, length of sessions)	Comparison group	Study period (f/up)	Data analysis	Study outcomes
Wong and Cheng (2013)	To assess the effects of face-to-face and tel MI-consultations to promote weight loss in obese children (pre and post-intervention study)	Children, 9 to 11 y (n=185)	Nurse (n=1)	Training given but no details provided	<i>MI group:</i> 3x30 min sessions every 3 wks, 2 sessions every 4 wks <i>MI+ group:</i> as for MI group, with parent tel consultations 1 wk before each MI session (n=5) Areas addressed: importance and benefits of weight loss, facilitators and barriers, diet and physical activity habits, strengthening self-efficacy, relapse prevention. Self-monitoring resources provided, e.g. 7 d diet journal and exercise log	No treatment provided (n=49)	14 wk, no f/up	Not stated	Significant differences in pre and post-intervention <i>MI group</i> BMI ( $t=5.36$ , $p<0.01$ ) Significant between group differences, i.e. <i>MI</i> vs control ( $t=3.32$ , $p<0.01$ ) and control vs <i>MI+</i> ( $t=3.84$ , $p<0.01$ )
Taveras <i>et al.</i> (2011)	To examine the effect of MI on obesity (in the primary care setting) (RCT)	Parents, 2 to 6 y olds (n=475)	Paediatric nurses and practitioners (10 paediatric practices) (n=not known)	Training given but no details provided	<i>MI group:</i> 4x25 min MI-sessions, and 3x15 min tel calls Brief focussed tailored negotiation, parents given responsibility of identifying problem behaviours, encouraging parents to resolve ambivalence about behaviour change, goal-setting. Resources for self-monitoring, e.g. electronic TV monitoring device, tailored materials and interactive website, e.g. providing recipes, incentives, e.g. eater bottles, books, snack containers, etc.	Usual care	12 mth, no f/up	Intention to treat	Smaller but non-significant increases in intervention participants (0.21, $p=0.15$ ). Significant reduction in TV viewing and fast food. More significant BMI changes among girls (-0.38; 95% CI: -0.73 to -0.03, $p=0.03$ ) and in households with an income of <\$50000 (-0.93, $p=0.01$ )
Davoli <i>et al.</i> (2013)	To evaluate the effect of family-based MI on BMI in overweight children (RCT)	Parents and children, 4 to 7 y olds (n=372)	Primary care paediatricians (n=10)	20 h of training – no details given	Baseline 1x45 to 60 min 3 mth: 1x45 to 60 min 4 to 9 mth: 2x30 to 60 min MI sessions 12 mth: 1x45 min Families left each MI session with 2xagreed SMART goals (1xfood and 1xphysical activity-related). Transtheoretical model used	Usual care	12 mth, no f/up	Intention to treat	Significantly lower increase in BMI in MI group (-0.30, $p=0.007$ ). Greater effect in girls (-0.51, $p=0.072$ ), and if mother had a higher (>13 y) education (-1.04, $p=0.008$ )

**Table 12 cont. Summary of studies using MI to prevent or treat overweight in preadolescent children, including study design, target group (child or parent), intervention description and frequency, study period and outcomes**

Study	Study objective (design)	Target group, child age	Deliverers of MI (numbers involved)	MI training provided	Intervention description (number of MI sessions, length of sessions)	Comparison group	Study period (f/up)	Data analysis	Study outcomes
Taylor <i>et al.</i> (2015)	To determine whether a family-based intervention using frequent contact and limited involvement is effective in reducing excessive weight compared to usual care	Family-based, 4 to 8 y (n=206)	MI mentors: nutritionist (n=1), exercise trainer (n=1)	According to Dawson <i>et al.</i> (2014), 2 d training and online MI training (delivered over a 3 mth period). Video-recordings of sessions were rated using a standardised MI fidelity scale (timing and frequency of recordings is unclear) for feedback. Fortnightly clinical supervision with the clinical psychologist	<i>Baseline appt</i> (both parents with dietitian, exercise specialist, clinical psychologist and MI mentor): 1 to 2 h <i>MI sessions</i> (with MI mentor only): monthly in y 1 and quarterly in y 2, typically alternating between face-to-face sessions (30 to 40 min) (n=8) and tel calls (5 to 10 min) (n=8) Areas addressed: individual goals were negotiated and relevant resources based on behavioural strategies, were discussed. These included parenting strategies to manage child behaviours, goal-setting, problem-solving, as well as a range of information related to dietary intake and physical activity	Usual care, <i>Baseline appt</i> (usually mothers only with trained researcher): 1x30 to 45 min Areas addressed: individualised feedback about diet and activity habits, with relevant resources 6 mth: 1x15 to 30 min support session but no new information or resources given	24 mth, no f/up	Intention to treat	Children in the MI group had significantly lower BMI (-0.34, 95% CI: -0.65 to -0.03) and BMI z-score (20.12, -0.20 to -0.04) than children in the comparison group. Children in the MI group were physically active more often, i.e. counts per minute (60, 95% CI: 4 to 115, $p=0.035$ ), and they consumed more fruit and vegetables (1.0, 95% CI: 0.00 to 2.1) and low non-nutritive high fat/sugar foods (-0.3, 95% CI: -0.5 to -0.0), and less of these high calorie foods were available in the home ( $p=0.002$ )

MI – motivational interviewing, BMI – body mass index, SMART – specific, measurable, attainable, realistic, timely, Appt – appointment, Y – year(s), Mth – month(s), Wk – week(s), D – day(s), H – hour(s), Min – minute(s), Tel – telephone, F/up – follow-up, TV – television, CI – confidence interval

Half of the studies (Schwartz *et al.*, 2007; Taveras *et al.*, 2011; Wong and Cheng, 2013; Small *et al.*, 2014) failed to measure the long-term effects of MI. Children in the Davoli *et al.* (2013) study were recalled after 12 months (Broccoli *et al.*, 2016) and those in the intervention group had regained more than the control group, with an increased mean BMI change in the intervention group (post-intervention to 12 month follow-up) (1.06, 95% CI: 0.90 to 1.22) than in the usual care group (0.78, 95% CI: 0.59 to 0.97). The between-group difference in BMI was significant (Mann-Whitney U-test,  $p=0.011$ , median 1.06 vs 0.78). van Grieken *et al.* (2013) similarly found no lasting effect on BMI at one year following the intervention in five year olds. MI interventions may benefit from a period of lower level input before sessions are stopped altogether, such as the study conducted by Taylor *et al.* (2015).

Aside from the potential short-term effect on MI, getting families to complete MI treatment can be a challenge, and it should be noted that only three of the eight identified MI studies analysed data on the intention to treat basis. Attrition rates, particularly in studies that target parents (Schwartz *et al.*, 2007; Resnicow *et al.*, 2015), can be high, averaging 13 to 31% and increasing with the number of MI sessions involved. In one study (Bean *et al.*, 2015), MI participants were more adherent than controls at three months ( $p=0.040$ ) and six months ( $p=0.026$ ). Nevertheless, intervention group attrition rates were high at three months (27%) and increased at six months (52%). MI that aimed to address CWM as a

parent-child partnership (Taylor *et al.*, 2015) (n=196) had markedly lower attrition rates (8% in the intervention and 4% in the control group), possibly because sessions were held either at the university or in the family home. Intervention families received intensive MI support: monthly contact for the first 12 months and then quarterly thereafter. They found a significantly lower BMI z-score (-0.12, 95% CI: -0.20 to -0.04) in the intervention group compared to the control. Given that Waters *et al.* (2011) considered a BMI z-score reduction of 0.15 (calculated in children aged 6 to 12 years) to represent a small but clinically significant change in BMI, the BMI outcome for the Taylor *et al.* (2015) study is noteworthy.

Following the successful use of MI, Resnicow *et al.* (2015) touched on a crucial factor. The research team raised the question of how MI can be integrated into clinical practice.

#### **4.5 Integrating MI into dietetic weight management**

NICE (2014b) recommends a patient-centred approach to behaviour change interventions with strategies that have been shown to be effective. Rollnick *et al.* (1999a) have suggested that MI can be thought of as a framework within which to apply these principles, that can be adapted to individual needs. The starting point is readiness to change, but importance and confidence are equally valuable:

“If a change feels important to you, and you have the confidence to achieve it, you will feel more ready to have a

go, and more likely to succeed” (Rollnick *et al.*, 1999b, p. 18).

Effective interventions nurture a sense of individual control, such as building self-efficacy, helping patients to develop intentions and to translate those into concrete goals, as well as fostering skills to cope with different situations in order to prevent relapse (NICE, 2014b). Central to current advice is tailoring treatment to the needs of the patient (and their family), considering their priorities and motivations (NICE, 2013; NICE, 2014b). Interventions should therefore be tailored to individual beliefs, attitudes, intentions, skills, and existing knowledge (Pearson and Grace, 2012b).

As discussed in Chapter One, whether the child or the parent is the focus of the behaviour change intervention is important, as effective treatment should be age-appropriate. However, Borrello *et al.* (2015) were unable to recommend the extent of child and parental involvement in MI CWM interventions. A separate systematic review (Janicke *et al.*, 2014) found no relationship between parental involvement and clinical outcomes. Accepted clinical practice in CWM interventions views family members as important to successful interventions (Barlow, 2007; Epstein *et al.*, 2007; SIGN, 2010; NICE, 2013; NICE, 2015) but, given the shift towards patient-centred care, involving children in behavioural interventions should be supported. Child communication needs to be considered. Offering information and then allowing the child, and their parent(s), to integrate its meaning and apply it to their own situation helps to

build motivation to change (Rollnick *et al.*, 1999c).

Several MI interventions (Schwartz *et al.*, 2007; Davoli *et al.*, 2013; Small *et al.*, 2014; Resnicow *et al.*, 2015; Taylor *et al.*, 2015) have used resources to support MI interactions. However, how they have been used to support verbal communication within MI sessions is unclear. Furthermore, they tended to be health information leaflets aimed at parents, rather than the child. Taveras *et al.* (2011) developed resources to support families in behaviour change, which included printed materials as well as an interactive website with educational modules. Their target audience is unclear, but given the age of the children (two to six years) and the fact that the resources included recipes, it may be assumed that they were intended to support parent communication. The effect of using visual references in behaviour change interventions to support child communication with the preadolescent child is yet to be explored.

The *Feed-back* e-resource was therefore designed to support communication between the dietitian and the 7 to 11 year old child, within a CWM appointment with their parent/carer(s). Having explored the theoretical underpinning for the e-resource – the importance of child-centredness, a partnership approach between the child and their parent/carer(s), considering confidence and motivation, building self-efficacy, and supporting self-management – an appropriate framework was needed to design a prototype.



## **4.6 A framework for developing the e-resource**

As an emerging field, very little guidance exists on designing and developing e-resources to support face-to-face consultations with paediatric patients. Documentation of the development of e-resources (identified in Chapter Two) was poor, offering limited detail on the design or development process, and health professional or child involvement (Table 13). In this section, aspects of appropriate frameworks are explored, and then used to create a suitable structure.

### ***4.6.1 Approach to user involvement in the design process***

Chapter Two highlighted the importance of involving clinicians in e-resource development. Involving users may increase its use and the likelihood of clinical effectiveness (Bridgelal Ram *et al.*, 2008; Aldiss *et al.*, 2015). Coulter *et al.* (2013) have proposed a logical approach to designing electronic decision aids for adult patients. Their comprehensive framework recommends involving both clinicians and patients from the outset by establishing a steering group to address the needs of both user groups. The patient-users for this prototype are overweight preadolescent children, and their role within the design process requires clarification.

**Table 13. Design and development process of e-resources identified in the systematic review, including health professional and child involvement, and usability testing**

Study	E-resource	Framework/process described to develop the e-resource	E-resource design, development and testing	
			Health professional involvement	Child involvement
Eckler (1998)	<i>Interactive Consult 2.0</i>	Not described	Not stated	Not stated
Brown <i>et al.</i> (1997)	<i>Packy and Marlon</i>	Not described	Not stated	Not stated
Hazzard <i>et al.</i> (2002)	<i>STARBRIGHT World</i>	Not described	Not stated	Not stated
Davis <i>et al.</i> (2004)	<i>STARBRIGHT World: Fitting Cystic Fibrosis into your Everyday Life</i>	Not described	Not stated	Not stated
Redsell <i>et al.</i> (2003)	<i>All About Nocturnal Enuresis</i>	Iterative cycle of development involving children (age unknown), parents and health professionals in a hospital-based enuresis clinic (n=not stated) (Evans <i>et al.</i> , 1998). No further detail available	The e-resource was peer-reviewed by 2 health professionals (not involved in the development process)	Usability tested with 8 to 10 year olds (n=43) from a primary school
Krishna <i>et al.</i> (2003)	Interactive Multimedia Program for Asthma Control: <i>IMPACT Asthma Kids</i>	<i>IMPACT</i> was initially developed in an illustrated storyboard format	The development team was 'multidisciplinary' but details about clinicians are not available	Not stated
Connelly <i>et al.</i> (2006)	<i>Headstrong</i>	Not described	Not stated	Not stated
McPherson <i>et al.</i> (2006)	<i>The Asthma Files</i>	Not described	Health professionals (n=unknown) were involved in the design and development process but their role is unclear	Piloting with 7 to 14 year old children (n=31) with asthma, within an outpatient clinic setting, over the course of 1 year (McPherson <i>et al.</i> , 2002)
Bartholomew <i>et al.</i> (2000) Bartholomew <i>et al.</i> (2006)	<i>Watch, Discover, Think and Act</i>	Not described	Not stated	Some testing was done with 7 to 12 year old children but no details about the number of children given, or whether they had asthma

**Table 13 cont. Design and development process of e-resources identified in the systematic review, including health professional and child involvement, and usability testing**

Study	E-resource	Framework/process described to develop the e-resource	E-resource design, development and testing	
			Health professional involvement	Child involvement
Dragone <i>et al.</i> (2002)	<i>Kidz with Leukemia: A Space Adventure</i>	<p>Patient-centred design, guided by health professional involvement:</p> <ul style="list-style-type: none"> <li>Needs assessment conducted with children and parents from the relevant age group, and health professionals</li> <li>Script and storyboards developed by paediatric oncology nurse practitioner (alongside multidisciplinary review panel that included health professionals, multimedia designers and a child patient)</li> <li>Iterative design process that involved ongoing feedback from child-patients, parents and clinicians via focus groups, questionnaires, interviews, and pilot testing</li> </ul>	<ul style="list-style-type: none"> <li>Interviews with health professionals, working in paediatric oncology (n=24), guided content development</li> <li>Health professionals (n=21) assessed the CD-ROM prototype</li> <li>A pediatric oncology nurse practitioner developed the script, which was reviewed by a multidisciplinary panel (n=14) that included university-based experts in pediatric oncology, developmental psychology, and children's health promotion, as well as an adolescent with leukemia</li> <li>Telephone interviews were conducted with eight paediatric oncology clinicians to discuss adaptations for children aged 4 to 6 years</li> </ul>	<ul style="list-style-type: none"> <li>Focus groups with 7 to 11 year old children (with leukemia) (n=14) and their parents (n=16) were held to guide content development</li> <li>CD-ROM prototype was evaluated by 7 to 11 year olds (n=20) and their parents</li> <li>Further focus groups were held with 4 to 6 year olds with leukemia (n=7) and their parents (n=8) to determine the adjustments needed for the CD-ROM to be suited to this younger age group</li> <li>Healthy 4 to 6 year olds (n=6) tested usability of the prototype</li> <li>Following changes, further testing was carried out with seven 4 to 11 year old children with leukemia</li> </ul>
Ritterband <i>et al.</i> (2003)	<i>U-Can-Poop-Too</i>	Not described	<p>Professionals from clinical psychology, paediatric gastroenterology, nursing and paediatrics were involved in the creation and refinement of the content. Further details are unable, e.g. numbers of each profession and the extent of the involvement</p>	Not stated

**Table 13 cont. Design and development process of e-resources identified in the systematic review, including health professional and child involvement, and usability testing**

Study	E-resource	Framework/process described to develop the e-resource	E-resource design, development and testing	
			Health professional involvement	Child involvement
Homer <i>et al.</i> (2000)	Asthma Control	Not described	A 'generalist' and a specialist asthma expert were named as members of the development team (along with a software programmer and members of the research team)	Individual and group pilot testing with children (n=not stated) of similar age to the study participants (i.e. 3 to 12 year olds). These children were defined as socioeconomically more advantaged than study participants. No changes were reportedly made following usability testing/piloting, but authors mentioned that "minor modifications [ <i>were made</i> ] in response to comments and suggestions by early users [ <i>after the study had commenced</i> ]" (Homer <i>et al.</i> , 2000, p. 211)
Runge <i>et al.</i> (2006)	Not stated	Not described	Not stated	Tested successfully in a "focus group [ <i>of</i> ] 50 children in an inpatient setting" (Runge <i>et al.</i> , 2006, p. 583). No further details about procedures, whether the children had asthma or their ages

Druin (2002) identified different types of child involvement at various stages of e-resource development:

- Design partner: equal stakeholders throughout the process,
- Informant: at various stages of the process, and
- Tester: offering responses to developed prototypes versions towards the end of the development process

There is a growing move towards consulting children from the outset, called participatory design (Scaife *et al.*, 1997; Druin, 2002; Williamson, 2003; Allsop, 2010; Tsvyatkova, 2013; Manning *et al.*, 2015), largely because a child's unique complementary perspective has been found valuable to the design process (Nesset and Large, 2004).

How and when children are invited into the design process needs to be carefully considered, particularly when the children in question are also patients. Some NHS Trusts have established patient-user groups or advisory panels. Patient volunteers can also be accessed through condition-specific support groups (Tsvyatkova, 2013), but involving child-patients through clinical services requires ethical approval (Bridgelal Ram *et al.*, 2008). A number of health-related e-resources have failed to specify whether the children involved in development were patients (Bartholomew *et al.*, 2000; Homer *et al.*, 2000; Runge *et al.*, 2006) (Table 13). Some developers have accessed non-patient groups, such as schoolchildren (Evans *et al.*, 1998; Redsell *et al.*, 2003; Allsop, 2010), to circumvent the need

for NHS ethics approval. However, children receiving treatment for a condition are likely to experience a resource in a different way to non-patients. Aquino Schluzas *et al.* (2013) involved nurses (n=18) in early stage design of a new medical product. Nurses were categorised as either expert or novice, depending on their experience and competence in the field. Novice nurses largely detected usability issues while experts focussed on design functionality. Similarly, non-patient 'novice' children may help to identify usability errors, but children receiving weight management treatment could comment on the e-resource suitability to CWM treatment. Both contributions are important.

The point at which child-patients, or experts, are involved may depend on the purpose of the e-resource. In order to design an interactive e-book for children with newly diagnosed type 1 diabetes, Tsvyatkova (2013) first accessed preadolescent children (aged 8 to 12 years) with diabetes (from diabetes support groups) (n=7) and then explored concepts with non-diabetics (from community groups) (n=14). Small groups of children with diabetes helped to identify key themes (Tsvyatkova and Storni, 2015) and then non-patient peers assisted in further exploration of these concepts to ensure that information was pitched at an age-appropriate level (Tsvyatkova, 2013; Tsvyatkova and Storni, 2015). In contrast, Aquino Shluzas and Leifer (2014) reviewed case studies with health professionals and found that, irrespective of the order, involving a wide range of users, improves clinical usability of the

technology.

Coyle *et al.* (2007) proposed using technology to support face-to-face consultations with adolescents with mental health problems. Instead of prioritising the involvement of young people, they emphasised collaborating with the relevant health professionals, to ensure that the design was compatible with existing working methods, only introducing the intervention to adolescent patients once health professionals had verified its therapeutic validity. Given the sensitive nature of CWM (Chapters One and Three), this approach was favoured for the *Feed-back* e-resource.

Another consideration is generating sufficient interest from clinical experts to enlist their expertise (Dragone *et al.*, 2002; Bartholomew *et al.*, 2006). Involving clinicians is important because they have the power to determine whether e-resource interventions are incorporated into clinical practice, or not (Stacey *et al.*, 2014). This thesis invited dietitians into the planning stages, before the design process had begun (Chapter Three).

#### **4.6.2 Creating a suitable framework for development**

Having established the dietitian as the key stakeholder in the early stages of design, the next step was to consider how further development of the e-resource could be progressed.

Boyle *et al.* (2006) suggested that Agile Methodology could offer a

flexible e-resource development structure. The developed framework (Figure 6), mirrors the ethos of the Methodology, developing small (functional) releases of the software and seeking ongoing collaboration from dietitians to make iterative improvements. With no similar e-resources available for dietitians to base their expectations on for the development of the new prototype, an Agile approach would give participants early insights into the scope of the e-resource, facilitating their input to ensure that the end product meets user requirements and expectations (Walters, 2007). An extract from the Agile Methodology manifesto reads:

“The highest priority is to satisfy the customer through early and continuous delivery of valuable software.” (Manifesto 2001)

Just as young children require scaffolding for improved communication (Vygotsky, 1978), so a functioning piece of software can help stakeholders to understand what they do not want, so that they are more able to express what they do want (Sutherland, 2013). The Agile design approach is therefore deemed particularly suited to new product development (Manifesto, 2001), such as the *Feed-back* e-resource.

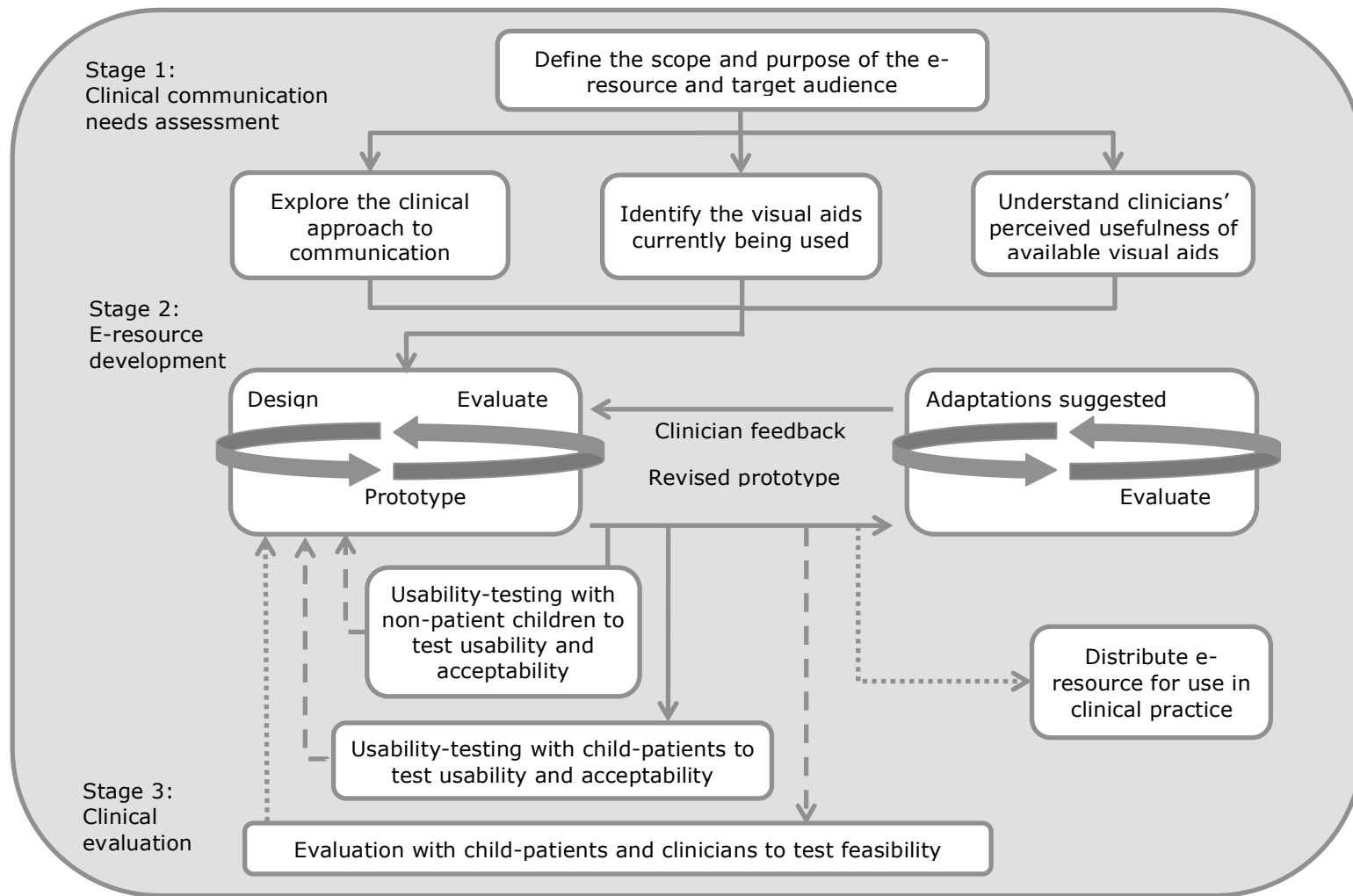


## **4.7 Developing the *Feed-back* e-resource**

### ***4.7.1 Clinical communication needs assessment***

Having explored the dietetic approach to the CWM appointment and recognising the importance of a partnership approach to communication with the child and the parent (Chapter Three), the next stage in the development process (Figure 6) was to identify visual aids being used in practice and to consider dietitians' perceptions of their usefulness. Data from Chapter Three further identified a number of visual aids routinely used in dietetic CWM consultations. Images and resources were used as visual references for the conversation, however, many dietitians suggested how some of these could be improved upon. Both the visual aids and the comments made about them have been summarised in Table 14.

Several visual aids (listed in Table 14) are recommended for behaviour change interventions within CWM: the populated and blank Eatwell Plate (FSA, 2007) (used for dietary analysis), the typical day template, and SMART goals (Pearson and Grace, 2012b). The Change4Life resources (DoH, undated) were identified as useful (Chapter Three) because they are familiar to families. Many dietitians favoured Change4Life design features, describing them as colourful, attractive, appealing, and fun.



**Figure 6. Framework for developing the *Feed-back* e-resource**

**Table 14. Summary of existing dietetic resources used in CWM consultations, with descriptors of general dietetic preferences for content, and presentation**

Dietetic resources	<i>Content</i>	Dietetic preferences	
		<i>Appearance and structure</i>	
Growth and BMI charts	Reinforce specific messages	Visually:	
Eatwell Plate	Messages are:	<ul style="list-style-type: none"> <li>attractive and appealing</li> <li>bright and colourful</li> </ul>	
Change4Life resources (various)	<ul style="list-style-type: none"> <li>meaningful</li> <li>relevant</li> </ul>	<ul style="list-style-type: none"> <li>age-appropriate</li> <li>picture-based (with familiar imagery – identifiable and memorable)</li> </ul>	
Capturing food and drink intake, i.e. typical day, 24 hour recall, food diary	<ul style="list-style-type: none"> <li>culturally familiar</li> <li>clear</li> <li>age-appropriate</li> <li>ability-appropriate</li> </ul>	<ul style="list-style-type: none"> <li>professional-looking</li> </ul>	
Reward charts	<ul style="list-style-type: none"> <li>evidence-based</li> </ul>	Minimal text that is:	
SMART goals, written goals	Tailorable and adaptable:	<ul style="list-style-type: none"> <li>simple</li> <li>clear</li> <li>specific</li> </ul>	
Portion size guidance (various)	<ul style="list-style-type: none"> <li>to complement individual dietetic practice</li> </ul>	Interactive	
Lunchbox ideas	<ul style="list-style-type: none"> <li>to suit the child (and their family), requiring unique advice</li> </ul>	Fun and engaging	
Food labelling			

Resources (Table 14) were studied for style, content, and potential for interactivity. While some provided useful ideas, tried to communicate concepts that were over ambitious, with too many health messages. Too much information can be confusing and off-putting. Roper and Hogan (2003) produced a colourful 16 page A4 booklet, for preadolescent children, that covered numerous CWM concepts: nutrient functions and sources, food labelling, food additives, food advertising strategies, and a glossary of food-related words and phrases (such as cholesterol, saturated fat, polyunsaturated fat, and monounsaturated fat). The colourful images were suitable for the preadolescent child but messages were arguably too advanced and numerous for this age group.

The starting point for designing the *Feed-back* e-resource was to create age-appropriate, clear, and simple messages (Chiasson and

Gutwin, 2005) that the child could actively integrate into their existing understanding (Chapter One).

#### **4.7.2 Iterative e-resource development and evaluation**

##### *4.7.2.1 Design and development*

Draft e-resource sections (Table 15) were based on clinical recommendations for treatment (Chapter One). Written objectives stipulated a clear purpose for each section. Messages from existing visual aids (Table 14) were extracted and used as a springboard for designing interactivity. Storyboards (Figure 7) were then created, using iMockups for iPad®, to show general screen functionality, multimedia elements and animations.

Four core sections (Table 15) were further developed into the *Feed-back* e-resource prototype. These sections represent topics regarded as typical to most CWM consultations (Barlow, 2007; SIGN, 2010; NICE, 2013; NICE, 2015).

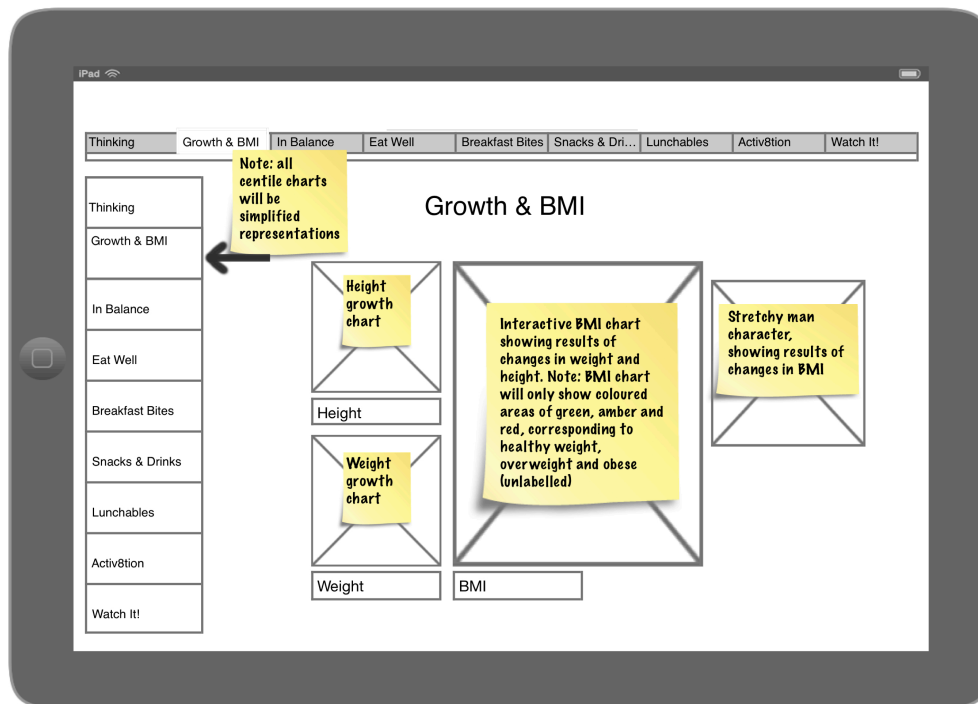
Due to dietitians' expressed regard for the Change4Life resources (Chapter Three); the simplicity of the figures, and their colourful nature that seemed to appeal to a wide age range (including preadolescent children), drawings created for this e-resource attempted to replicate these qualities. Images were created in iDraw for iPad® and then imported into the resource library of the

development platform Tumult Hype® (selected for ease of use and functionality across web browsers).

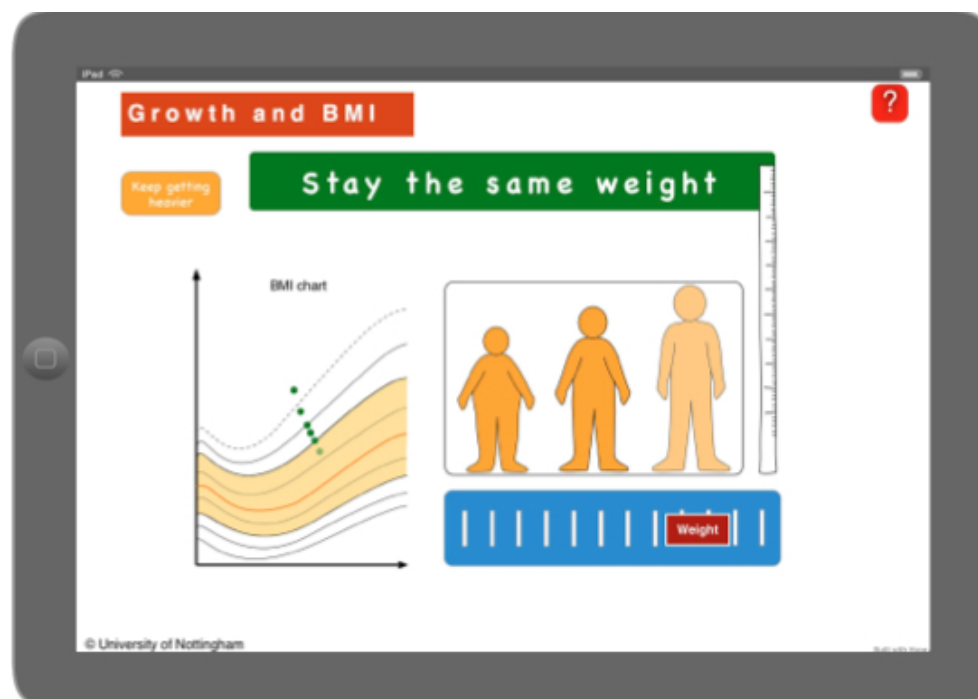
**Table 15. Draft sections for the *Feed-back* e-resource**

Sections	Descriptions and objectives
Time to Think*	Helps to open discussions with the child about being a healthy weight: <ul style="list-style-type: none"> <li>- to understand the child's thoughts on what it would mean to them to be a healthy weight (what is important)</li> <li>- to establish the child's readiness, and confidence, to make lifestyle changes</li> <li>- to identify enablers and barriers to change</li> </ul>
Growth and BMI*	Illustrates the link between BMI and change in body shape over time: <ul style="list-style-type: none"> <li>- to illustrate periods of weight maintenance, versus episodes of further weight gain</li> </ul>
In Balance*	Explains the relationship between energy intake and expenditure: <ul style="list-style-type: none"> <li>- to demonstrate energy balance (and imbalance)</li> <li>- to describe the relative calorie content of selected food, and how these calories are used in different activities</li> </ul>
Eat Well*	Provides a platform for discussing the sections of the Eat Well Plate, and how the child's diet compares to the plate <ul style="list-style-type: none"> <li>- to provide an opportunity to discuss foods contained in the food groups and the main nutritional function of each group</li> <li>- to enable the child to analyse their own diet</li> <li>- to help the child to set their own diet-related goals</li> </ul>
Breakfast Bites	A teaching and assessment tool: <ul style="list-style-type: none"> <li>- to provide the opportunity to talk about the importance of having breakfast, and that some breakfasts are better than others</li> <li>- to enable the child to analyse their breakfast choices</li> <li>- to agree improvements</li> </ul>
Lunchables	A teaching and assessment tool: <ul style="list-style-type: none"> <li>- to explain what makes a lunchbox healthy</li> <li>- to help the child to describe the contents of a typical school lunchbox</li> <li>- to offer the chance to make improvements</li> </ul>
Active8	A teaching and assessment tool: <ul style="list-style-type: none"> <li>- to demonstrate why physical activity is important and that children are recommended to have 60 minutes of medium intensity physical activity each day (and what this means)</li> <li>- to establish the child's current activity levels, and how this compares to the recommendation</li> <li>- to decide on specific ways to increase activity levels</li> </ul>
Watch It!	A teaching and assessment tool: <ul style="list-style-type: none"> <li>- to help the child to assess their own leisure screentime</li> <li>- to challenge the child to find ways to work towards the advised two hours maximum each day</li> </ul>

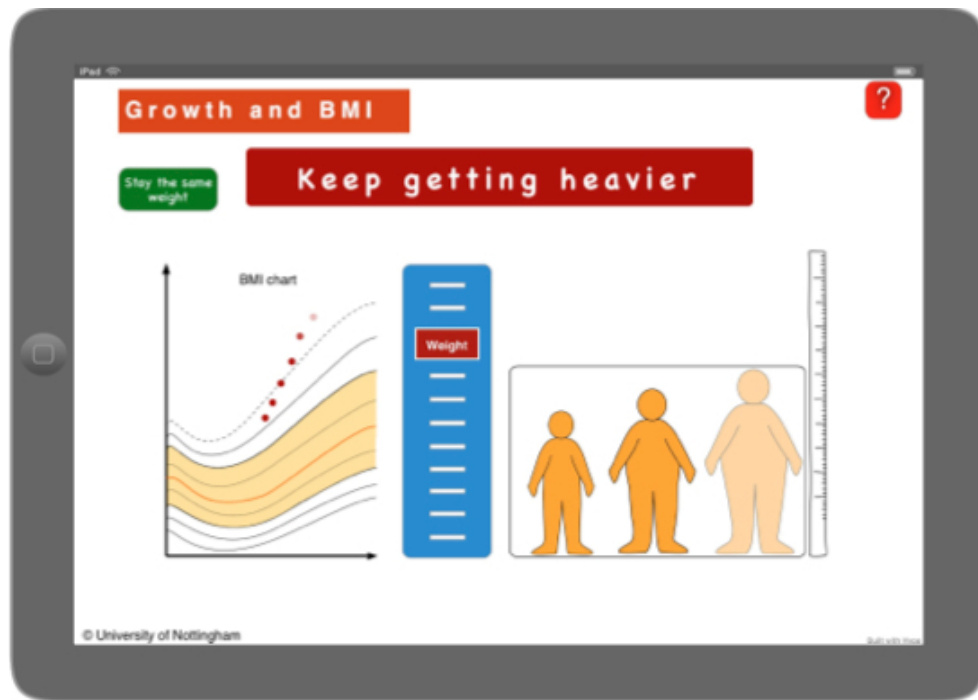
\* Sections developed into the *Feed-back* e-resource prototype



**Figure 7. Storyboard for a Growth and BMI screen**



**Figure 8. Screenshot of the Growth and BMI screen – Stay the Same Weight**



**Figure 9. Screenshot of the Growth and BMI screen – Keep Getting Heavier**

Different internet browsers (and their different releases) vary in their representation of images and text. For this reason, each section was tested on Safari, Chrome, Internet Explorer, and Mozilla Firefox. Amendments to image and textbox placement as well as font style and sizes were made accordingly. Generally, the smaller iPad tablet device screen presented design and layout limitations, but did not restrict navigation or onscreen interactivity.

#### *4.7.2.2 Clinician evaluation*

Following the design of two sections, a blog was created (<http://dietitian-feed-back.weebly.com>) (Appendix 6) to enable dietitians to access the prototype, and thus facilitate clinical feedback during the design and development stages. The landing page introduced the concept of the e-resource, and provided

background to its development. A page was given to each section of the e-resource, charting a brief summary of the purpose of the screens and their interactions, how it could be used in clinical practice and guidance as to the type of comments that would be useful. Dietitians could convey their comments publically by posting their thoughts on the blog pages or privately, using a comments box on the 'contact me' page, or directly by email.

The blog was advertised to members of the Paediatric Group and Obesity Specialist Interest Groups of the BDA. However, dietitians attempting to view the prototype on NHS computers found that NHS server security measures prevented file downloads from the blog and therefore hampered access to the e-resource. The files were subsequently uploaded onto the University of Nottingham SONET (School of Nursing Educational Technology Group) webspace, and then linked to the blog.

Dietitians were supportive and encouraging in their feedback, leaving comments such as:

"This looks great! ...I am not good with computers at all but think this is an excellent idea...The BMI bit worked well...and is really good. I think this will help parents to understand as well as kids as graphs are often foreign to the population we serve where English is rarely the first language." Paediatric dietitian

"I feel that this will be a really useful resource. ...I feel the explanation of staying the same weight and BMI is great –



good visual for getting taller and slimmer.” Paediatric dietitian

“This looks really interesting and we could potentially use it on the tablet devices we have.” Ex-paediatric dietitian, managing a team that delivers community-based family weight management

“I would definitely be interested in an e-resource pack for weight management in children, I think it would be valuable and look forward to it becoming available to use.” Paediatric dietitian - diabetes

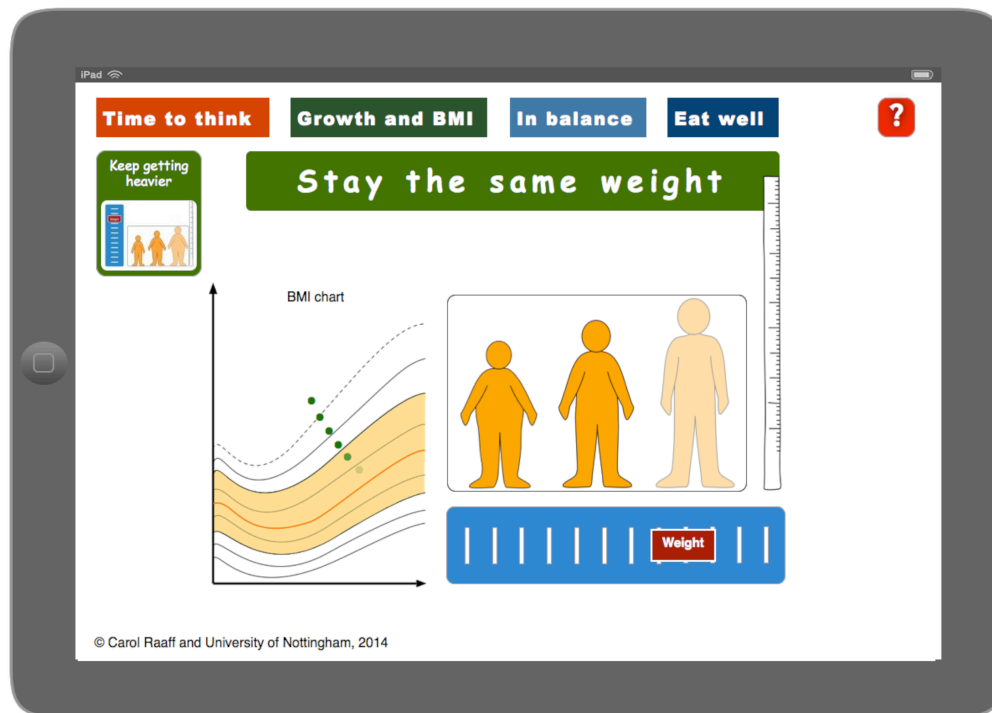
Dietitians seemed reluctant to offer specific suggestions, or to post comments publically. All those who contacted the author (n=8) did so privately, via the ‘contact me’ section of the site. This precluded open discussion and debate about aspects of the e-resource that could have enhanced the depth of responses. To encourage more specific comments, a series of short questionnaires were added to each blog page (Appendix 6). The blog was again advertised, this time through an online professional publication (Appendix 3) and by emailing dietitians who took part in the qualitative research (Chapter Three).

The results of the blog questions have been summarised in Table 16 and were used to modify the prototype (Figure 10). Subsequent sections were developed, tested and uploaded to the blog.

Comments and feedback indicated that, despite the help facility on the e-resource, there seemed to be a lack of understanding as to how each screen could be used in clinical practice:

"...I'm looking forward to hearing more about the resource and how it can be used in practice..."

Suggestions for clinical use were therefore added to provide further clarity (Appendix 14).



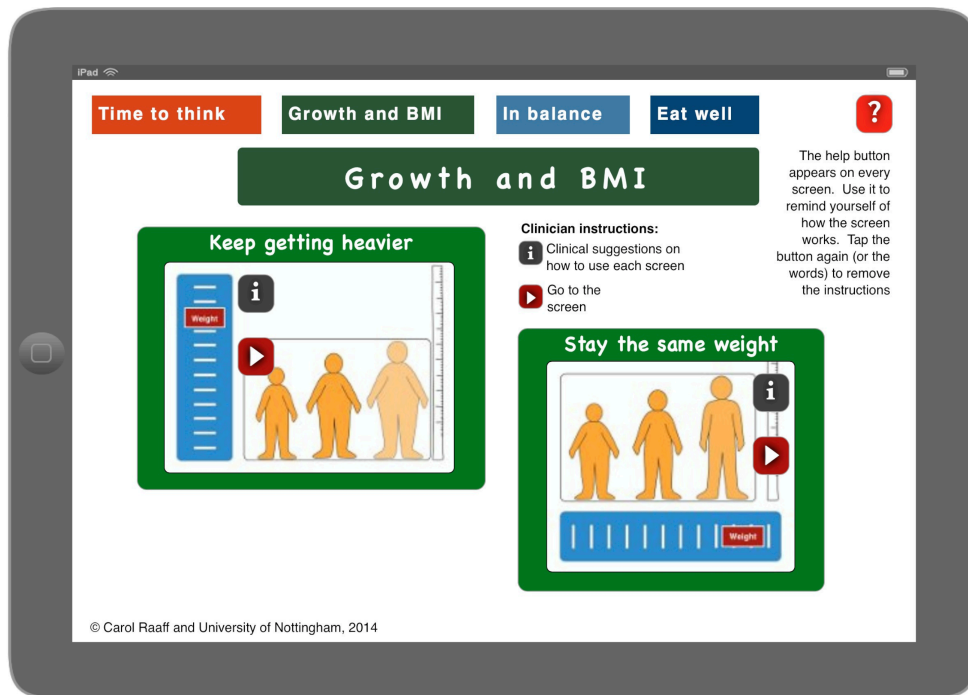
**Figure 10. Screenshot of amended Growth and BMI page – Stay the Same Weight**

Notification of these updates were circulated in a further professional publication (Appendix 4). A questionnaire (Appendix 15) was developed to encourage further specific comments and circulated to paediatric dietitians and health professional colleagues working in CWM within Staffordshire and Stoke on Trent Partnership NHS Trust. While verbal affirmations of the concept and design of the e-resource were provided, no questionnaires were returned. Only one CWM dietetic assistant emailed the following comment:

**Table 16. Summary of clinician responses to e-resource blog questions**

Feed-back section	Question	Answer (no.)	Answer (no.)	Answer (no.)	Comments
Time to Think	Specific suggestions/comments about the following screens: 'Being a Healthy Weight Means...' 'Rate Yourself' 'When it's Difficult'  Are the illustrations helpful? Do they capture what children tend to tell you in your consultations? Would the Time to Think set of screens suit your clinical practice?				
Growth and BMI	Is the Growth and BMI section easy to navigate, and work your way around? Do you think the images and graphics are appropriate for preadolescent children? Would this Growth and BMI section suit your clinical practice?	Yes (2) Yes (4) Yes (3)		Other (2)	<i>"The chart was a little unclear, perhaps spacing the dots would be clearer."</i>
In Balance	Does the Activity Tracker (on the Balancing Act page) work as a concept? What are your thoughts on the tipping points of the balance beam on the Balancing Act page? Does the Calories and Energy ('Caloriser Machine') work as a concept? Would this In Balance section suit your clinical practice?	Yes (1)   Yes (1)		Other (1)	<i>Unable to view comment</i>
Eat Well	Could this Eat Well section help you to explain and use the Eatwell Plate? Is this Eat Well section easy to navigate, and work your way around? Do you think the images and graphics are appropriate for preadolescent children? Would this Eat Well section suit your clinical practice?	Yes (4) Yes (2) Yes (3) Yes (4)		Other (1)	<i>"I found the swap section a little difficult to get to work but the idea was good."</i>  <i>"Option of written explanation. Star on best option."</i>

“The ‘climbing a mountain’ analogy... ..is a great way for children to visualise the hard work that they will have to put in to make healthier lifestyle choices and the possible barriers that get in the way. You had really thought through what those barriers are and I [*hear*] them said many times in clinic...”



**Figure 11. Screenshot of suggestions for clinical use - Growth and BMI**

A poster was presented (Appendix 7) at a national CWM study day, arranged jointly by the BDA Paediatric Group and Obesity Group, to elicit responses to the prototype from other dietitians interested in childhood obesity. The presentation included a demonstration of the prototype and was made available for dietitians to use themselves. Ten copies of the questionnaire, together with self-addressed envelopes were distributed to interested attendees, together with over 40 copies of the poster (detailing the blog address). An electronic version of the questionnaire was posted on the blog and a

third article was published (Appendix 5) inviting final comments. No dietitians responded.

#### **4.7.3 Usability testing and evaluation**

The standard definition for usability is:

“the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (Jokela *et al.*, 2003, p. 53)

With this in mind, dietitians contributed to the aspects of effectiveness and efficiency by evaluating the clinical content and appropriateness of the e-resource. The next step (Figure 6) in the *Feed-back* e-resource design phase was to consider the perspective of child-users. Child responses were invited to understand how children engaged with the e-resource (i.e. satisfaction) and to identify usability problems, thereby capturing effectiveness and efficiency experiences from this user group as well.

The prototype (Appendix 16) was first tested with a number of non-patient 7 to 11 year olds. Nielsen (2000) argued that only five users are needed to detect most (about 80%) of the problems and 15 testers should find all usability problems. Faulkner (2003) challenged this theory. She tested 60 users and then randomly sampled sets of five from the whole, in so doing Faulkner demonstrated the risks of using only five individuals. Some sets of five found 99% of the problems and other sets found only 55%. Her study illustrates that 15 participants would identify a minimum

of 90% of the problems, increasing to 95% with 20 participants. On that basis, it was decided that 15 non-patient children would be asked to test the *Feed-back* e-resource, followed by a second wave of testing with a further five child-patients. The testing focussed initially on identifying usability errors and then moved on to understand how children engaged with the e-resource, particularly within the clinical context.

#### *4.7.3.1 Procedure for usability testing with 7 to 11 year old children*

Each of the two testing phases followed the same basic procedures and involved piloting the knowledge and satisfaction measures. Following administration of the baseline child knowledge questions (Section 4.8), each child was introduced to the e-resource. They were directed to one or two e-resource sections, each of which were discussed and evaluated in terms of usability and communication of concepts. Images and interactions were also used as visual references for assess existing knowledge and to clarify misunderstandings.

Author field notes (Appendix 17) were used to capture technical problems and elements that were particularly successful, either because children seemed to enjoy using them or because they generated discussion. Reflections on how a screen or interaction could be woven into the structure of an appointment were noted, highlighting visual components that might be potentially relevant to the treatment conversation.

Post-intervention measures were then administered. A parent satisfaction measure (Section 4.8.1) was completed after testing sessions with child-patients (n=5). Sessions with child-patients took about 30 minutes (excluding completion of measures) as they doubled as treatment appointments, with 15 to 20 minutes either interacting with or referring to the e-resource. Similarly, non-patient peers used the e-resource for 15 to 20 minutes each.

#### *4.7.3.2 Usability testing with non-patient peers*

A convenience sample of 7 to 11 year olds were invited to participate. Fifteen preadolescent school children, available during the two-week testing period, took part. Parents were provided with information sheets (Appendix 18) and encouraged to discuss details with their children before agreeing to take part. Prior to each session, the testing procedure was explained to the child. Parents verbally agreed and children gave their assent. The group consisted of 7 to 10 year old girls (n=8) and boys (n=7). Sibling testers (n=3) were separated from each other during test sessions that took place in the home environment.

Usability testing focussed on two of the sections – *Eat Well* and *In Balance*. The remaining sections were both designed for discussions with the overweight child about becoming a healthier weight. While two *Time to Think* screens were shown to one child early on in the testing, it became apparent that these were better suited to a

weight management context. Since children in this cohort had not been identified as overweight, nor had they been referred for weight management advice, the messages contained in these screens were deemed unsuitable to test at this stage.

Testing highlighted several (n=10) technical errors. These related to misplaced hotspots throughout all four sections. Other problems related to image design (n=2); a reference to the immune system (*Eat Well*) was only correctly recognised by two children, and facial features were needed on another image (*Time to Think*). This phase of testing also gave the author an opportunity to reflect on how the screens might be used in the treatment setting, and led to changing a label from 'calories' to the more meaningful 'energy or calories' (*In Balance*).

#### *4.7.3.3 Usability testing with child-patients*

To ensure that the e-resource catered for the communication needs of the child, parent and dietitian within an appointment, usability testing with child-patients within the consultation setting was required (Figure 6). Ethics approval to access NHS patients for this purpose was granted by the East Midlands – Nottingham 2 – Research Ethics Committee (ref: 14/EM/1310) (Appendix 19), together with agreement from Staffordshire and Stoke on Trent Partnership NHS Trust (Appendix 20).



A convenience sample of five 7 to 11 year old overweight children and their parents were recruited from the Healthy Kid5 (an NHS community-based CWM service). Full inclusion criteria and recruitment procedures are outlined in Chapter Five. Appointments were held in consulting rooms within health centres that were locally accessible to families. After obtaining informed written assent and consent, the treating dietitian (C.R.) provided the 'usual' dietetic care (relevant advice tailored to the needs of each child and their parent(s)), using the *Feed-back* e-resource to facilitate some of these discussions.

Participants included four girls and one boy; ages ranged from 7.71 years to 11.83 years, with a mean(SD) age was 9.70(1.54) years. All four sections of the *Feed-back* e-resource were tested. Usability errors (n=4) were found in two sections (*Growth and BMI* and *In Balance*). Specifically, a user-controlled slider on two *Growth and BMI* screens would occasionally fail to track the child's finger and instead jump spontaneously to the end of slider. An error was detected on the *Balancing Act* screen of the *In Balance* section; if all of the selected foods and physical activity were removed from the balance beam, the beam did not always return to the original 'balanced' position.

The e-resource was generally well received by both children and parents. Some parents commented that they liked the *Feed-back* e-resource because it

"...[was] very informative, easy to understand, [and] fun to use."

"...makes it fun for the child and makes sense to them."

"...was brightly coloured with child-friendly pictures."

Children's comments related to visual references, such as:

"When I clicked on the food, it showed me how much energy [it was worth]." 10 year old girl

"[It showed] how much you eat on your plate." Seven year old girl

Children found the e-resource enjoyable. A nine year old girl called the interactive elements "games", and another simply said:

"It was fun." 11 year old boy

There were no negative comments.

Since the prototype was internet-based and was tested in health centres without WiFi connectivity, the author tethered an iPad Air® to a MacBook Pro® (where the source files for the e-resource were stored) using Bluetooth technology. This enabled the child to access the *Feed-back* e-resource on an iPad®. However, this arrangement presented some difficulties; it precluded the option to toggle between different sections, instead source files had to be streamed individually. This resulted in a high incidence of technical problems; larger source files took longer to load, there were no sound effects in some sessions, and Bluetooth spontaneously disconnected during several sessions. It was decided that a 4G mobile WiFi device may improve functionality during the feasibility study (Chapter Five).

## **4.8 Development of child knowledge and satisfaction measures**

Several outcome measures were developed and piloted during both waves of child testing. These included the satisfaction measure (child and parent) and knowledge questionnaire.

### ***4.8.1 Child and parent E-resource Satisfaction and Acceptability Measure (E-SAM)***

Post-intervention satisfaction questions were developed to gauge acceptability of the e-resource. Items were adapted from an existing evaluation measure (RLO-CETL 2005). Separate, but similar satisfaction items for the child (Appendix 21a) were developed for the parent measure (Appendix 21b). Each measure contained seven items that included a combination of four-point Likert scales, polar questions and open questions. Questions captured overall opinion of the e-resource, perceived ease of understanding of the messages contained, enjoyment, and endorsement of the tool. Questions were piloted during usability testing with children (n=20) and parent/carer(s) (n=5).

### ***4.8.2 Child Healthy Eating Knowledge Questions (CHEKQ)***

Knowledge and attitudes can influence behaviour and behaviour change. Existing knowledge measures (St. Pierre *et al.*, 1981; Gillespie, 1984; Anderson *et al.*, 2002; Kreisel, 2004; Baños *et al.*,

2013) contained items that required multiple choice style test-retest responses. However, open or free responses were preferred to probe depth of understanding (Macías and Glasauer, 2014), and to minimise guessing and interference from re-test recall.

Questions were derived from previous lifestyle surveys (NOO, 2011b) and existing CWM guidelines (SIGN, 2010). They focussed on three main areas: knowledge of general healthy principles, application of these principles through a brief evaluation of how their own health could be improved, and understanding of the need to balance energy intake (diet) with energy expenditure (physical activity). The draft measure was iteratively piloted and revised during usability testing with 7 to 11 year olds (n=20). Adjustments to items and the final CHEKQ is described in Chapter Five.

## **4.9 Strengths and limitations**

The e-resource prototype was designed for patient-centred care and was founded on evidence-based behaviour change theories. It also considers current dietetic CWM treatment approaches and resources used in clinical practice. Design and development has been guided by a coherent framework and has incorporated significant user-involvement. Practising health professionals in the field have contributed to its development and the e-resource was extensively tested with children from the intended age group.

Involving dietitians in the development of the e-resource was met with limited success. Despite the range of techniques used to spark professional interest, relatively few clinicians responded. Dietitians in the NHS were initially unable to download the e-resource from the blog due to server security restrictions, which may have further deterred potential involvement. As is common with other studies (Dragone *et al.*, 2002; Bartholomew *et al.*, 2006), disappointingly low professional input may not have provided balanced feedback. Furthermore, dietitians who did comment or make suggestions demonstrated a lack of understanding of the prototype purpose. A series of focus groups with several interested clinical experts may have produced a different level of constructive criticism.

Design and development was carried out solely by the author (with supervision from C.G. and H.W.). Collaboration with, or mentorship from, an expert in software development may have improved code efficiency. It is possible that more streamlined and compact code design could have prevented some download delays.

#### **4.10 Summary**

The design and development of the *Feed-back* e-resource was a culmination of the findings of the systematic review (Chapter Two) and qualitative research (Chapter Three) that explored the needs and expectations of dietitians working in CWM services. The e-resource is underpinned by relevant health and communication

theory, and seeks to support health behaviour change that complements current clinical practice in this field.

Dietetic approaches to treatment provided the inspiration for this e-resource. However, it was difficult to engage with enough dietitians who were committed to shaping the development of this intervention. The initial stages of usability testing involved fifteen 7 to 11 year old non-patients. Testing was then carried out in CWM appointments with five child-patients from the same age group.

The *Feed-back* e-resource was designed to serve as visual scaffolding for child communication within CWM treatment (with the long-term goal of contributing to behaviour change). To this end, the next chapter describes the feasibility of using the e-resource to facilitate child communication within the clinical setting.

## **Chapter Five: A feasibility study to measure the effect of the *Feed-back* e-resource on child communication**

### **5.1 Introduction**

NICE has highlighted effective communication as a key factor in weight management:

“...emphasis[ing] the importance of tailoring messages according to...the information needs of different groups.”  
NICE (2015, p. 22)

In Chapter Four we established that offering information and then enabling the child to make sense of it and apply it to themselves and their own circumstances may help to build motivation to change (Rollnick *et al.*, 1999b; Rollnick *et al.*, 2008). Effective child-clinician communication is important for improving understanding, self-efficacy and a sense of control (Bandura, 1977). Nevertheless, child-patients are often marginalised in the information exchange process (Chapter One). If treatment-related discussions are not meaningful to the child, they may be less likely to be motivated to change lifestyle behaviours (Erickson *et al.*, 2005).

Children need to be given a way into the conversation but health professionals do not always consider their potential contribution. A nurse in a Swedish study (Soderlund *et al.*, 2009) who sought to provide motivational interviewing (MI) interventions for five to seven year old overweight children said:

“I am surprised that kids in the first grade know so much about food and sweets, even about soft drinks. They say that they know that this is not good for their health, yet they eat it! You might think that young children do not reflect on such things, but they really do.” (Soderlund *et al.*, 2009, p.446)

However, the preadolescent child may lack the verbal means to express what he or she knows or understands, clearly and unambiguously (Wood, 1998). Epstein and Wayman (1998) suggested that health professionals may similarly lack the verbal structuring required to communicate at a level appropriate for the child.

Bruner (1983) noted that games provide an opportunity to structure a series of events by enabling participants to direct their attention toward certain events that take place within a specified sequence. He also proposed that games mimic language because they enable an interchangeable assignment of roles. There is always a leader and a follower, and this can change from game to game. The *Feedback* e-resource (Chapter Four) was designed to provide visual scaffolding to structure treatment discussions between the dietitian, and the overweight child and their parent(s). The e-resource provides visual interactions intended to support verbal communication of clinical concepts within an appointment. Key indicators of the usefulness of this type of e-resource include its effect on the child’s communication and understanding within the appointment setting.



To date, research has explored involvement in the consultation using either content analysis to explore turn taking (Drew *et al.*, 2001; Bates and Meeuwesen, 2001; Cahill and Papageorgiou, 2007), or interaction analysis to capture the dynamics of the exchange (Roter and Larson, 2002; Wassmer *et al.*, 2004). Both measures favour video data (Pantell *et al.*, 1982; van Dulmen, 1998; Bates and Meeuwesen, 2000; Bates *et al.*, 2002; Cahill and Papageorgiou, 2007; Turer *et al.*, 2011) but video-recording can alter behaviour (Coleman, 2000) and yield data that is time-consuming to analyse. Furthermore, video-recording may have a negative impact on health professionals' willingness to participate in research and could disrupt the quality of the consultation, although there is limited research on its effect on clinician behaviours (Coleman, 2000).

A systematic review by Dobber *et al.* (2015) of the measures used to identify the communication components of MI, including patient communication, recommended MISC (Motivational Skill Code) 2.0/2.1 and SCOPE (Sequential Code for Observing Process Exchanges). Both have been designed to code audio or video data from adult interventions (Martin *et al.*, 2005; Moyers *et al.*, 2005; Moyers *et al.*, 2007; Miller *et al.*, 2008). Ledoux *et al.* (2013) subsequently adapted these MI measures to create the Patient-Centred Communication Coding System (PCCCS) for non-physician patient-centred approaches to preadolescent child weight management (CWM) interventions in primary care, compatible with audio-recordings. However, this measure captures clinician (rather

than child) communication. An audio-based measure, suitable for analysing child contribution to triadic conversations within the CWM consultation is required.

The primary aim of this study was to explore the feasibility of the *Feed-back* e-resource to support preadolescent child communication during weight management treatment discussions with a dietitian. One study objective was to gauge acceptability of the e-resource, when used to support treatment, along with treatment satisfaction. A further objective was to develop feasible, valid and reliable outcome measures to assess the impact of *Feed-back* on child communication.

## **5.2 Materials and methods**

### **5.2.1 Design**

This feasibility study was carried out with a convenience sample of fifteen overweight 7 to 11 year old children. The child-patients all attended a dietetic appointment with the same dietitian (C.R.) within a community-based NHS-provided CWM service. The tablet-based *Feed-back* e-resource was used during an audio-recorded consultation with each child and their parent/carer(s). Pre and post-intervention child and parent/carer measures were used to gain information about demographics and parental perception of child talkativeness in the CWM appointment (Appendices 22a and 22b).

### **5.2.2 Measures**

#### *5.2.2.1 Child and parent E-resource Satisfaction and Acceptability Measure (E-SAM)*

Acceptability of the e-resource as a treatment tool was assessed using child (Appendix 21a) and parent (Appendix 21b) post-intervention satisfaction questions, development of which has been described in Chapter Four. The measures consisted of seven items, five of which were four-point Likert scales or polar questions, followed by two open questions. The measure sought to capture a general impression of the e-resource, perceived clarity of the information content, overall enjoyment and endorsement of the tool, as well as specific aspects that were particularly appreciated and those that were not. Appointment attendance was also analysed.

Construct validity was ensured because items were based on an existing measure (RLO-CETL, 2005) for this purpose and reviewed by supervisors (C.G. and H.W.). The E-SAM was checked for content and face validity during piloting with children (n=20) and parent/carer(s) (n=5) and no further changes were made. Stability of the measure was tested informally, with similar outcomes as those produced in piloting to be taken as an indicator of reliability.

#### *5.2.2.2 Child Healthy Eating Knowledge Questions (CHEKQ)*

We established in Chapter Four that knowledge and attitudes can have an impact on behaviour and behaviour change. The final

CHEKQ (Appendices 22a and 22b) contained three items probing understanding of 1) healthy eating, 2) how to improve their own health (in terms of dietary intake, physical activity or both), and 3) the principle of energy balance.

Pre and post-intervention questions were the same, with the exception of the 'healthy eating' question. During piloting, children tended not to repeat the information that they had provided in pre-intervention responses. Instead, they were observed to focus on what they had learnt from the e-resource. For this reason, the related post-intervention question asked for what they had learnt about healthy eating. Post-intervention responses for this first question were therefore merged with those for the baseline 'healthy eating' knowledge question and scored, to capture total child knowledge for this domain. This was found to improve face validity.

With regard to construct and content validity, questions had been developed from national UK diet and lifestyle-related surveys (Chapter Four) that were adapted to incorporate the aims of each of the *Feed-back* e-resource sections.

Item scoring reflected the aim of healthy eating: to promote a balanced and varied diet (SIGN, 2010; NICE, 2015), and was therefore based on the five food groups, an indication of quantity, balance and variety (FSA, 2007). Scoring also considered the recommendation that behaviour change goals should be SMART:

small (or specific), measurable, achievable, recorded and timely (Stewart *et al.*, 2005). SMART can be simplified to 'what needs to change, how it will be changed and when?' (Pearson and Grace, 2012b). Potential total knowledge scores ranged from 0 to 10, with higher scores indicating more comprehensive knowledge.

#### *5.2.2.3 Triadic Communication Rating Scale (TRI-COM-RS)*

Child communication in a paediatric appointment can be affected by both parent/carer and the clinician (van Dulmen, 1998). The TRI-COM-RS (Table 17) was developed to measure child, parent and dietitian-contribution. To ensure construct and content validity of the measure, items were created from existing research (Tates and Meeuwesen, 2000; Street and Millay, 2001, Wassmer *et al.*, 2004; Howells *et al.*, 2010; Whitehead *et al.*, 2014) (and Chapter Three), chosen for their effect on child contribution. Each item consisted of a three-point scale ('no', 'somewhat', and 'yes') and was limited to measure one dimension only. A rating guideline (Appendix 23) was developed to support the measure, describing each item and providing relevant examples.

Item descriptors were adjusted following discussions with independent researchers (S.L. and B.D.), thus ensuring face and content validity of the rating scale and the guideline.

**Table 17. Items from the Triadic Child Communication Rating Scale (TRI-COM-RS) to assess child, parent and dietitian contributions**

Sub-scale	Item	0= No	1= Somewhat	2= Yes
Child participation	<p><i>Child engages in the conversation</i>: evidence of interest, wanting to be involved, follow-up question(s) and/or appropriate response(s) to question(s)<sup>1,2</sup></p> <p><i>Child disengages with the conversation</i>: appears disinterested, needs or seeks additional prompting, fails to respond. May be disruptive and/or make inappropriate comments or noises</p> <p><i>Child plays a role in goal-setting and decision-making</i>: active in goal-setting, e.g. takes opportunities to contribute to decision-making by makes suggestions and/or tries to problem-solve (rather than passive agreement)<sup>2</sup></p>			
Parent contribution	<p><i>Parent tries to include the child during parent contributions (partnership working)</i>: makes the conversation accessible to the child through words, framing of concepts and/or suggestions to the child<sup>2</sup></p> <p><i>Parent insensitive to the child or their contribution</i>: devalues, undermines, and/or contradicts the child insensitively<sup>3</sup></p> <p><i>Parent intrusiveness</i>: interrupts, answers for the child (without leaving sufficient space for him/her to answer), talks over the child and/or makes inappropriate or distracting comments<sup>4</sup></p> <p><i>High level of parental need for their own health-related conversation</i>: often pursues own diet or health-related agenda, frequently seeking information from the dietitian, taking opportunities to state or discuss their opinion(s)</p>			
Dietitian approach	<p><i>Dietitian appropriately tries to engage the child early in the consultation</i><sup>5</sup>: adjusts approach to the child's response<sup>5</sup></p> <p><i>Dietitian maintains rapport with the child throughout the consultation</i><sup>5</sup></p> <p><i>Empathetic and supportive – dietitian shows concern and responds to the family's predicament</i><sup>4,5</sup>: much warmth and natural empathy throughout the consultation, trying to address parental and child perspectives and disagreements sensitively. Involves seeking out and/or listening to concerns, as well as dealing with them.</p> <p><i>Dietitian uses appropriate communication techniques</i><sup>5</sup>: good balance of open and closed questions, allows space for child participation, sensitive style for all family members</p> <p><i>Dietitian offers appropriate information to the child on how food and/or physical activity relates to the weight management</i>: well organised, tailored, jargon-free information, with appropriate checks on understanding (attempts to address misunderstanding)<sup>2,4</sup></p> <p><i>Dietitian involves the child and parent in goal-setting</i>: invites the parent and child to participate in decision-making, as a partnership. Offers opportunities for them to lead on goal-setting or adjust goals<sup>5,6</sup></p> <p><i>Dietitian explores possible (goal) difficulties with the parent and child (contingency planning)</i>: potential difficulties discussed and/or alternative means of implementing the goals, prepares for thinking about future goals<sup>5,6</sup></p>			

<sup>1</sup> Street and Millay (2001), <sup>2</sup> Chapter Three, <sup>3</sup> Wassmer *et al.* (2004), <sup>4</sup> Bates and Meeuwesen (2000), <sup>5</sup> Howells *et al.* (2010), <sup>6</sup> Whitehead *et al.* (2014)

The child participation sub-scale consisted of three items (child engagement, child disengagement, and the child's role in goal-setting and decision-making). Polarity of the child disengagement item was reversed on analysis to give a maximum score of six. Higher scores indicated better quality interactions. Similarly, polarity on all but the first item on the four-item parent sub-scale were reversed for analysis, yielding a maximum score of eight.

Again, higher scores indicated parent-contributions deemed to be more supportive to child participation. Since only one dietitian was involved in the feasibility study, the dietitian sub-scale was not tested in this research.

#### *5.2.2.4 Child Contribution Coding System (CCCS)*

The quality of the child-clinician verbal exchange may be important to the efficacy of the health intervention. Speech is used to communicate meanings and intentions, such as through requests, pronouncements and statements of commitment (Searle, 1969). Amrhein *et al.* (2003) explored this concept further by analysing the connection between 'commitment' language used during MI sessions and behavioural outcomes. Components included expressions of desire, ability, reasons, and need to change. Coded statements were given a strength value, either positive or negative, determined by the strength of expression for either continuing or reducing the behaviour. They found that strength of language, as opposed to frequency of utterances, predicted changes in behaviour.

**Table 18. Summary of the Child Contribution Coding System (CCCS) to assess child autonomous contribution**

Code	Description	Subcategory	Example
Seeking information	Questions about any aspect of the consultation including clarifying information and probing deeper into a topic being discussed		[Child]: "What are pomegranates?"
Giving information	Engaging in the conversation goes beyond answering 'yes' or 'no' to questions. It involves autonomous expressions of emotion or preferences, disagreeing, interrupting, making suggestions or recommendations	Expressions of preference, interests, and spontaneous contributions	[Dietitian]: "If you could choose any <i>[food]</i> you wanted, what would you choose?" [Child]: "It's between crisps and a coke. Not a chocolate bar because that fills me up."
		Spontaneous descriptions of how he or she is feeling	[Dietitian]: "Which one would you choose?" [Child]: "Ooooooh...chocolate."
		Expressions of emotion	[Child]: "Cool!" or "Yay!"
		Self-aware and self-affirming statements	[Dietitian]: "So, would you do some running after school?" [Child]: "I am really good at running. I can run really fast."
		Disagreeing and challenging	[Parent]: "See, you don't even know what you have in your lunchbox today." [Child]: "Grapes...orange..."
		Starting to talk when another person is already talking	
		Accepting an alternative view point or opinion	[Child ( <i>not coded</i> ):] "I don't do much walking." [Parent]: "You do lots of walking. We walk everywhere." [Child ( <i>coded</i> ):] "Oh yeah, we do."
		Attempts to clarify their position	[Dietitian]: "So you don't like the tomatoes?" [Child]: "Cherry tomatoes."
		Making suggestions or recommendations	[Dietitian]: "And what happens if it is raining?" [Child]: "I could put my waterproofs on."

Street and Millay (2001) also investigated patient participation in the appointment. They defined significant patient contributions as asking questions, expressions of concern, and assertive statements. Active patient participation in discussions about clinical treatment has been shown to lead to improved health outcomes (Kaplan *et al.*, 1989; Street and Millay, 2001; Moyers *et al.*, 2007).



The MI consensus statement for 'change talk' (Miller *et al.*, 2006) adopted Amrhein's 'commitment' language that they suggest eventually leads to discourse about specific plans to change behaviour. Building on this work, and adapting it to capture child contribution, the Child Contribution Coding System (CCCS) (Table 18) with construct and content validity was therefore developed, to score episodes of child autonomous engagement. Audio data were used to develop and then refine codebook descriptors (Appendix 24) for giving and seeking information. Seeking information demonstrates active engagement because it discloses a lack of understanding, and a wish to clarify information or acquire additional knowledge (Street and Millay, 2001). Giving information used nine descriptors, all of which signal a deeper involvement in the conversation beyond merely answering questions, expressions of emotion or preference, disagreeing, interrupting, or making suggestions or recommendations. Once again, face and content validity of items was improved by clarifying codebook descriptors after discussions with independent researchers (S.L. and B.D.).

Scoring the CCCS was based on 'turns' (Sacks *et al.*, 1974). The start of each child turn is marked by a verbal contribution (other than 'mmm' or 'ummm'), and then finished when the child comes to the end of what they are saying, or is interrupted. Using this definition, a turn can comprise of one or more utterances; an utterance may be a single word, clause, or sentence (Tates and Meeuwesen, 2000) that is measured in seconds.

### **5.2.3 Recruitment**

Healthy Kid5 was a community-based NHS-provided CWM service offering behaviour change support and advice to children with a BMI above the 91<sup>st</sup> centile (Cole *et al.*, 1995; NOO, 2011a). Referrals were accepted from parents, and health and social care professionals. Treatment involved an initial assessment, followed by half-hour appointments at four to six-weekly intervals for up to 12 months. Child anthropometric measurements were taken on initial assessment and then quarterly.

The study was carried out between January and February 2015. A child was eligible to take part if they were 7 to 11 years old, due to receive a follow-up appointment, and had not taken part in child-patient usability testing of the e-resource (Chapter Four). Children were excluded if they or their parent(s) were not sufficiently proficient in the English language to communicate without an interpreter, or if cognitive impairment could interfere with gaining informed consent/assent, the completion of measures, or the intervention itself.

The author approached most parents of potential participants (n=14) by telephone. In a few cases (n=5), eligible children and their parent/carer(s) were approached during routine Healthy Kid5 appointments. The author followed up contacts made by Healthy Kid5 colleagues (n=3) with a telephone call to the parent, to ensure that study aims and procedures had been conveyed accurately and

to answer any initial questions. Those interested in the study were then posted two information sheets, one designed for the parent (Appendix 26) and the other for the child (Appendix 27), to be read and discussed as a family before their next appointment. Two parents asked to receive the information by email.

#### **5.2.4 Participants**

The feasibility study recruited 15 children (seven boys and eight girls) (Table 19). The mean age of the sample was 9.82 (range=7.08 to 11.80) years. Most (n=9) children were on or above the 99<sup>th</sup> centile for BMI (Cole *et al.*, 1995). Children had attended a median of four (range=1 to 9) previous Healthy Kid5 appointments. Three children were in receipt of additional support with the school curriculum for learning difficulties that included memory impairment (n=2), dyslexia (n=1) and dyspraxia (n=1). One other child was also known to have dyslexia and another was on the autistic spectrum. Table 20 details the characteristics of attending parent/carer(s). Participants were primarily from a White British background (n=14), and parent/carer(s) (n=12) tended to have A-level qualifications or above.

**Table 19. Characteristics of feasibility study child participants**

Characteristics	Participants (n=15)
Gender, n (%)	
Girl	8 (53.3)
Boy	7 (46.7)
Age, mean (SD)	9.82 (1.8)
Receiving additional help at school, e.g. SENCO <sup>1</sup>	3 (20.0)
BMI centile, mean (SD)	97.07 (3.4)
Latest change in BMI centile, n (%)	
Increase	7 (46.7)
Static	1 (6.7)
Decrease	5 (33.3)
Missing data	1 (6.7)
Previous Healthy Kid5 appts <sup>2</sup> , mean (SD)	3.67 (2.2)
Previously seen by researcher in appts, n (%)	
Yes	6 (40.0)
No	9 (60.0)

SENCO – special educational needs co-ordinator,   Appt – appointment(s),  
SD – standard deviation

**Table 20. Demographic characteristics of feasibility study parent/carer(s)**

Characteristics	Participants (n=15)
Relationship to the participant, n (%)	
Mother	12 (80.0)
Father	2 (13.3)
Grandmother	1 (6.7)
Ethnicity, n (%)	
White British	14 (93.3)
Black Caribbean	1 (6.7)
Highest level of parent education, N (%)	
O-levels/GCSE/Foundation certificate/NVQ 1 or 2	3 (20.0)
A-levels/National certificate/NVQ level 3	7 (46.7)
Professional diploma or certificate/NVQ level 4	2 (13.3)
Foundation degree/Higher national diploma	1 (6.7)
Undergraduate degree or equivalent	1 (6.7)
Postgraduate degree or equivalent	1 (6.7)

SENCO – special education needs co-ordinator,   Appt – appointment(s),  
GCSE – subject-specific school qualification(s) taken between 14 and 16 years,  
NVQ – national vocational qualification(s) (work-based awards)

### 5.2.5 Procedures

Study appointments were held at typical community-based venues; health centres, and outpatient clinics. At the start of each study appointment, the researcher went through the process of written informed parental consent, and child assent (Appendix 28). An

identifier was assigned to each participant to preserve confidentiality and anonymity. The author verbally administered baseline knowledge questions from the CHEKQ to the child, and captured responses verbatim on paper. This eliminated the effect of variability in participant literacy skills. Where necessary, children were prompted by clarifying questions, such as 'what do you mean by 'good' or 'bad' foods?' encouraging fuller responses when initial attempts were vague. However, detailed probing, such as how food and drink choices fitted into their daily patterns of behaviour, was avoided. Their parent/carer simultaneously completed their baseline questionnaire (Appendix 25a).

The *Feed-back* e-resource, viewed on an iPad Air®, was then incorporated into the audio-recorded dietetic consultation. The author (and treating dietitian) used the e-resource to facilitate conversations about dietetic treatment with each child and their family, tailored to individual treatment requirements. Before leaving the appointment setting, children were asked post-intervention knowledge questions from the CHEKQ as per baseline procedures. The author then read satisfaction questions, as required, otherwise leaving the child to complete the E-SAM independently. The parent/carer completed their post-intervention questionnaires (Appendices 21b and 25b). A £20 Amazon gift voucher was given to families following completion of all measures.

To assess inter-rater reliability for the TRI-COM-RS, audio files for 10 consultations were randomly selected (Haahr, 2012) and rated for child and parent contribution. An independent assessor (B.D.) was given a three hour training session using the rating guideline and a different audio file to demonstrate application of the descriptors to the data, before independently rating the 10 audio files.

Audio data were coded using the CCCS in BORIS (Behavioural Observation Research Interactive Software) (version 2.0). In order to improve accuracy, audio data were slowed to a speed of 0.5. Extracts related to setting up the e-resource and dealing with technical problems were excluded. The CCCS was used to code all (n=15) audio files. Two sets of randomly selected (Haahr, 2012) audio data were re-coded using the CCCS, by the author, a month after initial coding. The codebook was also given to an independent assessor (S.L.), together with a written overview of the research, to measure inter-rater agreement. Training consisted of a one-hour discussion about codebook descriptors and instruction in the BORIS software. Five audio files were randomly selected (Haahr, 2012) for independent coding. Before starting to code these data, two different audio files were first independently coded by the assessor and the results discussed as part of the training process.

### **5.2.6 Ethical Approval**

The study was approved by the East Midlands – Nottingham 2 Research Ethics Committee (14/EM/1310) (Appendix 19), and Staffordshire and Stoke on Trent Partnership NHS Trust (Appendix 20).

### **5.2.7 Statistical analysis**

Validity of the CHEKQ was examined. Knowledge questions should not be too easy or too difficult, and an appropriate range for correct responses has been suggested, as between 20 and 80% (Parmenter and Wardle, 2000). However, this is for multiple-choice style questions. Scores to open questions in this study were measured in quartiles, with particular interest in results of 75% and upwards and those between 50 and 74%. Item discrimination is the ability of individual item to differentiate between participants with high and low overall scores, calculated using Spearman's rho (two-tailed), as a correlation between the item and the total score for that measure, indices above 0.2 are considered acceptable and above 0.3 good (Kline, 2000).

Item discrimination was also calculated for the child and parent subscales of the TRI-COM-RS. Internal consistency for this measure was gauged using Cronbach's alpha. An alpha value of above 0.70 is considered acceptable (Bland and Altman, 1997; Lance *et al.*, 2006).

Data captured after the e-resource had been introduced to the conversation was used. The CCCS calculated mean turn time for child autonomous engagement, frequency of these turns, and number of contributions relating to goal-setting. As a result, precise inter-rater agreement on data arising from the CCCS was sought, specified as within 1.000 seconds.

An interclass correlation coefficient (ICC) measured inter-rater reliability (Shrout and Fleiss, 1979) for the CCCS and the TRI-COM-RS. ICC values have been classified as: <0=poor; 0 to 0.20=slight; 0.21 to 0.40=fair; 0.41 to 0.60=moderate; 0.61 to 0.80=substantial; and 0.81 to 1.00=almost perfect agreement between raters (Landis and Koch, 1977).

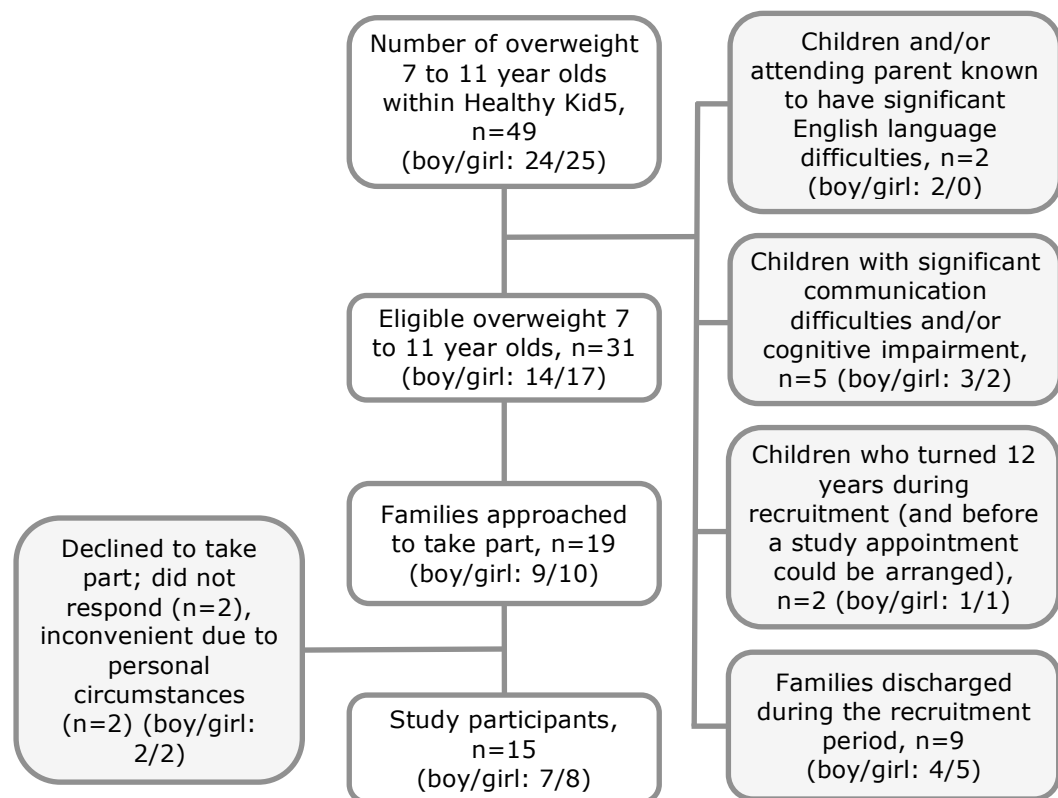
Descriptive statistics, along with qualitative analysis, were used to collate E-SAM data. The Wilcoxon signed-rank test compared change in knowledge scores. Spearman's rho (two-tailed) explored associations within and between measures. Data were collated in Microsoft® Excel® 2011 (version 14.2.4) and analysed with IBM® SPSS® Statistics (version 22). The significance level was set at  $p \leq 0.05$ .

### **5.3 Results**

Nineteen families were approached to take part (Figure 12), and 15 (78.95%) agreed to participate. Reasons for not participating include moving out of the area (n=1), difficulty in finding a



convenient appointment time (n=1) and non-response (n=2). Thirteen families (86.70%) attended their scheduled appointment, somewhat higher than the 67.90% attendance rate for routine follow-up appointments found in a recent Healthy Kid5 audit (Dodgson *et al.*, 2015). Of the two families who did not attend their arranged study appointment, one cancelled at short notice due to an overcommitted diary, and the other failed to attend due to illness.



**Figure 12. Participant flow through the feasibility study recruitment process**

Each recorded appointment lasted a mean(SD) of 29.49(5.59) minutes (median=31.73, range=17.36 to 36.73). One (n=7) or two (n=8) e-resource section(s) were used during each appointment for between 10.86 to 23.32 minutes, mean(SD) 15.78(3.68) minutes. Technical problems with the e-resource were encountered in eight

appointments, with multiple setbacks in some (n=4) cases.

Disruptions to WiFi connectivity caused lengthy delays 2.25(2.57) minutes. Usability errors were less time-consuming 11.90(3.74) seconds. Two participants accessed the e-resource through source files on a MacBook Pro® laptop as a WiFi connection could not be established.

### **5.3.1 E-resource satisfaction and acceptability**

Despite technical setbacks, all (n=15) parents and most (n=14) children gave it the highest rating on the E-SAM of *very good* (one child indicated that it was *good*). Most children (n=9) and parents (n=8) thought the e-resource was *very easy to understand*, the remainder felt that it was *easy to understand* (with the exception of one child who said that it was *very hard to understand*). This positive reaction was reinforced in comments made by children and parents. Eleven children said that they liked the e-resource because of what they had learnt, their comments indicated a degree of empowerment:

“...now I understand [*that*] fruits are still calories but less to exercise off [*than other snacks*].” 10 year old boy

“[*It was*] easy to understand, compared with just talking.”  
Boy, aged eight years

Nine parents similarly indicated that they appreciated how the e-resource facilitated their understanding of weight management concepts:

"It made things very clear and easy to understand." Mother to an eight year old boy

"[It was] visually interesting. Easy to see the impact decisions have." Father to a nine year old girl

Twelve out of the 15 parents thought that the *Feed-back* e-resource had been *very useful* in the appointment. The remaining three regarded it as *quite useful*, and all parents (n=15) were in favour of this sort of e-resource being used in future appointments.

There was little that children or parents did not like about the e-resource; 12 children said *nothing* or *I don't know*, and parents (n=12) said *nothing* (or the equivalent). Most of the responses to the two open satisfaction questions included reactions to the multimedia elements of the e-resource (such as images, sound and interactivity) (Table 21). Two children disliked the sounds but a number of parents and children expressed their appreciation for the visual (n=9) and design concept(s) (n=8). One parent suggested that the e-resource was:

"Possibly too basic for [an] 11 year old." Mother to a boy, aged 11

**Table 21. Number of child participant and parent/carer comments relating to acceptability of *Feed-back* e-resource multimedia design**

Aspect relating to multimedia design	Liked		Disliked	
	Participants (n=15)	Parents (n=15)	Participants (n=15)	Parents (n=15)
Images and colour	4	7	1	
Interactive concept(s) and message(s)	2	6		1
Sound			2	
Entertainment and enjoyment	4			
Age-appropriateness	1	7		

Parents commented on how the e-resource had given them ideas about how they could talk to or support their child to make healthy changes. In some cases, it was identified as a potential help to establish a common frame of reference:

"The seesaw of food versus exercise – great and simple – [*I will*] refer back to that." Father to a 10 year old

"...easier way of explaining energy balance[*e*]." Mother to a seven year old

Other parents mentioned that the e-resource had clarified their own knowledge (which they may in turn be able to reinforce during future parent-child discussions):

"[*I was*] shocked to see how much [*physical activity is*] needed [*to work off*] a chocolate bar." Mother to an 11 year old

"It has given me a better understanding of the healthy eating plate and how to make swaps, giving my son better options." Mother to an eight year old

Nine parents/carer(s) felt that their child had been more talkative than in usual Healthy Kid5 appointments (Table 22). Most children (n=14) enjoyed using the e-resource. All but one child indicated that they wanted to carry on using it, and 12 children said that they would recommend the e-resource to their friends.

**Table 22. Comparative parent/carer-assessed child communication during study appointment**

Parent-assessed communication during usual appt	Parent (n=15)	Comparative parent assessed communication during study appt	Parent/ (n=15)	Participant treated by author prior to study appt (n=15)
About as talkative as usual	10	Less talkative		
		As talkative	4	1
		More talkative	6	2
Less talkative than usual	4	Less talkative		
		As talkative	1	1
		More talkative	3	2
More talkative than usual	1	Less talkative	1	
		As talkative		
		More talkative		

Appt – appointment(s)

### **5.3.2 Child weight management (CWM) knowledge**

Items in the CHEKQ appeared to have a high difficulty rating (Table 23). The first pre-intervention question asked: 'What do you think healthy eating is?' Only one participant answered the first pre-intervention question with 75% accuracy or above. Subsequent pre-intervention questions were also difficult: one child scored 75% for 'how could you be more healthy?', and one child scored 1/1 for 'What does it mean if you balance your energy?'. All questions demonstrated an item discrimination of above the 'good' target 0.3.

**Table 23. Items, participant scores, difficulty index (using percentage score quartiles:  $\geq 75\%$  or 50 to 74%), item discrimination (item-total correlation) for the pre and post-intervention Child Health Knowledge Questions (CHEKQ)**

Timing of question	Question	Maximum score achievable	Minimum score	Maximum score	Mean (SD)	Median (interquartile range)	Item difficulty n scores $\geq 75\%$ (%)	n scores 50–74% (%)	Item discrimination Item-total <sup>4</sup> , r-value
Baseline	What do you think healthy eating is? <sup>1</sup>	5.0	0.5	4.0	1.4 (0.93)	1.0 (1.5)	1 (6.67)	0	0.818**
	How could you be more healthy? <sup>2</sup>	4.0	0	3.0	1.07 (0.73)	1.0 (1.0)	1 (6.67)	0	0.402
	What does it mean if you balance your energy? <sup>3</sup>	1.0	0	1.0	0.07 (0.26)	0.0 (0.0)	0	0	0.443
	Pre-knowledge total	10.0	1.0	5.5	2.53 (1.29)	2.0 (1.5)			
Post-intervention	What have you learnt about healthy eating?	5.0	1.0	5.0	2.53 (1.25)	2.0 (2.5)	2 (13.33)	5 (33.33)	0.803**
	How could you be more healthy?	4.0	0	3.5	2.17 (1.06)	2.5 (1.5)	5 (33.33)	5 (33.33)	0.758**
	What does it mean to balance your energy?	1.0	0	1.0	0.80 (0.37)	1.0 (0.5)	11 (73.33)	2 (13.33)	0.405
	Post-knowledge total	10.0	2.0	9.0	5.50 (2.00)	6.0 (3.5)			

<sup>1</sup> NOO (2011b). Original question from the Health Survey from England (2007): 'What would you consider to be a healthy diet?'

<sup>2</sup> NOO (2011b). Original question from the Low Income Diet and Nutrition Survey (2005): 'What changes would you make to your own diet?'

<sup>3</sup> SIGN (2010), <sup>4</sup> Item-total correlation using Spearman's rho (two-tailed), \* Correlation is significant at the 0.05 level, \*\* Correlation is significant at the 0.01 level

Baseline CHEKQ scores (out of 10) were low (mean[SD] 2.53[1.29]). Significant associations were found between baseline knowledge and age ( $r=0.522$ ,  $p=0.046$ ), and number of previous Healthy Kid5 appointments ( $r=0.565$ ,  $p=0.028$ ), respectively. No relationship was found with gender ( $U=19.5$ ,  $p=0.314$ ). There was a significant overall improvement in knowledge (Wilcoxon signed-rank,  $p=0.001$ , median 2.0 vs 6.0) following the appointment using the *Feed-back* e-resource.

Scrutiny of the data showed that all three children receiving additional help at school had improved knowledge after the consultation, with no significant difference between these and other children. Age was not associated with improvements in knowledge ( $r=0.346$ ,  $p=0.207$ ), and neither was gender ( $U=19.5$ ,  $p=0.316$ ).

### **5.3.3 Child communication**

#### *5.3.3.1 Global Child Communication Rating Scales (TRI-COM-RS)*

Internal consistency for the TRI-COM-RS was  $\alpha=0.701$ , interpreted as 'acceptable' ( $\alpha>0.700$ ). Item discrimination was above the recommended 0.3 for all items (Table 24). The ICC was 0.671, with a 95% confidence interval of 0.518 to 0.782, demonstrating 'substantial' (0.61 to 0.80) inter-rater reliability.

Higher parental insensitivity, defined as undermining or devaluing the child's contribution, was associated with lower levels of child

engagement in the conversation ( $r=0.524$ ,  $p=0.045$ ). Older children showed lower rated disengagement scores ( $r=0.647$ ,  $p=0.009$ ), suggesting that younger children showed more signs of disengagement from the conversation than older participants. Older children had higher child participation sub-scale scores ( $r=0.550$ ,  $p=0.034$ ), suggesting that older children were more engaged in communication.

**Table 24. Child and parent contribution sub-scale scores for the Triadic Child Communication Rating Scale (TRI-COM-RS), showing score means and variance, and item discrimination (item-total correlation) using Spearman's rho (two-tailed, significant at the 95% CI)**

Item category	Item	Minimum score	Maximum score	Mean (SD)	Item-total correlation ( $p$ -value)
Child-participation sub-scale	Child engages in the conversation	1	2	1.87 (0.35)	0.595 (0.019 <sup>*</sup> )
	Child disengages with the conversation <sup>+</sup>	0	2	1.27 (0.88)	0.721 (0.002 <sup>**</sup> )
	Child plays a role in goal-setting and decision-making	0	2	1.07 (0.88)	0.624 (0.013 <sup>*</sup> )
Parent contribution sub-scale	Parent tries to include the child (partnership)	0	2	1.33 (0.62)	0.400 (0.140)
	Parent insensitive to the child or their contribution <sup>+</sup>	0	2	1.27 (0.96)	0.782 (0.001 <sup>**</sup> )
	Parent intrusiveness <sup>+</sup>	0	2	0.53 (0.74)	0.511 (0.052)
	High level of parental need for their own health-related conversation <sup>+</sup>	0	2	1.53 (0.74)	0.619 (0.014 <sup>*</sup> )

<sup>+</sup> Recoded so that higher scores indicate better quality interactions, CI – confidence interval, <sup>\*</sup> Correlation is significant at the 0.05 level, <sup>\*\*</sup> Correlation is significant at the 0.01 level

### 5.3.3.2 Child Contribution Coding System (CCCS)

The author intra-rater ICC score was 0.841, with a 95% CI of 0.779 to 0.885, demonstrating 'substantial' (0.61 to 0.80) intra-rater



reliability. However, the independent ICC was lower at 0.550, indicating only 'moderate' (0.41 to 0.60) inter-rater reliability. Given the number of coding discrepancies (55.56%) across the first two independently coded data sets, further independent analysis using the current version of the CCCS was halted. Author CCCS data were explored for interest only. Mean turn time correlated with the child-participation subscale (TRI-COM-RS) ( $r=0.632$ ,  $p=0.011$ ), but not with gender ( $p=0.867$ ) or age ( $r=0.330$ ,  $p=0.230$ ). As one might expect, coded goal-setting (CCCS) correlated with rated child involvement in goal-setting (TRI-COM-RS) ( $r=0.524$ ,  $p=0.045$ ). No significant correlations were found with turn frequency ( $r=0.336$ ,  $p=0.220$ ).

## 5.4 Discussion

The aim of this study was to explore the possibility of using the *Feed-back* e-resource to support child communication within dietetic CWM appointments. Further objectives were to evaluate child and parent satisfaction with using the e-resource in a treatment setting, and to develop viable outcome measures to capture the effect of such an e-resource on child communication. These included a child knowledge measure (CHEKQ), a rating scale (TRI-COM-RS) to score triadic communication and an audio coding system (CCCS) to capture child autonomous engagement. This study has confirmed that this e-resource can be used within an appointment setting and it may assist child-dietitian communication and child engagement, demonstrating an increase in post-intervention child knowledge.

Children and parent/carer(s) were interested in taking part in the research and enthusiasm for the tool was further evidenced by study appointment attendance, and e-resource satisfaction results (E-SAM) ratings. This echoes attendance improvements seen in studies that have used other health-related e-resources (Bartholomew *et al.*, 2000), but e-resources do not always enhance the treatment experience (Eckler, 1998; Homer *et al.*, 2000). Overall, families in this study felt that the tool was easy to understand, and enjoyable to use. One child expressed dissatisfaction. When these data were further explored, data inconsistencies were found between written responses and verbal comments captured in the audio-recordings, and this child was recorded as saying that they wanted to continue using *Feed-back*. Parental responses indicated that the e-resource may have a role to play in parental education, as well as providing a visual reference for more meaningful discussions both within and beyond the appointment setting.

The visual references and interactions depicted in the *Feed-back* e-resource were generally well received by children and their families. Several children disliked the sounds that accompanied some animations. Research suggests that extraneous sound effects can be distracting (Clark and Mayer, 2008b), limiting effective communication. The e-resource itself may have been distracting for two participants; a boy and girl, aged seven and eight respectively.

For some child-patients, a visual aid of this kind could even hinder constructive communication. Even so, it is worth mentioning that high rates of attention difficulties have been found amongst overweight and obese children (Holtkamp *et al.*, 2004) and it is therefore important to identify resources able to sustain engagement for CWM.

The extent of concepts addressed in this prototype were limited but highlighted that, while the e-resource could be tailored to the treatment needs of most children (including those needing additional educational support), there is a limit to its ability to support conversations that occur in every treatment scenario. A parent properly identified that it may not have suited another child. She felt that it had been because of the age of her (11 year old) son. However, he had achieved the highest baseline knowledge score (Table 23). Future versions of the e-resource could include additional sections to broaden the scope of its appeal and relevance to this age group.

The *Time to Think* e-resource section was not used in the feasibility study. It was originally designed to facilitate exploration of the child's motivation and confidence to make behaviour changes. These aspects are usually addressed during initial appointments or when there is implied or expressed resistance to change (Pearson and Grace, 2012a). However, these treatment strategies were not encountered during this research.

Several measures were developed with data from this feasibility study. Intra-rater reliability of the Child Contribution Coding System (CCCS) was shown to be substantial, but there was only moderate inter-rater reliability. Significant coding differences deemed the measure unsuitable for use without simplification to the measure itself, improvements to training, and further testing. The Child Healthy Eating Knowledge Questions (CHEKQ) showed good item discrimination but baseline questions were perhaps too difficult or these study participants may have had low levels of knowledge. Overall, participants improved knowledge scores and post-intervention responses showed an ability to apply learning to lifestyle choices:

*Pre-intervention: 'What do you think healthy eating is?' –*  
"Some protein, some carbohydrates, and some fruit and vegetables. Sweets and sugary foods aren't healthy."

*Post-intervention: 'What have you learnt about healthy eating?' –* "Some things that I thought were healthy to eat, weren't as healthy, like corner yoghurts." 11 year old boy

Increasing the number of pre and post-intervention questions may further improve reliability of the measure.

There was a significant relationship between age and baseline knowledge. Roos (2002) and Zeinstra *et al.* (2007) found that 9 to 11 year olds were able to correctly identify foods considered to be healthy. Similarities in ability to explain the healthiness of food in terms of nutrient associations have also been found in children aged

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7 and 11 years of age (Hart *et al.*, 2002; Zeinstra *et al.*, 2007). However, in the Hart *et al.* (2002) study (n=114), preadolescent girls were more able (than boys of a similar age) to correctly identify calorie-dense foods such as those high in fat and refined carbohydrate. Changes in health knowledge in this study were also not correlated to age or gender. The age range may be too narrow to detect these differences and results in this study may have been affected by the small sample size.

The Triadic Child Communication Rating Scale (TRI-COM-RS) demonstrated a strong internal consistency, substantial inter-rater reliability and produced some noteworthy associations. Strikingly, when comparing the child and parent sub-scales, there were more positive items for child communication (n=2) with significantly more negative parent items (n=3) in the measure. Indeed, one positive item ('parent encourages the child to provide information: offering verbal encouragement, etc.') (Table 17) from the parent sub-scale was removed because it showed poor item correlation and would have reduced the internal consistency of the measure to  $\alpha=0.601$ . This implies that it may be easier to identify parental inhibitors, as opposed to enablers, of child communication. Parent/carer(s) need to be careful not to undermine the child or to dominate the conversation. It has been widely documented that verbal parent-dietitian exchanges limit the time available for child contribution (van Dulmen, 1998; Tates and Meeuwesen, 2000; Cahill and Papageorgiou, 2007; Coyne and Gallagher, 2011). As found in

other research (Wassmer *et al.*, 2004), this study found that parental insensitivity may have a particularly negative effect on child engagement in the conversation. Devaluing or undermining the child or what they say seems to have a profound effect on the child's ability to communicate effectively. In contrast, a parent that fosters the partnership approach to communication, by drawing the child into the discussion through their use of words and framing of concepts, could help the child to play a more active role in their treatment.

The e-resource did not lead to longer appointment times, as the extent of use varied depending on treatment need and time available. However, WiFi connectivity problems caused significant disruptions to seven appointments, and necessitated two children interacting with the e-resource on a laptop rather than a tablet device. While this problem did not appear to negatively impact satisfaction ratings, it is unclear how these distractions may have affected child communication and knowledge. WiFi connectivity would need to be addressed before integrating an internet-dependent tool into routine clinical care. One solution would be to remove the need for WiFi by packaging it as a standalone app.

## **5.5 Strengths and limitations**

This is the first study to use an electronic visual aid to facilitate child-dietitian communication, and to attempt to measure child engagement in the conversation. The e-resource itself was

evidence-based, designed for and tested by the intended users, and peer-reviewed by dietitians. WiFi-connectivity posed technical difficulties. With the research field in its infancy, validated data collection and outcome measures (Parmenter and Wardle, 2000) were not available. As a result, measures were developed and piloted.

Measures developed for this study were based on existing instruments, and further validity and reliability testing is needed in some cases. While a positive relationship was found between baseline knowledge and age, and number of previous Healthy Kid5 appointments, construct validity of the CHEKQ may be improved with additional knowledge questions. The 'moderate' ICC and coding discrepancies detected with the CCCS might in part be explained by limited training. Clinician communication (Table 17), crucial to triadic discussions (Howells *et al.*, 2010; Whitehead *et al.*, 2014), was not explored in this study. Reliability testing of this TRI-COM-RS sub-scale is needed.

The author was also the treating dietitian, responsible both for providing clinical treatment and conducting the study. This presented both strengths and limitations. One strength was the seamless integration into the Healthy Kid5 Service, enabled because of the author-dietitian already provided a dietetic service to some of these children, with a thorough understanding of treatment methods routinely used. As a result, study appointments followed the

structure of routine follow-up appointments. However, whilst juggling the two roles, some of the recordings were turned off prematurely, failing to capture goal-setting and other examples of child engagement. Recording the semi-structured interviews (that sought answers to the pre and post-intervention child knowledge questions) would have enabled consistency monitoring of the use of prompts across all participants.

The dual author-dietitian role, may also have introduced bias into the feasibility study. The inherent enthusiasm to use the e-resource to support treatment discussions may have affected the experience of children and their parents/carers, potentially positively skewing acceptability and satisfaction ratings. Furthermore, the author had developed the CHEKQ, which posed a different risk of bias.

Appointment conversations may have been steered to cover content that would have prepared children for the post-intervention knowledge questions. This could have affected the extent to which child knowledge was improved following the intervention. Recruiting other dietitians and researchers to future research, and blinding dietitians to the knowledge questions, will remove the risk of this type of bias.

Children and parents appeared to have genuine interest in the study, but it is conceivable that the £20 Amazon voucher, used as an incentive for participation, could have improved attrition rates.



## 5.6 Conclusion

The *Feed-back* e-resource may have a role to play in supporting dietetic conversations with overweight 7 to 11 year olds about their treatment. Both children and their parent/carer(s) found the e-resource acceptable, with high treatment satisfaction rates.

Overweight 7 to 11 year olds and parents found the visual references enjoyable and easy to understand. The study demonstrated an overall improvement in knowledge scores amongst girls and boys, including those in receipt of additional support at school. Further research is needed to extend the range of baseline and post-intervention knowledge questions with the CHEKQ measure.

The TRI-COM-RS rating scale was developed to assess child communication. Early results indicate that the child and parent sub-scales are reliable components that could capture child engagement in conversations about their weight management, and may help to explore the role of the parent in these discussions. Further research is needed to test the validity and reliability of the dietitian approach sub-scale and to simplify the CCCS measure. These types of instruments may assist investigations into the use of e-resources to support child communication and to improve treatment compliance and ultimately health outcomes. In order to achieve this, an appropriately powered RCT is needed.



## Chapter Six: Overall discussion and future plans

This thesis documents pioneering research into the use of an e-resource to enhance child communication within the child weight management (CWM) appointment setting. The aim was to develop a theoretically driven, evidence-based interactive e-resource and to explore the feasibility and acceptability of using it to facilitate communication between preadolescent children and the dietitian within the context of child weight management (CWM) appointments.

The development of *Feed-back* was informed by findings from a systematic review of e-resource interventions for paediatric populations (Chapter Two), a qualitative study with dietitians (Chapter Three) and a usability study with a sample of healthy and overweight children (Chapter Four). A feasibility study (Chapter Five) has demonstrated that the *Feed-back* e-resource prototype is an appropriately designed interactive visual aid which can be integrated into the CWM appointment. Children and parents found the resource useful and child knowledge increased following its use.

Chapter One outlined the legal rights of the child to be more involved in health-related decisions, which government policy indicates that the UK is moving towards. To date, little consideration had been given to how the preadolescent child could be empowered to play a more active role in treatment discussions.

Few studies have explored how to improve communication with this age group to enable them to play an active role in treatment discussions (Chapter Five). Child knowledge and communication measures have been developed, offering a platform on which to conduct further research into the effect of such an e-resource on behaviour change and health outcomes.

## **6.1 Key findings**

The key finding of this research is an e-resource that can be used within a dietetic weight management appointment. It has been designed to engage the child and deepen understanding. Measures have also been developed to assess the impact of such a visual aid on child communication within the appointment.

### ***6.1.1 Feed-back: An e-resource that forms part of the child weight management (CWM) intervention***

Prior to designing the *Feed-back* e-resource, a systematic review (Chapter Two) considered the impact of e-resources that have been used to deliver health services to preadolescent children with chronic conditions, within the clinical setting. The research focussed on the quality of child-clinician communication, and its effect on satisfaction and self-management. Of the 14 interventions identified, only one (Eckler, 1998) explored the effect of technology on child-clinician communication. This e-resource focused on clarifying orthodontic treatment options. Children in the study felt more involved but not listened to, which implies that the design or

use of the e-resource favoured clinician communication but was less successful at helping the child to express their questions or concerns. Overall, the review found improvements in child knowledge, self-efficacy, health outcomes and satisfaction with the e-resource. However, difficulties were reported with enlisting the expertise of health professionals in e-resource development.

To ensure that the proposed e-resource met the clinical needs and expectations of health professionals, interviews with dietitians (n=18) explored their approach to CWM appointments through thematic analysis (Chapter Three). The research confirmed that dietitians already use visual aids or resources as references for dietetic conversations with the child and their parent(s). There was consensus over the strategies dietitians use to manage conversations with 7 to 11 year olds, but a divergence of views over the role of the child and their parent in weight management (and the extent to which the child should be involved in their treatment). Parental support was seen as vital to the child's treatment and half of the dietitians (n=9) aimed to establish a partnership with the child and parent. Dietitians chose clinical resources to complement their verbal strategy. Most dietitians (13/17) supported the idea of an e-resource to facilitate paediatric health-related discussions.

The *Feed-back* e-resource (Chapter Four) was designed to support verbal exchanges within the CWM appointment. The iterative design approach sought to involve dietitians in the formative stages.

Seven to 11 year olds were involved in two rounds of usability testing (n=20), the latter included child-patients and took place within the CWM appointment setting. The feasibility study (n=15) (Chapter Five) showed that the tool was suited to a standard 30 minute appointment, with potential to engage the child and improve knowledge.

### ***6.1.2 Feed-back: An e-resource designed to engage the child and deepen understanding***

Attrition rates and piloted satisfaction questionnaires were used to gauge acceptability of the e-resource amongst children and their families. Children and their parent/carer(s) endorsed the concept by stating that they thought the *Feed-back* e-resource was good or very good and all but one child rated it as easy or very easy to understand. When compared with usual follow-up appointments, study appointment attendance rates were higher. Parents indicated that they thought the tool had been either quite useful (n=3) or very useful (n=12) to the appointment.

There was a significant overall improvement in child knowledge (Wilcoxon sign-ranked,  $p=0.001$ , median 2.0 vs 6.0), amongst girls and boys. Age did not affect change in knowledge scores, which implies that the e-resource may have improved understanding in younger children, just as it did in older children. Although knowledge questions had been piloted, feasibility study results

indicated that the range and depth of these questions should be extended.

Some parents commented that the e-resource deepened their understanding of the principles of weight management, which could in turn improve their ability to support the child in the CWM efforts. The fact that both the child and their parent/carer(s) viewed the same animations could provide a common point of reference on which to base conversations that take place away from the appointment setting:

“The see-saw of food versus exercise – great and simple – [*I will*] refer back to that.” Father to a 10 year old

In so doing, the e-resource may strengthen the partnership approach to behaviour change and contribute towards improved self-management.

### ***6.1.3 Measuring child contribution within the CWM appointment***

In the absence of a suitable measure to quantify child contribution, this research developed the Triadic Communication Rating Scale (TRI-COM-RS): three point rating scales to capture child communication within the appointment, together with aspects of parent-participation that may affect this contribution.

Parental contributions that undermined, devalued or contradicted the child insensitively were associated with lower levels of child

communication ( $r=0.524$ ,  $p=0.045$ ). Younger children showed signs of being more disengaged with the conversation, while older children tended to be more active participants in discussions. Given that younger children improved knowledge scores as much as older children, the item-descriptors in the child sub-scale may have been skewed to age (Table 15). Attention span and appointment length may equally have played a role.

TRI-COM-RS was found to have 'acceptable' internal consistency, 'substantial' inter-rater agreement and proved efficient to use. They also allowed for the capture of parent/carer (and potentially dietitian) interactions that could be further explored for their effect on child communication.

## **6.2 Contribution of the thesis**

Strengths and limitations of individual elements of this research have been discussed in their respective chapters. The purpose of this section is to offer a summative assessment of the thesis as a whole.

### ***6.2.1 Addressing the gaps in the literature***

Chapter One identified that eHealth has shifted its emphasis from cost-efficiency and financial savings, to improving quality of care and the patient experience. However, to date, digital health



research and health app development have failed to address several gaps that have been dealt with in this thesis.

There has been a shift towards patient (and child) centred care that values listening to and involving patients in their treatment (Chapter One). Active participation and empowerment is at the heart of this principle. The development of shared decision aids (NHS, 2014a) recognises the role of multimedia in learning (Clark and Mayer, 2008a) but similar digital health resources have not yet been developed for children. The *Feed-back* e-resource has been created to improve child participation in CWM treatment, providing access to verbal exchanges about care-related decisions, such as goal-setting.

Specifically, the *Feed-back* e-resource was designed to support face-to-face child-dietitian communication, an area identified by this thesis as underexplored within all health-related areas (Chapter Two). This is perhaps surprising given the recent change in focus within eHealth towards enhancing the patient experience and improving the quality of care patients receive (Chapter One). Coyle *et al.* published their work on using technology to support face-to-face consultations between adolescents and psychologists in 2007. However, this thesis identified no further work in this field until 2011, with the important acknowledgement by Mohr and colleagues of the complimentary role of eHealth and human support in behaviour change and treatment outcomes.

A repeat of the systematic review search terms revealed that another group of Norwegian researchers (Vatne *et al.*, 2013; Tsimicalis *et al.*, 2015) have started to explore the potential of an interactive multimedia e-resource to improve appointment-based child-clinician communication for long-term conditions such as heart disease and cancer. The *Sisom* e-resource sought to enable 7 to 13 year olds to express their symptoms more coherently so as to improve their treatment. While *Sisom* also encouraged child and clinician involvement in the development process (Tsimicalis *et al.*, 2015), there are also differences. The e-resource was intended for use before (rather than during) an appointment and the effect on child communication was captured using potentially more intrusive video data and analysed using dynamic exchanges (Roter and Larson, 2002). Preliminary findings suggested that *Sisom* may improve health professional communication with the child and vice versa (Vatne *et al.*, 2013). However, the study failed to differentiate between autonomous engagement and more passive exchanges making an evaluation of the extent of child participation in treatment-related discussions less clear. The measures developed in this thesis (Chapter Five) sought to provide a global rating of triadic communication (TRI-COM-RS) that based on audio data that did not need to be transcribed. Further validity and reliability testing of the coding system for autonomous engagement (CCCS) is needed.

Commercially available apps operate in an unregulated sector and have not been developed for use by health professionals to support clinical interventions. The review by Schoffman *et al.* (2016) that evaluated apps, developed for the prevention and treatment of childhood obesity, against expert-recommended guidelines for the treatment of CWM concluded that there was a general disregard for health professional-endorsed best practice and accepted treatment techniques. This thesis not only incorporated clinical guidelines but also considered the dietetic approaches to communication with the overweight child (Chapter), in order to ensure that the design of the e-resource was relevant to CWM treatment methods.

Clinicians that featured in papers identified in Chapter Two (and the subsequent repeated search) did not include dietitians or dietetic assistants. Generally, digital health research has focussed on medical and dental practitioners, and the nursing profession. Research contained in this thesis offers the basis for further development of digital health within the dietetic profession, which would be welcomed by some dietitians practising in CWM (Chapter Three).

### **6.2.2 Reflections on the research approach**

The strength of this research is that it brings a number of different specialities together; it was carried out by a specialist dietitian, with an interest in software development as opposed to a software specialist (likely to have little or no knowledge of dietary health or

CWM). Patient-centred evidence-based clinical practice has informed all aspects of this thesis. As ground-breaking work in this area, various fields of research were explored. The systematic review (Chapter Two) found that only one-third (n=4) of the identified e-resources are still available. However, the use of these electronic tools by health professionals themselves, remains unclear. The intention was to design an e-resource that could be integrated into clinical practice. Clinical validity was achieved by involving dietitians at an early stage (Coyle *et al.*, 2007). So as to understand their communication needs, Chapter Three analysed interviews with dietitians working in the field of CWM. Inductive thematic analysis described emerging themes, structuring the opinions of dietitians on their approach to CWM, and their use of visual aids in an appointment.

These findings formed the design basis for the e-resource.

Dietitians remained integral to the development process, which was both transparent and rigorous (Chapter Four). Involvement of child-users was an important consideration, critical to ensuring that the e-resource appealed to this age group and that interactive animations could serve as scaffolding for treatment conversations. A feasibility study, carried out within a clinical setting helped to confirm its potential for integration into dietetic care (Chapter Five). A limitation was that only one dietitian (the author) used the *Feed-back* e-resource. More dietitians would need to test the tool in order to be more confident of its general relevance to clinical practice.

WiFi-related technical problems became apparent during feasibility testing, a difficulty that would need to be overcome before making such a visual aid widely available.

Beyond the e-resource itself, outcome measures (Chapter Five) were developed to capture child communication. While measures offer a valuable contribution to future research in this area, they would benefit from further testing and development. Furthermore, this work offers the necessary starting point for progressing this field of study: extending the e-resource prototype for use in a larger RCT that could establish its effect on child communication and long-term effects on health outcomes.

### **6.2.3 Involving health professionals**

A strength of this thesis is that the work was embedded in the NHS. Including child-patients and dietitians, within NHS (from across the UK and Ireland) (Chapter Three) and then carrying out the feasibility study in an NHS community-based weight management service, makes the research relevant to one of the largest providers of healthcare in the world.

Dietitians were willing to take part in interviews about their clinical approach to communicating with children and their families (Chapter Three) but it was more difficult to engage them in the design and development of the e-resource itself (Chapter Four), a problem noted in other research (Dragone *et al.*, 2002, Bartholomew *et al.*

2006). Various approaches were tried – verbally, by post and electronic means. The eight clinicians that offered email feedback provided brief general encouragement rather than detailed constructive criticism. Dietitians did not seem invested in the concept. Mair *et al.* (2012) pointed out that there is a gap in understanding how to engage with health professionals, both before and during the implementation of IT solutions.

It is likely that time pressures and lack of ‘ownership’ of the e-resource contributed to the disappointing response rate amongst dietitians. Collaboration with two or three other interested dietitians, committed to co-authorship of the tool, would have been an alternative approach. Another solution might have been to hold iterative rounds of focus groups, carefully timed to capture formative and summative design evaluation. Within this type of forum, the purpose of the e-resource could be explained, dietitian ‘ownership’ of the project encouraged, and the design preferences of clinicians understood.

#### **6.2.4 Equipping the healthcare sector**

Having created an evidence-based prototype for clinical dietetic practice, practical obstacles will need to be overcome before this type of technology can be integrated into routine clinical care.

Designed for a tablet device, the *Feed-back* e-resource could be classified as mHealth. In 2011, the WHO global review of mHealth

indicated that the main barrier to implementing mHealth in Europe related to priorities, suggesting that:

“A stronger understanding of mHealth applications within the context of eHealth will be essential to align the benefits of mobile technologies within broader health and eHealth priorities.” (WHO, 2011, p. 67)

Greater awareness of the potential impact of e-resources on health outcomes is needed, together with the ability to integrate them with existing technology and healthcare strategy as a whole.

Taking first the need for technology integration, WiFi and internet connectivity are important technology considerations for the *Feed-back* prototype. A RCT for a web-based application, aimed to improve collaboration and communication between GPs and hospital-based obesity specialists (Lycett *et al.*, 2014) was conducted in Australia between 2008 and 2011. The authors noted that only 12 of the participating GPs (n=30) attempted to install the software and of those, just four were successful. Error messages and unacceptable download delays (of between 15 and 60 minutes) hampered efforts, and poor internet connection speeds, insufficient computer processing speeds and memory capacity were blamed. These sorts of technical obstacles can become deterrents in themselves, preventing assimilation into clinical practice (Liddell *et al.*, 2008; WHO, 2014). In recognition for the substantial investment required to ensure an adequate technology infrastructure, NHS England (2014b) has made a commitment to equip the health service to meet the growing demands of eHealth.

E-resource development will need to take account of existing future technology provision.

The second point is the integration into healthcare practice.

Clinicians themselves will need to understand how e-resources could be useful to patients before efforts are made to design and then accommodate them into various aspects of clinical care. Gracy *et al.* (2012) studied how electronic patient records have been translated from adult to child health settings. These are largely administrative tools, used to facilitate communication between health professionals (NHS, 2014b). Gracey and his colleagues identified a mismatch between aspects of the adult and child systems, with a need to support the different clinical conversations and practices specific to treating children and families. Given the inherently more complex nature of visual e-resources that are intended to support child-clinician communication, this type of e-resource will need to demonstrate that it does cater for triadic communication within CWM behaviour change interventions. Evidence on how this type of tool could enhance practice should be made available to clinicians, together with appropriate training and technical support to ease transition into patient care.

The final aspect raised by the WHO (2011), is the widespread awareness of the potential health impact of these resources amongst health professionals and providers, which is discussed in Section 6.5.



### **6.3 Implications and recommendations for further research**

This research has demonstrated that an interactive e-resource has a role in CWM consultations. Just as Rao *et al.* (2011) argue in relation to the internet, visual e-resource are instruments capable of supporting behavioural interventions for a range of different health conditions and population groups. Patients who may benefit from this type of visual aid include those with chronic conditions such as diabetes, allergies, disordered or restricted eating habits, and learning disabilities. A similar design and development strategy (Chapter Four) could be used to develop patient-centred tools in these areas. Further research is needed to understand the impact of such tools on behaviour change and health outcomes, when they are used to support child-clinician communication within the appointment setting.

Following on from treatment discussions, behaviour change requires adherence to the agreed goals. Another phase of the research recommendations includes exploring how e-resources can support motivation beyond the consultation setting. Children and parents in this research wanted access to the e-resource at home. While a strength of the *Feed-back* prototype is its heavy reliance on imagery, this in turn relies on the appropriate verbal framing of messages so that accurate and relevant information is conveyed to the child (and their parent/carer(s)). This visual aid is therefore

recommended for use within a consultation with clinically competent practitioners who is able to provide context and tailored advice.

Nevertheless, there is an argument to provide complementary resources that support child and parent self-management beyond the consultation setting as well.

Self-monitoring can improve self-management. Self-monitoring can be a reminder of the agreed goals and to encourage perseverance with lifestyle behaviours that may be unpalatable at first (Mockus *et al.*, 2011). Such resources could include an accelerometer to support increased physical activity, an electronic diary to capture physical activity and/or dietary changes, or a progress chart that helps to track instances of adherence to agreed goals. A further option could be to extend the scope of the *Feed-back* e-resource to incorporate downloadable electronic information sheets (McPherson *et al.*, 2006; Taveras *et al.*, 2015) or open access to evidence-based educational e-resources (Rao *et al.*, 2011). Evidence demonstrating that open access to e-resources can lead to self-management of chronic conditions is beginning to emerge (Ferguson *et al.*, 2016).

The design of open access e-resources and information for children needs to be based on sound pedagogical principles and provide cognitive support for a range of individual abilities and learning styles (McPherson *et al.*, 2014). McPherson *et al.* (2014) found that even websites with high reliability markers, such as clear aims, author name and date last updated, did not necessarily provide high

quality information. Aside from quality, other crucial considerations for open source information include reading level, ease of navigation, and multimodal transmission (such as illustrations, animations, video and interactive games), which can improve understanding and learning (Chapter One).

Intermittent feedback from the health professional can also improve motivation to behaviour change goals. Text messaging has been an effective means of clinical support (Bauer *et al.*, 2010; Fassnacht *et al.*, 2015). In their study with 8 to 10 year old children, Fassnacht *et al.* (2015) encouraged children (with support from their parents) to provide daily text-based monitoring on specific treatment-related goals, such as fruit and vegetable intake, physical activity and screen time behaviour. In return, researchers aimed to motivate children to reach age-appropriate recommendations for these behaviours by reinforcing positive changes and addressing negative behaviours, e.g.

“Great, you met your goal for physical activity and screen time! What happened to fruits and vegetables?” (Fassnacht *et al.*, 2015, p. 77)

In this small (n=49) school-based study population, there was a significant mean(SD) increase in fruit and vegetable intake following the eight week intervention period from 2.0(0.8) to 2.8(1.1) ( $p<0.05$ ), but this improvement was short-lived with a drop in mean intake to 2.5(1.2) four weeks later. Reductions in screen time were significant and maintained over time. Although children and parents

were very satisfied with the concept of text messaging, adherence to sending the monitoring texts diminished over time, from an average of 0.94 messages per day in the first week, down to 0.65 in weeks five and six, and 0.45 in weeks seven and eight (Fassnacht *et al.*, 2015).

In a feasibility study (Bauer *et al.*, 2010) with 40 overweight and obese children aged 7 to 12 year olds, children were asked to text weekly self-monitoring data for 36 weeks following a 12 week treatment period, involving group sessions with children and parents. One feedback message per week was sent back to the child in response. On average, 67% of the expected weekly messages were received and there was a positive correlation between children who had been more successful at reducing BMI in the treatment phase and likelihood of sending self-monitoring texts. Although the paper describes the feedback messages as 'tailored', they were tailored to the content sent by the child and then automatically generated according to an algorithm (Bauer *et al.*, 2010). They do not appear to have been tailored to individualised agreed adjustments required to make changes to their routine dietary and activity patterns. Those with lifestyles that deviated substantially from the 'healthy guidelines' may have viewed these messages as confirmation that their efforts were ineffectual, which may have contributed to their waning adherence.

Technology could improve adherence through self-monitoring (Bauer *et al.*, 2010; Fassnacht *et al.*, 2015), but a system that enables the health professional to offer personalised feedback that reinforces concepts discussed in the previous appointments may be more beneficial. This type of contact would serve to remind the child and their parent(s) of agreed changes, encourage and track progress, and form the basis of future appointment discussions.

#### **6.4 Reflections on the development and implementation of e-resources in dietetics**

Although several different methods were used in this thesis, attracting dietetic practitioners who were interested enough to invest in the *Feed-back* e-resource development proved difficult. In seeking to raise the profile of the e-resource (and eventually digital health) within the profession, the next step may be to raise the profile of the author and to develop a network of individuals to support this work. Joining BDA specialist interest group committees and creating a presence through professional discussion forums and social media groups would be one way of achieving this. This would be further enhanced through speaking engagements at professional conferences and through publications. Eventually, it is envisaged that a specialist interest group of its own will be created, to oversee future developments in this field and to offer guidance (such as e-resource accreditation for use in clinical practice). Dietitians should be open to forming collaborations with software developers,

academics and industry to influence the growth of digital health in dietetics.

An e-resource, such as *Feed-back*, would benefit from indepth scrutiny and constructive criticism from dietitian colleagues who would use it with their patients. A series of focus groups are likely to generate more discussion – rich data that should be transcribed and analysed qualitatively. This type of evaluation would help to further verify its construct and face validity, offering suggestions for improvement, highlighting potential barriers to implementation (along with possible solutions), and product endorsement. It would also inform the extent of supportive materials required to accompany such a tool, e.g. training, online information and guides, etc.

Making one evidence-based, clinically relevant and accepted dietetic tool is likely to create an appetite for similar tools within other areas of dietetic practice, such as paediatric diabetes, coeliac disease, and gastrointestinal disorders. These could similarly aim to enhance the quality of child-clinician communication but could equally be designed to support between-appointment treatment adherence and self-management. Some examples might include educational interactions and packages, or technology to support goal-related feedback (which may involve the use of accelerometers or electronic tracking of dietary intake). Ongoing research is needed to underpin these innovative ideas to ensure the effective use of resources that

improve treatment-related outcomes for patients. As technology progresses, previously assumed limitations on the uses of digital health will need to be reassessed.

## **6.5 Future plans**

Future plans involve this software, or a version of it, becoming integrated into dietetic practice. For this to happen, evidence of its value to dietetic treatment is needed along with making the e-resource available for clinical use.

The first step in realising these plans is to gather a core team, including a software developer and two or three clinicians. The coding and technical design of the e-resource needs to be checked, before it is package as a downloadable or web-based app. It is essential that the content keep abreast of clinical recommendations and evidence-based practice. During the course of this research, for example, the Eatwell Plate (FSA, 2007) was updated to the Eatwell Guide (PHE, 2016). This and future updates will need to be considered to ensure that the resource remains current. The option to extend the e-resource to include sections that address other dietetic strategies and behavioural targets (Chapter Four) will be explored. Clinical endorsement is also required to verify that it meets professional expectations, which could be carried out by interested clinicians on the 'team'.

The next step involves a RCT, using the developed *Feed-back* e-resource and outcome measures, to assess its relative effect on child communication and health outcomes amongst overweight 7 to 11 year olds. Measurable endpoints would include rated child communication, BMI z-score, and changes in dietary and physical activity behaviour. This study should be adequately powered and involve at least two dietitians over a period of up to 12 months, with a 6 to 12 month post-intervention follow-up. Further testing of measures, such as the dietitian sub-scale of the TRI-COM-RS, would be part of the study design.

The e-resource should be made available through access-restricted sites, requiring professional identification. Training for health professionals on effective use of the e-resource should be offered. Help features have been built in to the prototype and recommendations for clinical use are available from the blog site, but training would provide additional context to enhance clinical confidence. This could take the form of an online video, incorporating role-play and reinforced with downloadable reference documentation. Ongoing technical help and support will need to be considered, to deal with troubleshooting and to make upgrades that match technological advancement.

Integral to all future plans is the need to raise the profile of this work amongst the professional community (Section 6.4). There are



plans to publish further papers and to speak at professional dietetic meetings and conferences.

## **6.6 Conclusions**

An appropriately designed interactive e-resource could be integrated into the CWM appointment. This research demonstrates that child communication can be measured, and lays the foundations for further research into the effect of e-resources on the child's involvement in their treatment, self-management and subsequent behaviour change.



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