Weight Management in Children who have Asthma and Comorbid Overweight/ Obesity

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Doctor of Philosophy
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Abstract

Children living with asthma have an increased risk of overweight/obesity, and consequently, a greater prevalence and severity of asthma symptoms. Nevertheless, research on comorbid asthma and obesity, and how to optimise weight management support in this population, remains limited. This thesis uses a mixed-methods approach, including a systematic review, qualitative interview studies and questionnaire research, to explore the asthma-obesity relationship and to develop an asthma-specific weight management intervention. The systematic review highlights the potential to improve asthma outcomes through weight management; however, limitations in existing research mean it is not possible to identify optimal health behaviour theories or behaviour change techniques to do so. Findings from the qualitative research indicates that families and healthcare professionals recognise the multifaceted nature of comorbid asthma and obesity and that families' perceptions of asthma control could influence their engagement with weight management behaviours. Questionnaire findings corroborate reports of an interdependent relationship between asthma and overweight/obesity. Parents of children living with asthma reported significantly greater use of unhealthy feeding practices, such as using food to regulate emotions and restricting food for weight control, monitoring of child activity levels, pressure to exercise and control over child activity than parents of children without asthma. Asthma control was found to moderate a positive relationship between specific concerns about asthma medication and parental control of active behaviours, and parental asthma-related anxiety with the use of food to regulate emotions in the inadequately controlled asthma sample. Findings from this formative research were synthesised, and used to develop a theory-informed asthma-specific weight management intervention. This thesis demonstrates the necessity of bespoke weight management support for paediatric asthma and concludes with recommendations for future research and practice.

Keywords: asthma; obesity; paediatrics; weight management; intervention.

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List of Abbreviations

ACQ	Asthma Control Questionnaire
ACT	Asthma Control Test
AR-QOL	Asthma-Related Quality of Life
BCT	Behaviour change techniques
BMI	Body mass index
BMI-SDS	Standardised BMI
BMQ	Beliefs about Medicines Questionnaire
cACT	Childhood Asthma Control Test
CASP	Critical Appraisal Skills Programme
CEBQ	Child Eating Behaviour Questionnaire
CFQ	Child Feeding Questionnaire
CFPQ	Comprehensive Feeding Practices Questionnaire
ERV	Expiratory Research Volume
EIB	Exercise-induced bronchoconstriction
FeNO	Fractional exhaled nitric oxide
FEV	Forced expiratory volume
FEV_1	Forced expiratory volume in one second
FEV1%	Percent-predicted forced expiratory capacity in one second
FVC%	Percent-predicted forced vital capacity
GINA	Global Initiative for Asthma
GLTEQ	Godin Leisure-Time Exercise Questionnaire
HCP	Healthcare professional
IL-6	Interleukin 6
IL-8	Interleukin 8
IPQ	Illness Perceptions Questionnaire
MECC	Making Every Contact Count
MET	Metabolic equivalent of task
MI	Motivational Interviewing
MMR	Mixed methods research
MRCF	Medicine Related Consultation Framework
PAAS	Parental asthma-related anxiety scale
PAQLQ	Paediatric Asthma Quality of Life Questionnaire

PedsQL	Pediatric Quality of Life Inventory
PedsQL-AM	Pediatric Quality of Life Inventory Asthma Module
PRAM	Parenting Related to Activity Measure
RCT	Randomised controlled trials
TDF	Theoretical Domains Framework
TNF-Alpha	Tumour necrosis factor alpha
WHO	World Health Organisation

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Publications and Presentations Derived from this Thesis

Peer reviewed publications

Clarke, R., Health, G., Pattison, H. & Farrow, C. (2018). Weight-management in children living with asthma: a qualitative study of the experiences of paediatric healthcare professionals. Journal of Asthma, 56, 1274-1281.

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Oral presentations

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Clarke, R. (2018). *Weight-management in children living with asthma: a qualitative study of the experiences of paediatric healthcare professionals*. Powerpoint presentation at the Psychology of Eating in Adults and Children Research Group, Aston University, UK

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Clarke, R. (2018). *Weight-management in children living with asthma: a qualitative study of the experiences of paediatric healthcare professionals*. Powerpoint presentation at the Psychological Perspectives of Healthy Eating in Children Research Seminar Series, Staffordshire University, UK

Clarke, R. (2017). *Exploring Eating Behaviours and Weight Management in Children who have Asthma and Comorbid Obesity.* Powerpoint presentation at Health & Lifespan Psychology, Aston University UK.

Poster presentations

Clarke, R. (2019). *Parental feeding, child eating and physical activity: Differences in children with and without asthma*. Poster session presented at the Association for the Study of Obesity, Leeds University, UK.

Clarke, R. (2019). *Parental practices around feeding and exercise in children living with and without asthma*. Poster session presented at the British Feeding and Drinking Group, Swansea University, UK.

Clarke, R. (2018). *Weight-management in children living with asthma: a qualitative study of the experiences of paediatric healthcare professionals*. Poster session presented at Psychology Postgraduate Affairs Group, Huddersfield University, UK

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Clarke, R. (2018). *Weight-management in children living with asthma: a qualitative study of the experiences of paediatric healthcare professionals*. Poster session presented at Aston University's Prize Scheme Celebration, Aston University, UK

Clarke, R. (2017). *Exploring Eating Behaviours and Weight Management in Children who have Asthma and Comorbid Obesity*. Poster session presented at the Life and Health Sciences Postgraduate Research Day, Aston University, UK.

CHAPTER 1

Introduction and Literature Review

1.1 Overview

This chapter provides an introduction to the thesis and overview of the main concepts of this study. It begins by outlining background literature relating to comorbid paediatric asthma and obesity, before examining factors that may help to explain the relationship between asthma and obesity in children and young people. The current provision of weight management support for young people with asthma is then described. Following this, a justification for the methodology used within the thesis is presented. The chapter closes by identifying the overarching aim of the thesis and specific study objectives.

1.2 Background

1.2.1 Paediatric Asthma

Asthma is one of the most common, lifelong chronic illnesses in children (World Health Organization: WHO, 2019). The condition is recognised by the inflammation and narrowing of the airways that can limit expiratory airflow (National Institute of Health, 2020). Asthma exacerbation can cause uncommunicative attacks of breathlessness, wheezing and tightness of the chest (Global Initiative for Asthma: GINA, 2020). The UK has one of the highest prevalence rates for asthma symptoms in the world, with one in 11 children in the UK living with asthma (Asthma UK, 2019). Every day a child in the UK is admitted to hospital every 20 minutes because of an asthma attack (Asthma UK, 2017).

Asthma often develops in childhood (Yunginger et al., 1992). During childhood the incidence of asthma symptoms is often higher than adulthood when asthma symptoms may persist or decrease (Trivedi & Denton, 2019). Asthma incidence and the prevalence of symptoms is higher

in young boys during childhood due to a smaller airway diameter and reduced immune response compared to girls (Wijga et al., 2011; Yung et al., 2018). This gender disparity reverses during puberty however, when girls are considered to have a higher prevalence of symptoms that continue into adulthood, suggesting a role of hormones in the pathogenesis of asthma (Fu et al., 2014).

For people living with asthma, exposure to specific environmental factors can trigger asthma symptoms. These triggers can be both allergenic (e.g. pollens and house dust mites), or non-allergenic (e.g. passive smoking and stress) (Gautier & Charpin, 2017). The goal of asthma management is to achieve good asthma control thereby minimising the risk of asthma exacerbation (Papi et al., 2018). The ongoing use of asthma medication (inhalers and tablets) and the avoidance of environmental exposures which trigger asthma are important for achieving controlled asthma (GINA, 2020). As individual triggers vary from person to person the management of asthma in children often requires a bespoke treatment plan (Gupta et al., 2018).

Living with asthma can impose a significant burden on children and young people, their families and the wider community. The exacerbation of asthma symptoms for example, can result in young people and their parents missing school and workdays, and is one of the most common reasons for emergency hospital care in the UK (Nunes et al., 2017; Keeble & Kossarova, 2017). When asthma is uncontrolled, it can also place significant limitations on physical and social activities, such as playing outside with friends or visiting relatives who smoke (GINA, 2020; Bellin et al., 2017). As a result, living with asthma can impact negatively on psychological-wellbeing; living with asthma has been associated with higher anxiety and a lower reported quality of life in young people living with asthma (Sundbom et al., 2016). Moreover, asthma often co-exists with other health conditions, such as allergic rhinitis, gastroesophageal reflux disease and

obesity (Nunes et al., 2017). The management of these comorbidities is essential for asthma control as well as reducing costs and burdens placed on healthcare systems. At present, £1.1 billion is spent per annum on asthma care in the UK (Mukherjee et al., 2016).

1.2.2 An Obese-Asthma Interaction

Both childhood obesity and childhood asthma have grown in prevalence in recent decades (WHO, 2020**;** Global Asthma Report, 2018). Currently, 30% of children aged between 2 and 15 years in England are overweight or obese (Health Survey for England, 2017). Obese children have an increased risk of diseases such as cardiovascular disease, diabetes and sleep apnoea which can place additional demands on a child's asthma management (GINA, 2020). Several studies have also found that children who are obese are at a greater risk of developing asthma (McCallister et al., 2018; Lang et al., 2018; Thaker et al., 2020). At the same time, the risk of becoming overweight or obese is thought to be higher in those who are already living with asthma. Recent research in America has found that children diagnosed with asthma have a 51% increased risk of becoming obese over the next ten years compared with children without asthma (Chen et al., 2017). Another longitudinal study in Europe has found that early-onset asthma and wheezing is associated with a higher incidence of childhood obesity (Contreras et al., 2018).

Living with asthma and comorbid obesity is thought to modify the clinical characteristics of asthma and increase the risk for asthma exacerbation (GINA, 2020). Children who are overweight and living with asthma have a higher prevalence and severity of asthma symptoms as well as a lower quality of life (Peters, Dixon & Forno, 2018). Furthermore, many children living with asthma and obesity tend to have a decreased responsiveness to asthma medication (Forno et al., 2011). Therefore, comorbid asthma and obesity can result in higher doses of asthma medication and may explain increased asthma-related visits to the emergency

department and hospitalisations compared to peers living with asthma who have a healthy weight (Forno et al., 2011; Ahmadizar et al., 2016).

1.2.3 Directionality of the asthma-obesity relationship

To date, the mechanisms underlying the relationship between asthma and obesity are largely unknown. Several theories suggest that obesity precedes asthma and creates asthma-like symptoms. One potential explanation is that obesity alters lung mechanics. Central adiposity can cause mechanical changes on the chest wall, which can result in airway obstruction and reduced lung capacity (Shore, 2008). A decreased lung volume can lead to airway obstruction, an asthma-like phenotype and restricted tidal volume changes (Beuther, 2009; Fredberg, 2001). Changes in lung function and tidal volumes result in detachment of actin-myosin cross-bridges of airway smooth muscle and, in turn, reduced smooth muscle stretch (Shore, 2008). This causes the airway smooth muscle to constrict and become difficult to stretch, resulting in a latch state and chronic bronchoconstriction (Fredberg, 2001).

Another underlying mechanism could be the adipokines secreted by increased adipose tissue. An example of this would include leptin, which is produced in proportion to adipose tissue. Increased levels of leptin have been found in those living with asthma and obesity compared to an obese control sample (Sidaleva et al., 2012). Increased leptin can enhance airway hyper-responsiveness and has been found to correlate with worse lung function (Berthon et al., 2013; Huang et al., 2017). Leptin is also responsible for producing pro-inflammatory cytokines that can increase neutrophil function, greater neutrophil recruitment to the lungs and may cause neutrophilic airway inflammation (Caldefie-Chezet et al., 2001). Such systematic inflammation has been found in asthma patients who have worse lung function and more frequent asthma exacerbations (Peters et al., 2016).

Further research indicates that living with asthma may lead to weight gain (Chen et al., 2017; Contreras et al., 2018), however its role in doing so has not been well established. Environmental factors associated with the aetiology and/ or management of both asthma symptoms and obesity may mediate a cyclical relationship between asthma and obesity. These factors include physical activity, diet, asthma treatment and available weight management support. Such factors may be modifiable and be utilised in an asthma-specific weight management intervention. An overview of these modifiable factors and their relationship with the asthma-phenotype will now be discussed.

1.3 Modifiable Factors

1.3.1 Physical Activity Parameters

1.3.1.1 Challenges to Physical Activity in Asthma

Regular engagement in exercise may be a protective factor against obesity and poor asthma control. Higher daily exercise engagement has been associated with a decline in childhood weight and is often a component of weight reduction interventions (Sampasa-Kanyinga et al., 2019; Boff et al., 2016). Furthermore, regular exercise promotes stretching in the airways, hyperventilation and bronchodilation (Lang, 2012). Repeated stretching of the airway's smooth muscle can reduce the risk of airway hyper-responsiveness and narrowing of the airways (Fredburg, 1998). Thus, higher levels of engagement in physical activity not only has general health benefits but has been associated with reduced airway inflammation, higher exercise capacity and is a goal of asthma management (Cordova-Rivera et al. 2018; GINA, 2020). In contrast, sedentary behaviour has been found to increase the risk of asthma symptoms in children and adolescents living with asthma (Lu et al., 2016).

However, engaging in physical activity may present a challenge for young people living with asthma due to exercise-induced bronchoconstriction (EIB). EIB can be defined as a narrowing

of the airways caused by exercise, resulting in wheezing, shortness of breath and coughing during or after physical activity (Weiler et al., 2016). Consequently, young people living with asthma may engage in less exercise than their peers without asthma (Lam et al., 2016). One study conducted in America found that 58% of teenagers living with asthma reported exercise to be an asthma trigger and 63% reported that asthma limited their exercise capacity (Davis et al., 2011). Reduced exercise is not only associated with poorer overall health outcomes (Ruegsegger & Booth, 2017), but with increased asthma symptoms and increased weight (Leinaar et al., 2016).

Activity levels in children living with asthma could also be reduced as a result of living with obesity (Oudjedi & Aissa et al., 2020). Literature suggests that exercise may be more difficult when overweight or obese due to weight-related stigma and a reduced exercise capability caused by adverse effects on lung function (Suiraoka et al., 2017; Mazzeo, 2016). Furthermore, EIB is more likely when living with obesity (Souza de Almeida et al., 2020). Thus, obesity may lead to a decline in both aerobic capacity and asthma control during physical activity. However, as both EIB and poor aerobic fitness can create breathlessness (GINA, 2020), it is crucial to understand how families interpret breathlessness in relation to asthma control and how this can influence exercise engagement.

1.3.1.2 Perceptions of exercise capacity and asthma risk

Living with asthma may create a negative self-perception of exercise ability and discourage young people from participating in physical activity (Leinaar et al., 2016). As being fit and able to engage in exercise is associated with a sense of community and acceptance (Williams et al., 2010), children with asthma may prefer to engage in sedentary activities in order to avoid stigma and exclusion (Vangeepuram et al., 2014; Williams et al., 2008). Young people living with asthma have reported not wanting to feel different from their peers and feeling embarrassed

by asthma symptoms such as breathing heavily as a result of exercise (Svedsater et al., 2017). Embarrassment or shame caused by not being able to keep up with peers during physical activity, or feeling left out, can deter those with asthma from participating (Shaw et al., 2017; Winn et al., 2018).

Reduced exercise or exercise avoidance may also be a method to control asthma. Bruzzese and colleagues (2016) found that adolescents who experienced asthma-related anxiety adjusted their behaviours to prevent asthma symptoms from developing. Thus, the avoidance of exercise could be related to the fear of EIB (Winn et al., 2018). Park, Sawyer and Glaun (1996) created a model highlighting the role of cognitive factors in the development of panic disorder in children with asthma. The model proposes that children living with asthma may misconstrue typical symptoms of dyspnea with an asthma threat. The incorrect identification of asthma symptoms can thus create a positive feedback loop that reinforces the perception of limited exercise capacity and the need to avoid exercise (Yellowees & Ruffin, 1989).

Parental perceptions of the risk to asthma control may also influence young people's activity levels. In previous research, parents have reported perceiving their role as a parent to protect their child from unpredictable asthma exacerbations (Shaw et al., 2020). This may help to explain why two-thirds of the caregivers of children living with asthma perceive exercise as a danger for their children with asthma (Eisenberg et al., 2020). When physical activity was perceived to be a threat to asthma control, parents were more likely to limit or deter their child's engagement with physical activity (Williams et al., 2010; Holderness et al., 2017). However, as parents may not always correctly interpret the cause of breathlessness (Kornblit et al., 2018), some reduced activity in young people may not be clinically necessary; rather reflecting a form of "overprotective" behaviours in parents (Sicouri et al., 2017). Furthermore, discussions between parents and children have been found to influence avoidance and

prevention behaviours, leading parents to unintentionally transfer their interpretation biases to their children (Easter et al., 2015; Sicouri et al., 2017; Bell et al., 2015). This highlights the importance of including parents in paediatric asthma research and education, as well as gaining a greater understanding of how families interpret breathlessness.

1.3.2 Dietary Influences

1.3.2.1 Diet, systemic inflammation and asthma symptoms

Western societies have shown a preference for convenience foods. Western dietary patterns can be characterised by surplus energy intake as well as intake of refined grains, highly processed and red meats, desserts, fried foods, high-fat dairy products (Guilleminault et al., 2017). As a consequence, adherence to this diet can result in an increased risk of obesity (Wood, 2017).

A westernised diet is not only associated with obesity but can have other adverse health effects such as increased systemic inflammation; such that foods high in saturated fat can stimulate pro-inflammatory pathways that can increase airway inflammation (Wood, 2017). It is plausible that saturated fats may trigger the pro-inflammatory adipokines, including leptin, IL-6 and TNF-Alpha, that can induce asthma symptoms (Lang, 2012). Previous research has found that the consumption of convenience foods and red meat at least three times a week is associated with wheezing symptoms (Castro-Rodriguez et al., 2017). Furthermore, a higher prevalence of clinician-diagnosed asthma has been found in children who consumed a westernised diet (Patel et al., 2014).

Consuming salty foods may have a similar influence to saturated fats on asthma symptoms. Sodium can modify the muscle membrane sodium transport, which in turn can contribute to the contraction of the airway smooth muscle (Knox et al., 1990). Research has found that eating

salty snacks more than three times a week has been associated with a nearly six times higher likelihood of having asthma symptoms and a greater risk of severe asthma (Arvanti et al., 2011; Ellwood et al., 2013). Similarly, high sodium diets have been linked to bronchial hyper-responsiveness and wheezing symptoms (Burney, 1987). For children using corticosteroids, sodium intake is of particular importance as some asthma medication can cause sodium retention, resulting in potassium loss and hypertension (McEvoy et al., 2010).

In contrast, the Mediterranean diet has a high volume of fruits, vegetables and olive oil which contain anti-inflammatory micro-nutrients (Guilleminault et al., 2017). These anti-inflammatory micro-nutrients may offer a protective effect on asthma symptoms. Children with asthma who consumed more fruit and vegetables have been found to have a lower prevalence of wheezing (Hosseini et al., 2017). Further research indicates the intake of fruit, vegetables and fish are inversely associated with asthma symptoms, suggesting that antioxidant foods may have non-pharmacological benefits for asthma control (Papadopoulou et al., 2015). One experimental study found that adherence to a Mediterranean diet reduced the use of short-acting asthma medication (Lee et al., 2013), highlighting the overall importance of diet in asthma management.

1.3.2.2 Asthma and food allergens

The prevalence of asthma and food allergy comorbidity has thought to have risen over recent decades (Akinbami et al., 2016; Kim et al., 2016). Research has found that 49.2% of parents of children living with asthma have reported that their child has had an allergic reaction to a food consumed in the past (Arabkhazaeli et al., 2015). Those living with comorbid asthma and food allergy also have a higher risk for anaphylaxis and more severe asthma (Calvani et al., 2011; Wang & Liu, 2011). As food allergens can enhance bronchial hyperactivity and increase inflammation as they enter the airways, it is possible that they can be a rare trigger for asthma

symptoms (Krogulska et al., 2016; Caffarelli et al., 2016). Thus, integrating food allergies into asthma management may have benefits, as children report using less inhaled corticosteroid treatment when exposure to food allergens is reduced (Foong et al., 2017).

So far, there is limited insight into how living with asthma may influence dietary habits in individuals living with asthma. It is possible that young people living with asthma may adjust their food choices to manage their food allergies and asthma control. Research exploring the eating habits of teenagers living with food allergies found that they limited the variety of foods they consumed and relied on parental judgement of what was safe (Sommer et al., 2014). Furthermore, families have reported integrating natural remedies to manage asthma, such as anti-inflammatory foods like honey (Garbutt et al., 2017). Nevertheless, how families living with asthma alter their diet to enhance asthma control is poorly understood.

1.3.2.3 Parental feeding practices and child eating behaviours

A child's access to food is mostly dependent on their home environment and their parents. Prior research has found that adolescents are more likely to consume fruit and vegetables when there is a greater availability in the home (Pearson et al., 2017). The availability and consumption of fruit and vegetables has also been associated with eating meals together as a family (Christian et al., 2013). Families who regularly eat together are more likely to consume a higher quality diet and less fast food (Berge et al., 2018; Berge et al., 2016). As a result, regular family mealtimes may be a protective factor for childhood obesity (Berge et al., 2015). In comparison, the use of television during meal times, limited time to prepare food and conflicts over food choices are associated with poorer diet quality (Avery et al., 2017; Alm & Olsen, 2017). Such family mealtime practices and a poorer diet quality have been established to correlate with both a lower socio-economic status and childhood obesity (Drewnowski & Specter, 2004; Ojeda-Rodriguez et al., 2018).

It is clear then, that families have an important impact on children's dietary intake; parents model eating behaviours and patterns which are often mirrored by their children (Scaglioni et al., 2018). Moreover, parental feeding styles can shape children's preferences and responsiveness to food. Evidence suggests that parental feeding practices, such as restricting food for health reasons and using food as a reward can increase the desire for those foods and the prevalence of eating in the absence of hunger (Farrow, Haycraft & Blisset, 2015). Restrictive feeding practices have also been associated with a higher child body mass index (BMI) as children tend to crave (usually high fat, high calorie) foods that are restricted and rationed in the home (Rollins, Loken, Savage & Birch, 2014). Understanding modifiable practices that influence eating behaviours and food consumption in the home environment is vital for the development of effective dietary interventions.

Further evidence suggests that parental feeding practices may be modified by parenting a child living with chronic illness, where there are often greater levels of parental anxiety (Ghaffari et al., 2018; Avcil et al., 2019). In the case of asthma, increased anxiety may evolve from the unpredictability of asthma symptoms or difficulty balancing asthma management alongside other family demands (Selby et al., 2018; Fawcett et al., 2019). It has been suggested that living with ongoing stress can interfere with parental feeding strategies (El-Behaldi et al., 2015). Higher levels of reported parental stress have been associated with the greater use of unhealthy feeding practices, such as using food as a reward or overtly restricting food (Gouveia et al., 2019; Alm & Olsen, 2017) and may contribute to the increased risk of obesity in children who have asthma. While there is limited qualitative research to suggest that parents adjust their child's diet as a method to control asthma symptoms (Farnesi et al., 2019; Garbutt et al., 2017), how parental anxiety contributes to diet modification is unknown. A greater understanding of

the various ways in which parental feeding practices may change as a result of asthma thus requires further exploration.

Children living with asthma may also alter their eating behaviours, as research has found young people living with asthma to have a greater risk of developing unhealthy eating behaviours (Olguin et al., 2016). Limited research exploring asthma and child eating behaviours has found that adolescent girls with asthma are more likely to be obese and more likely to diet, eat for pleasure and eat when sad than their peers without asthma (Moreau et al., 2009). Moreau and colleagues (2009) attributed these findings to increased anxiety and depression and greater biological vulnerability in this population. Furthermore, binge eating behaviour, self-induced vomiting and laxative use have been associated with asthma (Olguin et al., 2016; Hatton et al., 2014). It is possible that young people living with asthma adjust their diet due to asthma-mediated weight gain (Farnesi et al., 2019; Garbutt et al., 2016). However, it is worth considering that it is weight status and body dissatisfaction that influence eating behaviours. While this limited research indicates that young people living with asthma may be at a higher risk for unhealthy eating behaviours, the factors that may influence them need greater exploration to understand the relationship. It is important to understand how eating behaviours develop in children who are living with asthma, as eating behaviour traits are stable over time and can be carried forward into adulthood (Houldcroft, Farrow & Haycraft, 2016).

1.3.3 Asthma medication

1.3.3.1 Adherence

Adherence can be defined as “the extent to which the patient's action matches the agreed recommendations” (NICE, 2009). Living with asthma means that young people need to incorporate healthy behaviours and adapt daily routines to include taking medication for the success of long term management (GINA, 2020). Adherence to asthma medication has been

found to have a positive association with better asthma outcomes, quality of life and reduced healthcare utilisation (Kaplan & Price, 2020).

Whether adherence occurs may depend on an individual's evaluation of the treatment and the degree to which it is thought necessary (Brownlee-Duffeck et al., 1987). The self-regulatory model of illness conceptualises the decision to take medication as a method of coping with an illness threat (Leventhal et al., 1992). According to this theory, a patient is more likely to take medication if it fits their 'common sense' beliefs about the condition (Leventhal et al., 1992; Leventhal et al., 2016). Thus, the belief that failure to take medication will result in negative consequences is likely to act as a motivator to take medication (Cummings et al., 1982). The Necessity-Concerns Framework suggests that a patient's motivation to adhere to medication is judged by perceptions of personal need for the treatment relative to concerns about negative consequences (Horne & Weinman, 2002). If asthma medication has not previously improved symptoms or had adverse consequences, adolescents may believe that they do not need them or choose not to take them (Halm et al., 2006; Mammen et al., 2017). Alongside this, the practical challenges should be considered. The Perceptions and Practicalities Approach (Horne, 2001) proposes that both intentional (e.g. deciding not to take medication) and unintentional factors (e.g. forgetting to take medication) can be barriers to adherence. Factors such as losing asthma inhalers and difficulty in remembering to take asthma medication when routines have changed have previously been reported as challenges to adherence (Holley et al., 2017).

1.3.3.2 Medication and Stigma

The evaluation of the necessity of asthma medication may also include psychosocial factors. For some, living with asthma can lead to feelings of embarrassment, denial of consequences and the perception of negative peer evaluations (Mäkelä et al., 2013; Rhee, Wenzel & Steeves, 2007). Young people living with asthma report perceiving peers to characterise the use of

inhalers as a sign of weakness (de Simoni et al., 2017). Perceptions of stigma may also occur as a consequence of previous episodes of bullying from having to use inhalers during physical activity (Monaghan & Gabe, 2015). Consequently, this perceived stigma may deter young people from using asthma medication when in public (de Simoni et al., 2017).

Instead, adolescents may prefer to use non-pharmacological approaches to manage asthma. As already mentioned, previous research has found the adjustment of leisure activity to be a method to maintain asthma control (Farnesi et al., 2019). Adolescents report preferring non-pharmacological methods of asthma management, such as slowing down, restricting daily physical activity and drinking water, over inhaler use (Mammen et al., 2017; Peláez et al., 2015). The anticipation of negative social stigma from medication use may, in part, explain non-adherence and reduced physical activity in asthma. It is possible that such techniques increase the risk of suboptimal asthma control, increased physical activity limitations and weight gain (Holderness et al., 2017). As such, the influence of social stigma in asthma medication adherence and physical activity engagement warrants further investigation to understand the relationship with weight gain.

1.3.3.3 Non-adherence as a strategy for weight management

Non-adherence may also occur due to perceptions and worries about the adverse consequences of taking medication, such as weight gain (Lycett et al., 2018). A positive relationship has been found between the use of corticosteroids to treat asthma and increased weight (Han et al., 2019). The BMI of children taking a high dose of steroids increased by 0.369 kg/m2, compared to a smaller increase of 0.195 kg/m2 in a low dose group (Han et al., 2019). As young people living with obesity have reduced responsiveness to corticosteroids, the dose often rises with increasing BMI (Chen et al., 2013). Consequently, a vicious cycle may be created between rising BMI and corticosteroid dose (Clarke et al., 2018).

Both parents and young people have reported concerns about asthma medication increasing appetite and weight gain (Lakhanpaul et al., 2017; de Simoni et al., 2017). Families may therefore, choose to prioritise weight management over asthma control; indeed, the belief that asthma medication will result in weight gain has been reported to reduce motivation to adhere (de Simoni et al., 2017; Lycett et al., 2018). It is possible that such weight management techniques further increase the risk of suboptimal asthma control, increased physical activity limitations, and the need for higher-dose treatment and further weight gain (Holderness et al., 2017). In order to increase families' asthma medication necessity beliefs and reduce concerns, it is necessary to gain a greater understanding of the different components of the cost-benefit analyses that influence adherence.

1.3.4 Paediatric Weight Management Support

1.3.4.1 Opportunities for weight management support

'Make Every Contact Count' (MECC) is an initiative developed and promoted in the National Health Service (NHS) to ensure that healthcare professionals (HCPs) provide opportunistic health behaviour change advice during every contact (Health Education England, 2020). This initiative includes training for professionals on health promotion and behaviour change, particularly around how to initiate difficult conversations. Through these conversations, HCPs can provide concise and consistent healthy lifestyle information that can enable individuals to make healthier choices. Instead of creating additional work, MECC aims to create a culture of providing concise, consistent health lifestyle information in existing health consultations and referring to other local services when necessary.

Despite initiatives such as MECC, engaging families in weight management conversations can be challenging. HCPs have reported there to be limited time in existing consultations to discuss

weight and insufficient training on how to deliver weight management advice (Bradbury et al., 2018). Uncertainty with how best to raise the topic of weight and limited access to resources for supporting families can act as barriers to providing advice on weight management (Bradbury et al., 2018; Kelleher et al., 2017). While strong relationships with families have helped to create a foundation to discuss child weight, other HCPs have reported fearing that such conversations can damage patient-physician relationships, break families' trust and result in negative family reactions (Dewhurst et al., 2017). As a consequence, some HCPs may miss opportunities to provide weight management support (Jones et al., 2014).

The patient-physician relationship and the delivery of weight management support may be further complicated by the beliefs HCPs hold around weight. Literature suggests that some HCPs may not understand the complexity of obesity and associate being overweight with traits such as laziness or lacking self-control (Pont et al., 2017). Some HCPs may also attribute childhood obesity to family characteristics (Bradbury et al., 2018). Believing families to be unmotivated to change could reduce the quality of care offered, as HCPs have reported spending less time with overweight patients than healthy-weight patients (Pearl et al., 2018). Furthermore, families have expressed dissatisfaction with HCPs use of stigmatising language, often perceiving HCPs to be dismissive of the challenges associated with losing weight (Pont et al., 2017). The internalisation of this stigma has been shown to increase weight gain and may reduce families' future healthcare-seeking behaviours (Puhl et al., 2020; Pont et al., 2017).

At the same time families are not always accepting or aware of their child's weight (Turner et al., 2016). As a result, they may decline referrals to weight management services or the future monitoring of their child's weight (Turner et al., 2016). It is possible that this occurs more frequently in families living with asthma, as parents of children living with asthma who are also overweight or obese may be less likely to recognise their child's weight status (Musaad et al.,

2013). An alternative solution could be to acknowledge asthma-obesity comorbidity. There is research to suggest that families wish for HCPs to incorporate health-specific challenges in weight management conversations (McPherson et al., 2015). Additionally, children and adolescents have expressed greater acceptance of weight conversations if they are discussed alongside biological factors, such as asthma management (Alexander et al., 2018). Thus, it is vital to understand how to tailor weight management conversations for the challenges created by asthma.

1.3.4.2 Asthma-specific weight management support

The multifaceted relationship between asthma and obesity suggests that children living with asthma may need additional weight management support. So far, most paediatric weight-loss interventions have focused on helping otherwise healthy young people to manage weight. However, these interventions may not necessarily address challenges to weight management that are related to living with asthma, such as the exercise parameters and psychosocial and cognitive barriers.

Currently, the Global Initiative for Asthma Guidelines recommends weight management and the use of "strategies for weight reduction" (GINA, 2020, p67) for asthma management. However, there is no guidance on how to do so in children or how to overcome challenges relating to asthma. As a result, there have been calls to develop asthma-specific resources to support families with lifestyle changes to promote weight reduction and improved asthma outcomes (Di Genova et al., 2018; Lang, 2014).

So far, a limited number of weight-loss interventions explicitly designed for children living with asthma have shown some promising results in weight reduction and improving clinical asthma outcomes (Lv et al., 2015; Okoniewski et al., 2018). These interventions have contained a range

of different components, such as dietary alteration, exercise training and cognitive behavioural therapy (Lv et al., 2015; Okoniewski et al., 2018). It is necessary to examine the effectiveness of these interventions to develop a body of knowledge on weight management in paediatric asthma.

1.4 Aims of the thesis

The above literature demonstrates the multifaceted nature of comorbid asthma and obesity which, in turn, can create challenges for managing asthma and weight. The overarching aim of this thesis was to explore the relationship between paediatric asthma and overweight/ obesity and to develop an asthma-specific weight management intervention.

The aims of the thesis are as follows:

1. To evaluate the effectiveness of existing paediatric weight management interventions for asthma and describe their use of theory, mode of delivery and behaviour change techniques (Chapter 2).
2. To explore the experiences, views and behaviours of healthcare professionals working with children who have asthma, and of the families living with children with asthma, concerning weight management (Chapters 3 and 4).
3. To examine parental and child attitudes towards feeding, eating and physical activity in families living with and without asthma (Chapters 5 and 6).
4. To synthesise the formative research and systematic review to develop a weight management intervention tailored to the needs of asthma (Chapter 7).

1.5 Research design

1.5.1 A Mixed Methods Research Approach

To best elucidate the experiences of paediatric weight management in asthma, and examine the underlying relationships identified, both qualitative and quantitative approaches were necessary. Creswell (2015a, p2) defines mixed methods research (MMR) as the collection, analysis and interpretation of both qualitative and quantitative data. Within the last decade, there has been growing momentum in the use of MMR in social and behavioural sciences (Timans, Wouters & Heilbron et al., 2019). This movement is reflected in the increasing number of MMR publications (Timans, Wouters & Heilbron et al., 2019), scientific journals (*Journal of Mixed Methods Research*) and associations (Mixed Methods International Research Association) focused on this methodology.

Despite this, using qualitative and quantitative research together has created ongoing controversy related to "paradigm incompatibility" (Tashakkori & Teddlie, 2003). Teddlie and Tashakkori (2009, p84) define a paradigm as "a worldview, together with the various philosophical assumptions associated with the point of view." It can also be described as the scientific assumptions that a discipline aligns with (Kuhn, 1962). These worldview stances comprise of the nature of reality (ontology), how knowledge may be known (epistemology), and how knowledge is constructed (methodology) (Ling, 2017). Qualitative and quantitative paradigm assumptions differ in ontology (subjective versus objective), epistemology (confirmatory versus exploratory) and methodology (such as experimental and predetermined questionnaires versus interviews and observations). Arguably, these stances can be seen as "incommensurate, like oil and water they do not mix well" (Shaw et al., 2018).

Nevertheless, combining methods has been suggested to be a pragmatic and problem-driven approach to solve the "practical problems in the 'real world'" (Crewell & Plano Clark, 2011;

Feilzer, 2010, p8). It allows researchers to prioritise the needs of the research study and can be selected when MMR will provide a greater understanding than a single approach could alone (Shaw et al., 2018; Crewell & Plano Clark, 2011). Greene and colleagues (1989, p259) have noted five justifications for using MMR: triangulation (collaborating results from different methods), complementarity (elaborating, enhancing or clarifying the results from one method with that of another), development (using the results from one method to help inform the other method), initiation (discovering paradoxes or new perspectives by contrasting results between methods), and expansion (to expand the breadth and range of inquiry).

A plethora of concurrent and sequential approaches to MMR can be taken (Cresswell & Plano Clark, 2011). In convergent MMR designs, quantitative and qualitative data are collected concurrently to address an overarching research question. The findings of each design are brought together following the completion of data collection in the interpretation phase to develop meta-inferences (Doyle et al., 2016). Alternatively, an explanatory or exploratory sequential design can be taken. In an explanatory design, the quantitative phase is followed by a qualitative phase which can be used to complement or explain the quantitative results. In an exploratory sequential design, a primary qualitative phase is used to identify unknown variables or develop hypotheses that can be tested in the following quantitative phase. In these designs, the priority given to each design is dependent on the overarching purpose of the research.

This thesis lends itself to an exploratory sequential design due to the uncertainty of the asthma-obesity relationship and how best to provide asthma-specific weight management support. As there is limited research about the experiences of asthma and weight management, the qualitative research design provides an opportunity to develop a rich understanding of HCPs' and families' experiences of asthma and weight management, and allow for novel concepts to emerge. The inferences drawn from this qualitative data are then used to identify variables

which can be tested more objectively in a subsequent quantitative phase. The quantitative approach helps to examine the nature of relationships that emerged in the qualitative phase and explore differences within the population. Thus, this equally weighted exploratory sequential design works to complement and enhance findings (Greene et al., 1989; Almalki, 2016) which are applicable to real-world problems.

1.6 Thesis structure

The thesis brings together new and existing evidence about comorbid paediatric asthma and obesity, in order to develop a weight management intervention tailored to the needs of paediatric asthma. Each chapter reports a different study, using an appropriate methodology for the research question that study aims to address. As such, each chapter is presented with its own introduction, method and discussion. Chapter 2 presents a systematic review of paediatric weight management interventions for asthma. Chapters 3 and 4 report findings from a qualitative study of HCP and families' views and experiences of weight management in families living with asthma. Chapters 5 and 6 present findings from a questionnaire study examining parental practices around feeding and exercise and child eating and exercise frequency in children living with and without asthma, and parental asthma-related anxiety and medication beliefs in parents of children living with asthma. Chapter 7 reports on the intervention development. Chapter 8 provides an overview and discussion of the main findings for all studies, including recommendations for future research and practice. Intervention resources developed from the formative research are presented within the appendices.

CHAPTER 2

Weight Management Interventions for Paediatric Asthma: A Systematic Review

2.1 Introduction

In this systematic review, the effectiveness of paediatric asthma weight management interventions and their intervention characteristics are examined. So far, evidence suggests that weight management in adults and children living with asthma and overweight may improve some asthma outcomes (Lv et al., 2015; Okoniewski et al., 2018). Nevertheless, the most effective approaches to weight intervention in this population remain unclear (BTS, 2019). Gaining greater insight into intervention characteristics is necessary to develop an evidence-based understanding of their associations with improved weight and asthma outcomes.

The identification of the use of theory in intervention design can provide a systematic way to understand health behaviours and outcomes (Michie et al., 2014). Theory can be used to explain and predict behaviour, as well as to conceptualise the mechanisms of actions and mediators through causal pathways (Michie et al., 2014). The proposal of behavioural determinants and process of change facilitates constructs that can be targeted and measured in interventions. These mechanisms of action can be evaluated to understand their effectiveness in promoting behaviour change in specific populations, contexts and behaviours (Michie & Abraham et al., 2004). As such, intervention components or theory can be refined (Michie & Prestwich et al., 2010). However, identifying and evaluating the use of theory in interventions can be difficult as many interventions do not report a theoretical basis or extensively apply theories to intervention design (Prestwich et al., 2014). Other literature suggests that how theory has been applied can be interpreted differently (Prestwich et al., 2013). Frameworks, such as The Theory Coding Scheme (Michie & Prestwich, 2010), have been developed to facilitate more rigorous identification and evaluation of the use of theory in behaviour change interventions.

Literature also suggests that intervention effectiveness may depend on the mode of delivery, that is, the format in which the intervention is delivered, and by whom (Dombrowski et al., 2016). For example, the delivery of intervention content by individuals perceived to have expertise and be trustworthy is thought to increase adherence to an intervention (Mohr, Cuijpers & Lehman, 2011), while other research has shown greater effects in peer-led interventions (Stice et al., 2020). Further evidence suggests that a variety of intervention formats have been associated with effectiveness in different populations. Weight management

interventions delivered using a combination of modalities, such as face-to-face and communication-mediated support at home, are thought to increase engagement and intervention effectiveness (Tate et al., 2017; Schippers et al., 2017). Other approaches suggest that face-to-face delivery and printed workbooks to complete at home have good acceptability and have shown improved health outcomes (Webb et al., 2017; Pramana et al., 2018; Saracutu et al., 2018). Given this emerging evidence, it is essential to understand the context in which weight management interventions occur in paediatric asthma and their association with outcomes (Moore & Evans, 2017).

Alongside theory application and mode of delivery, a greater understanding of the behaviour change mechanisms used in interventions is needed. Behaviour change techniques (BCTs) are described as observable and replicable components of a behaviour change intervention designed to alter behaviour (Wood et al., 2015). Interventions can consist of singular or multiple components which aim to change the behaviour of a group of individuals or a population. Being able to understand and identify the use of effective BCTs is crucial for the development of future interventions, so that the "active ingredients" can be reliably replicated. However, breaking down the components of an intervention can be difficult due to poor descriptions in reports or the use of different labels. Michie and colleagues (2013) developed the first cross-domain BCT taxonomy to provide a universal way in which to identify, categorise and describe the ingredients of an intervention. The BCT taxonomy v1 provides a list of 93 clearly labelled BCTs to help provide consistency when identifying the use of BCTs. Previous research has suggested that BCTs such as "goal setting (outcome)", "feedback on outcome of behaviour" and "adding objects to the environment" are associated with improved weight outcomes in weight management interventions (Samdal et al., 2017). The identification of BCTs in previous asthma weight management interventions will help to build an evidence-base for how to deliver effective asthma weight management interventions in the future.

2.2 Aim and Objectives

There are no published systematic reviews evaluating the use of theory, mode of delivery or the behaviour change techniques (BCT) used in paediatric asthma weight management interventions. This systematic review aims to evaluate the effectiveness of paediatric weight management interventions for young people living with asthma, and to identify their use of theory, mode of delivery, and the BCTs. The objectives were to:

1. Evaluate the effectiveness of weight management interventions on asthma outcomes in a paediatric population.
2. Describe the use of theory, mode of delivery and the behaviour change techniques in paediatric asthma weight management interventions.

2.3 Method

2.3.1 Review registration

The protocol for this systematic review was registered with PROSPERO International (https://www.crd.york.ac.uk/prospero) as CRD42017071798.

2.3.2 Eligibility criteria

The eligibility criteria for this review were:

1) Participants with clinician diagnosed asthma or self-reported wheezing and overweight/ obesity at the baseline (≤18 years of age);

2) Primary research studies that had intended to investigate weight management and asthma outcomes in young people;

3) Comparators with usual care, waiting list, placebo or alternative intervention;

4) Outcome measures reported for both weight and asthma control, such as; weight, body fat measures, BMI z-scores, lung function, asthma or wheezing symptoms, medication use, asthma-related quality of life, or health care utilisation;

5) Randomised controlled trials (RCTs), non-randomised control groups and single-arm designs with measurements before and after intervention.

No limitations were placed on the publication date or the setting and time frame of intervention delivery. Cross-sectional, qualitative research, case studies and articles not available in English were excluded from the review.

2.3.3 Information sources and search

Potential articles were identified through the systematic search of four electronic databases (Web of Science; ProQuest; Scopus; PubMed). Search terms were developed and adapted for use in the different databases: overweight, obese, weight, BMI, body mass index, adiposity, asthma, wheeze, breathlessness, bronchoconstriction, child, paediatric, youth, adolescent, intervention. These search terms were used in varying combinations using the Boolean search operators AND and OR. The following search strategy was used for Web of Science: (overweight

OR obes* OR weight Or BMI or body mass index OR adiposity) AND (asthma* OR wheez* OR breathlessness OR bronchoconstriction) AND (child* OR p$ediatric OR youth OR adolescent) AND (intervention). Additional articles were identified by searching the references of relevant studies and citation checking on Google Scholar.

2.3.4 Study Selection

The potential articles identified were downloaded and stored in the reference management software Endnote. Following this, the title, abstract and full-text were assessed against the eligibility criteria. Excel spreadsheets were used during the screening and data extraction stages to document the process.

2.3.5 Data Collection

This review used a data extraction template provided by the Cochrane Effective Practice and Organisation of Care (EPOC) group to extract data for systematic reviews. Extracted data included: study characteristics, participants' characteristics, intervention characteristics, methodology, outcomes measurements and any other relevant measurements.

Use of theory and theoretical basis

Interventions that have reported a theoretical basis or the use of theory in intervention design were coded using the Theory Coding Scheme developed by Michie and Prestwich (2010). The Theory Coding Scheme comprises of 19 statements, such as 'intervention based on single theory' and 'all intervention techniques are explicitly linked to at least one theory-relevant construct/ predictor'. Statements are coded 'yes', 'no' or 'don't know'. Coding 'yes' indicates that the article explicitly described the use of theory in intervention design. The Theory Coding Scheme has previously been used to assess the use of theory within behaviour change interventions (Bluethman et al., 2017; Patton et al., 2017).

Mode of Delivery

The mode of delivery was coded following the approach outlined by Webb and Sheeran (2006). The mode of delivery was divided and coded in two aspects: (i) the intervention format, whether the intervention was delivered one-on-one or in a group, (ii) the source of the intervention, who delivered the intervention.

Behaviour Change Components

The BCTs in interventions were identified and coded using Michie and colleague's (2013) BCTv1 taxonomy. This taxonomy has 93 BCTs clustered into 16 groups: Goals and Planning, Feedback and Monitoring, Social Support, Shaping Knowledge, Natural Consequences, Comparison of Behaviour, Associations, Repetition and Substitution, Comparison of Outcomes, Reward and Threat, Regulation, Antecedents, Identify, Scheduled Consequences, Self-Belief, and Covert Learning. The BCTv1 taxonomy has previously been used when extracting the behaviour change components of an intervention (Sawyer et al., 2019). Only when a BCT had been explicitly described to have been used in the intervention group was it identified and coded in this review.

2.3.6 Risk of Bias

The Cochrane Risk of Bias tool was used to assess the risk of bias in randomised controlled trials (RCTs) (Sterne et al., 2019). The risk of bias in non-randomised studies was evaluated using the Cochrane ROBIN-I tool (Sterne et al., 2016). The Risk of Bias tool assesses the risk of bias across nine standardised criteria: random sequence generation; allocation concealment; baseline outcome measurements similar; baseline characteristics similar; incomplete outcome data; knowledge of the allocated interventions adequately prevented during the study; protection against contamination; selective outcome reporting; other risks of bias. Each domain was categorised as 'low risk', 'unclear risk' or 'high risk'. The ROBINS-I tool assesses the risk of bias across seven domains: bias due to confounding; bias in the selection of participants into the study; bias in classification of interventions; bias due to deviations from intended interventions; bias due to missing data; bias in the measurement of outcomes; and bias in the selection of the reported result. These domains were categorised as 'low risk of bias', 'moderate risk of bias', 'serious risk of bias', 'critical risk of bias', or 'no information'.

2.3.7 Quality Assessment

The quality of included research studies was coded using the Critical Appraisal Skills Programme (CASP) tool for RCTs and cohorts (CASP: Randomised Controlled Trial Checklist, 2018; CASP: Cohort Study Checklist, 2018). The CASP Randomised Controlled Trial Checklist and CASP Cohort Study Checklist consist of 11 and 12 questions respectively, across three sections to appraise the study validity, the quality of the methodology and presentation of results, and the external validity. The quality of the research is rated based on the answers to 11 questions for RCTs and 12 questions for cohorts that can be answered 'yes', 'can't tell', or 'no'. A higher number of 'yes' responses equate to a higher score and higher quality research.

2.3.8 Data Synthesis

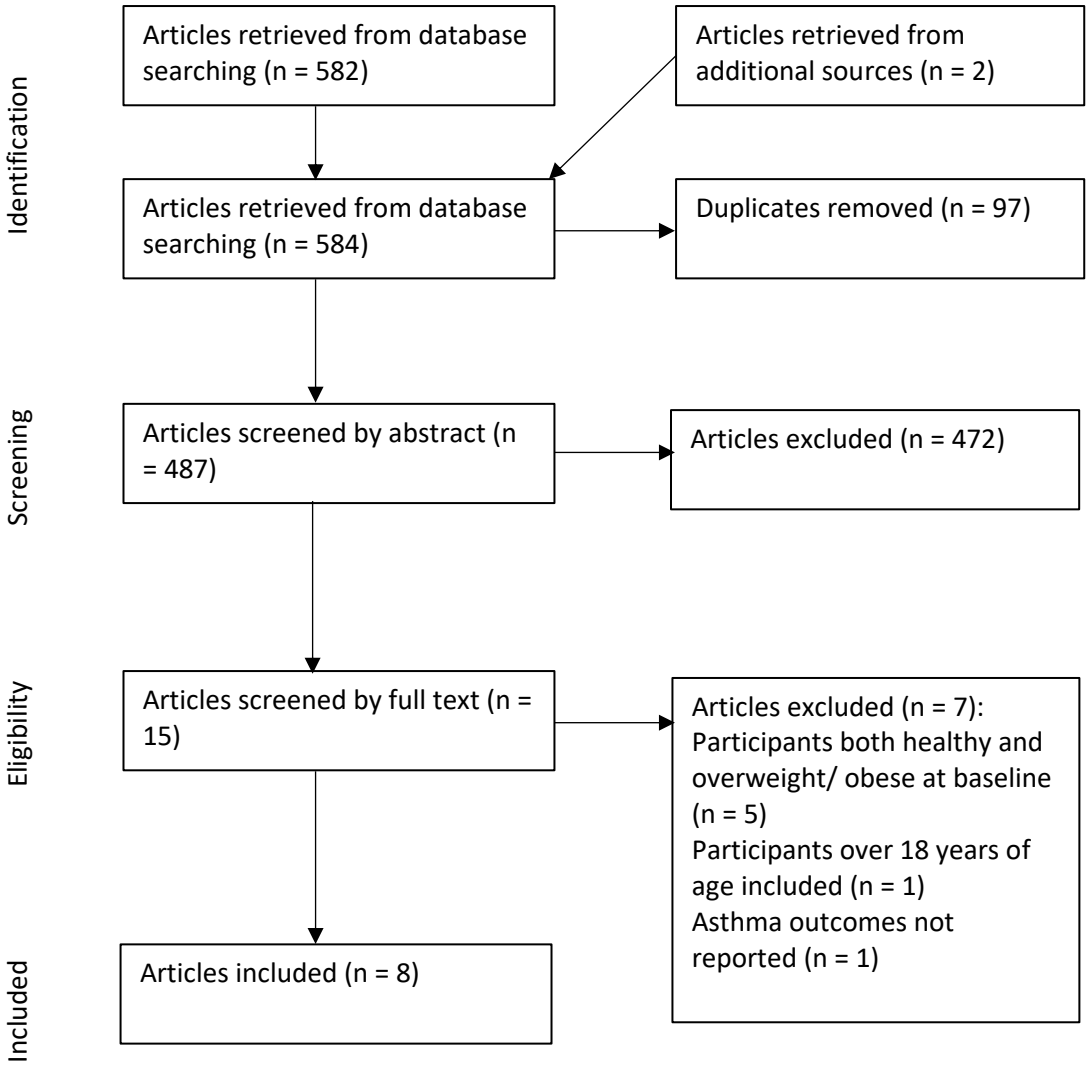
The effect size of the interventions was calculated using the standardised mean difference at baseline and post-intervention in the intervention group (Hedges' *g*). The effect sizes were reported and narratively summarised for the interventions weight and asthma outcomes where possible. Calculating intervention efficacy was dependent on the articles presenting a standardised mean difference for the outcome measurements. As a result, an effect size was not always possible to calculate for every outcome.

Due to the heterogeneity of the intervention components, outcome measures and control conditions, a meta-analysis was not conducted on the included interventions. Instead, a narrative synthesis was conducted on all of the studies and comprised of intervention characteristics, outcomes and the interventions use of theory, mode of delivery and BCTs. Patterns were identified in the use of theory, mode of delivery and BCTs of studies in the studies that reported group allocation effects.

2.4 Results

The systematic search of electronic databases yielded 582 articles, with two additional articles added from additional sources (Google Scholar). Following the removal of duplicate articles (n = 97), the remaining 487 articles were screened by title and abstracts and excluded if not relevant. The full texts of the remaining articles (n = 15) were then assessed. The main reasons for exclusion following full-text assessment were reported data containing both healthy and overweight participants (n = 5), reported data containing participants >18 years of age (n = 1) and outcome measures not including asthma outcomes (n = 1). The phases of the review and reasons for excluded articles are detailed in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram (Figure 1).

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the systematic search and selection of articles.



2.4.1 Characteristics of included studies

Six of the included studies were RCTs (Bseikri et al., 2018; El-Kadar et al., 2013; Fedele et al., 2018; Jensen et al., 2013; Luna-Pech et al., 2014; Willeboordse et al., 2016), one was an uncontrolled cohort (Martin et al., 2016) and one was a prospective open-label design (van Leeuwen et al., 2014). Three of the studies were conducted in America (Bseikri et al., 2018; Fedele et al., 2018; Martin et al., 2016), two in the Netherlands (van Leeuwen et al. 2014; Willeboordse et al., 2016), one in Australia (Jensen et al., 2013), one in Mexico (Luna-Pech et al., 2014) and one in Saudi Arabia (El-Kadar et al., 2013). The interventions were mostly delivered within a clinical setting (n = 7), while one was conducted in the participants' homes

(Martin et al., 2016). The sample size in the included studies ranged from 20 to 87 participants, with participants aged from 5 to 18 years. Across the included studies, the baseline weight of young people varied. Five interventions included participants who were overweight and obese (Bseikri et al., 2018; Fedele et al., 2018; Martin et al., 2016; van Leeuwen et al., 2014; Willeboordse et al., 2016), while three interventions only included young people who were obese (El Kader et al., 2013; Jensen et al., 2013; Luna-Pech et al., 2014).

2.4.2 Risk of bias and quality assessment

Seven interventions had a moderate risk of bias, and one had a high risk of bias (see Table 1 and 2). In contrast, the interventions quality assessment ranged from five to nine out of a total score of 11 (see Table 3) and seven to nine out of 12 (see Table 4). Knowledge of the intervention group was often not prevented or reported in the included studies (Bseikri et al., 2018; El Kader et al., 2013; Fedele et al., 2018; Jensen et al., 2013; Luna-Pech et al., 2014; Willeboordse et al., 2016) and only one study had similar baseline characteristics and outcome measurements between groups (Luna-Pech et al., 2014). Furthermore, the following were often unclear or not reported in the studies: the method used to generate the allocation sequence (El Kader et al., 2013; Fedele et al., 2018; Luna-Pech et al., 2014), allocation sequence concealment (Bseikri et al., 2018; El Kader et al., 2013; Fedele et al., 2018; Jensen et al., 2013; Luna-Pech et al., 2014; Willeboordse et al., 2016), and whether the study design and implementation prevented contamination between groups (Bseikri et al., 2018; El Kader et al., 2013; Fedele et al., 2018; Jensen et al., 2013; Luna-Pech et al., 2014; Willeboordse et al., 2016). The majority of studies were free of the suggestion of selective outcome reporting. Whereas, El-Kader (2013) described lung function's association with the primary outcome measures and reported the measurement of lung function at the baseline yet did not report lung function post-intervention.

Table 1: Risk of bias for included RCTs adapted from the EPOC risk of bias tool

	Bseikri (2018)	El Kader (2013)	Fedele (2018)	Jensen (2013)	Luna-Pech (2014)	Willeboordse (2016)
Random sequence generation	✓			✓		✓
Allocation concealment		✗				✗
Baseline outcome measurements similar	✗	✓	✗	✗	✓	✓
Baseline characteristics similar	✗		✓	✗	✓	✗
Incomplete outcome data	✓	✗	✓		✓	✓
Knowledge of intervention group prevented	✗	✗		✗	✗	✗
Protection against contamination						✗
Selective outcome reporting	✓		✓	✓	✓	✓
Other risks of bias	✓	✓	✓	✓	✓	✗
Overall risk of bias	Moderate	High	Moderate	Moderate	Moderate	Moderate

Green ticked boxes: low risk of bias. Orange blank boxes: unclear risk of bias. Cross: high risk of bias.

Table 2: Risk of bias for included cohorts adapted from the EPOC risk of bias tool

	Martin (2016)	Van Leeuwan (2014)
Bias due to confounding	Moderate risk	Moderate risk
Bias in selection of participants into the study	Low risk	Low risk
Bias in classification of interventions	Low risk	Low risk
Bias due to deviations from intended interventions	Moderate risk	Moderate risk
Bias due to missing data	Low risk	Moderate risk
Bias in measurement of outcomes	Moderate risk	Moderate risk
Bias in selection of the reported result	Low risk	Low risk
Overall bias	Moderate risk	Moderate risk

Table 3: Total quality assessment scores of using the CASP RCT checklist

	Bseikri (2018)	El Kader (2013)	Fedele (2018)	Jensen (2013)	Luna-Pech (2014)	Willeboordse (2016)
1) Did the trial address a clearly focused issue?	1	1	1	1	1	1
2) Was the assignment of patients to treatment randomised?	1	1	0	1	0	1
3) Were all of the patients who entered the trial properly accounted for at its conclusion?	1	0	1	0	1	1
4) Were patients, health workers and study personnel 'blind' to treatment?	0	0	0	0	0	0
5) Were the groups similar at the start of the trial?	0	0	0	0	1	0
6) Aside from the experimental intervention, were the groups treated equally?	1	1	1	1	1	1
7) How large was the treatment effect?	0	1	0	1	1	0
8) How precise was the estimate of the treatment?	0	0	1	0	1	0
9) Can the results be applied in the local population, or in your context?	0	0	0	1	1	1
10) Were all clinically important outcomes considered?	1	0	1	1	1	1
11) Are the benefits worth the harms and costs?	0	1	0	1	1	0
Total score (out of 11)	5	5	5	7	9	6

1: Yes, 0: can't tell/ no

Table 4: Total quality assessment scores of using the CASP cohort checklist

	Martin (2016)	Van Leeuwan (2014)
1) Did the study address a clearly focused issue?	1	1
2) Was the cohort recruited in an acceptable way?	1	0
3) Was the exposure accurately measured to minimise bias?	0	0
4) Was the outcome accurately measured to minimise bias?	1	1
5a) Have the authors identified all important confounding factors?	1	0
5b) Have they taken account of the confounding factors in the design and/or analysis?	0	0
6a) Was the follow up of subjects complete enough?	1	0
6b) Was the follow up of subjects long enough?	1	0
7) What are the results of this study?	1	1
8) How precise are the results?	0	0
9) Do you believe the results?	0	1
10) Can the results be applied to the local population?	0	1
11) Do the results of the study fit with other available evidence?	1	1
12) Does the study have implications for practice?	1	1
Total CASP score (out of 12)	9	7

1: Yes, 0: can't tell/ no

2.4.3 Characteristics of Interventions

Intervention components varied across the studies (see Table 5). One provided education on physical activity (Martin et al., 2016), while four implemented physical activity sessions (Bseikri et al., 2018; El-Kadar et al., 2013; Fedele et al., 2018; Willeboordse et al., 2016). All eight interventions contained at least one dietary component, such as diet alteration (Bseikri et al., 2018; El-Kadar et al., 2013; Jensen et al., 2013; Luna-Pech et al., 2014; van Leeuwen et al., 2014), and dietary education (Bseikri et al., 2018; Fedele et al., 2018; Jensen et al., 2013; Martin et al., 2016; Willeboordse et al., 2016). Other components included asthma education (Fedele et al., 2018; Martin et al., 2016) and obesity education (Martin et al., 2018). The use of cognitive behavioural strategies was also incorporated by four interventions (Fedele et al., 2018; Jensen et al., 2013; Martin et al., 2016; Willeboordse et al., 2016).

The duration of intervention delivery ranged from 6 weeks to 18 months in length. Bseikri and colleagues (2018) offered an additional 4-month intervention to participants. However, a "very

small" number of participants agreed to continue, and participants' weight outcomes were not reported after the intervention extension. All of the interventions collected data pre- and post-intervention. Only one intervention collected data again at a 6-month follow-up (Fedele et al., 2018).

2.4.4 Weight outcomes

The intervention efficacy on paediatric weight outcomes was calculated for all of the included studies. Seven studies reported sufficient BMI or BMI z-score standardised mean difference at baseline and post-intervention, while Jensen and colleagues (2013) only reported a standardised mean difference for total lean body mass. Two large intervention effects were found: El Kader's (2013) reported a significant mean BMI reduction of -5.16 ±2.38 (g =-2.11) in the intervention group, and Luna-Pech (2014) reported a significant BMI z-score reduction from 2.18 ±0.3 at baseline to 1.66 ± 0.2 (g =-2.01) post-intervention. Small to medium effect sizes on weight were found in four interventions: Jensen (2013) reported a significant increase in mean total lean body mass (%) by 2.1±3 (g = 0.453); Martin (2016) reported a significant reduction in BMI z-score from 2.13 ±0.4 at baseline to 1.97 ±9.79 (g = -0.26) post-intervention; Willeboordse (2016) reported a significant reduction in BMI-SDS by -0.14 ±0.29 (g = -0.29), and van Leeuwan (2014) reported a significant reduction in BMI z-score from 2.2 ±0.4 at baseline to 2.0 ±0.5 at post-intervention (g = 0.43). Little to no effect size (g = -0.01 - -0.06) was reported on weight outcomes in Bseikri and colleagues study (2018). Fedele (2018) also reported little to small effect sizes, as BMI z-score was reported to reduce from 2.25 ±0.58 at baseline to 2.17 ±0.63 (g = -0.12) post-intervention, and 2.04 ±0.66 (g = -0.33) at a long-term follow-up. However, as no within-group analysis was conducted, it is not known if these findings were significant. The effect of intervention duration on intervention efficacy was unclear, as the two longest interventions were found to have both small (Willeboordse et al., 2016: g = -0.29) and large effects (Luna-Pech et al., 2014: g =-2.01) on weight. Meanwhile, one of the shortest interventions had the largest effect on paediatric weight outcomes (El Kader et al., 2013: g =-2.11).

2.4.5 Asthma outcomes

Seven of the included articles reported a standardised mean difference for asthma measurements at the baseline and post-intervention in the intervention group (Bseikri et al., 2018; El-Kadar et al., 2013; Fedele et al., 2018; Jensen et al., 2013; Martin et al., 2016; van

Leeuwen et al., 2014; Willeboordse). Intervention efficacy on participant asthma outcomes could not be calculated for Luna-Pech (2014) as sufficient data was not provided.

Asthma control

Martin (2016) measured asthma control using the childhood asthma control test (cACT) and reported a significant mean cACT increase of 1.9 ±4.4 from baseline to post-intervention (g = 0.47). However, it was noted that an improvement of >2 is needed to classified as clinically important. Two other studies reported the standardised mean difference for asthma control using the asthma control test (ACT) and found large effect sizes. Fedele reported an improvement in the mean ACT score, from 18.83 ±3.92 at baseline to 21 ±2.83 post-intervention (g = 0.61) and 22.40 ±1.95 (g = 1.09) at the long term follow up. The largest effect size on asthma control was reported by Bseikri (2018), who found ACT scores to significantly increase by 5.34 ±3.13 (g = 1.71) in the intervention group.

Lung Function

Medium to large effect sizes on lung function was reported by both Jensen (2013) and Willeboordse (2016). Jensen reported residual volume to total lung capacity (RV/TLC%) to significantly decrease by -6.9 ±9.2 (g = -0.72). Willeboordse (2016) reported percent-predicted forced expiratory capacity in 1 second (FEV1% predicted) to significantly improve over 18 months from 90.5 ±12.5 to 99.7 ±11 (g = 0.77). Percent-predicted forced vital capacity (FVC% predicted) and percent-predicted expiratory reserve volume (ERV% predicted) were also reported to significantly increase by 10.1 ±8.7 (g = 1.06) and 12 ± 20.5 (g = 0.56) respectively (Willeboordse et al., 2016).

Intervention efficacy on lung function was found to be more modest in a further three studies. Fedele found small to medium effect sizes on FVC (g = 0.53), FEV1 (g =0.33), FEF25-75 (g =0.19) and forced expiratory flow at maximum effort (FEFmax) post-intervention (g = 0.44). However, these outcomes were not sustained at the long term follow up: g =0.44, g = -0.04, g = -0.18, and 0.196 respectively. Bseikri reported small, significant increases by 5.4 ±12.05 to FVC% (g = 0.29) and 5.18 ±13.17 to FEV1% (g = 0.23). Whereas, little to no effect sizes were reported on the forced expiratory volume in the first second to the forced vital capacity (FEV1/FVC) (g = 0.08) and the forced expiratory flow at 25-75% of FVC (FEF25-75%) (g = 0.14) (Bseikri et al., 2018). Little to no effect on lung function was also reported by Van Leeuwan (014) on forced expiratory volume in 1 second (FEV1) (g = 0.03), FEV1% predicted (g = -0.02), FVC% predicted (g = 0.15)

and the percentage of FVC expelled in the first second of forced expiration (FEV1/FEV-100) (-0.14).

Inflammation

The efficacy of the interventions improving inflammation in participants varied across four studies. El-Kader (2013) found medium to large intervention effects on reducing inflammation: mean values of tumour necrosis factor-alpha (TNF-Alpha), IL-6, interleukin (IL-6), interleukin 8 (IL-8) and leptin significantly decreased (-0.76 ±1.12 (*g* = -0.56), -0.34 ±0.76 (*g* = -0.43), -3.54 ±3.72 (*g* = -0.83) and -4.45 ±4.50 (*g* = -0.88) respectively) whilst adiponectin significantly increased 4.11 ±2.38 (*g* = 1.22). In comparison, Bseikri (2018) reported a medium effect size on the increase in adiponectin of 354 ±692 (*g* =0.55), whilst there was no effect on the mean levels of high sensitivity C-Reactive Protein (hsCRP) (*g* = -0.03) and immunoglobulin (IgE) (*g* = -0.01). Similarly, van Leeuwen (2014) and Willboorsde (2016) reported no effect on inflammation.

Quality of Life

Only two studies reported standardised mean differences that were sufficient to calculate intervention efficacy on quality of life. Bseikri (2018) used the Pediatric Quality of Life Inventory (PedsQL) to measure participants' quality of life and reported small effect sizes after a mean improvement of 10.08 ±13 (*g* = 0.33) post-intervention. The Pediatric Quality of Life Inventory Asthma-module (PedsQL-AM) was used to measure the asthma-specific quality of life in the same study. Bseikri (2018) reported a larger effect size in PedsQL-AM following an increase of 11.84 ±11.49 (*g* = 0.79) post-intervention. In comparison, Fedele used the Paediatric Asthma Quality of Life Questionnaire (PAQLQ) to measure the asthma-related quality of life, which improved from 5.37 ±1.59 at baseline to 5.72 ±1.51 (*g* = 0.61) post-intervention, and 6.29 ±1.27 (*g* = 1.09) at the long term follow up.

2.4.6 Physical Activity and Dietary Intake Outcomes

Only three studies reported behavioural outcomes (Bseikri et al., 2018; Martin et al., 2016; Willeboordse et al., 2016). Bseikri (2018) used the Physical Activity Questionnaire for Adolescents to measure young people's activity levels and found a small effect size following an improvement of 2.33 ± 0.6 at baseline to 2.54 ± 0.73 following the intervention (*g* = 0.31). Martin (2016) and Willeboordse (2016) did not provide sufficient data for physical activity and dietary intake outcomes. Therefore, effect size cannot be calculated for these two studies.

Table 5: Characteristics of interventions

	Sample size and inclusion criteria	**Description of intervention**	**Duration**	**Findings**	**Effect size in intervention group (*g*)**	**Conclusion**
Bseikri (2018)	Intervention group: n = 37. Control group: n = 19. Aged 14-18 years, BMI percentile >85th percentile, self-reported physician-diagnosed asthma, ACT score ≤ 19.	Intervention group: One 90-minute-long nutrition and exercise class a week. Twice-daily consumption of a nutrient bar with 8 ounces of water. No specific instruction on whether nutrient bar should be used as a meal replacement. Control group: Attendance to a weekly, 90-minute-long nutrition and exercise classes.	2 months (an additional 4-months was offered)	Analysis of compliant, low FeNO participants (intervention, n=16, control group, n=15) indicated significantly improved lung function ($p < .05$) within the intervention group (FVC% (+2.84%) and FEV1% (+3.68%). No indication of significant between-group differences. No significant improvements in weight occurred. Significant improvements to ACT ($p < .001$), PedsQL ($p < .05$), PedsQL-AM ($p < .001$), and physical activity score ($p < .05$) were found in the intervention found but no between-group differences were found.	Weight outcome: -0.01 - -0.06 Asthma control: 1.71 Lung function: 0.08 – 0.29 Inflammation: -0.03 – 0.55 Quality of Life: 0.33 – 0.79 Physical activity: 0.31	The intervention suggests that nutritional supplementation can improve lung function in overweight/ obese adolescents living with asthma without weight loss. This effect may be reduced by chronic inflammation.
El-Kader (2013)	Intervention group, n = 40. Control group, n = 40.	Intervention group: 250-kcal/day deficit (15% protein, 30-35% fat, 50-55% carbohydrate),	2 months	Pre-post analysis showed that the intervention group significantly decreased TNF-alpha, IL-6, IL-8, leptin and BMI	Weight outcome: -2.11 Inflammation: -0.88 – 1.22	Weight loss improves markers of systematic inflammation in obese children living with asthma.

	Aged 12 – 18 years, BMI 30-35 km/m^2, physician diagnosed asthma.	aerobic classes four times a week, and usual medical treatment. Control: Usual medical treatment only.		and increased adiponectin (all $p <$ .05). No significant changes were found in the control group. Significant differences were found between the groups post-intervention.		
Fedele (2018)	Intervention group, n = 14. Control group, n = 10. Aged 6 – 12 years, BMI ≥ 85^{th} percentile, physician verified persistent asthma diagnosis.	Intervention group: 12 group-based sessions (3 per month, 90-minute each) and four individual family sessions (1 per month, 90-minute each) included: progress review; skills training; goal setting, feedback, and encouragement; educational components; physical activities. Control group: Health education sessions but no behaviour change strategies.	4 months	There were no significant differences between the intervention and control group after 12 months or at the 6-month follow-up.	Weight outcome: -0.12 Asthma control: 0.61 Lung function: 0.19 – 0.53 Quality of Life: -0.01 – 0.22	Although slightly more prominent effects were found in the intervention group, significant between-group differences were not found. Addressing barriers to attendance may create greater outcomes in future intervention.

Jensen (2013)	Intervention group, n =13. Control group, n = 15. Aged 8 – 17 years, BMI z-score ≥ 1.64, physician diagnosed asthma.	Intervention group: 500-kcal/day deficit individually tailored to participants' energy requirements. Weekly in-person or telephone-mediated counselling included: theoretical and practical education on food selection and serving sizes, identification and resolution of barriers, and goal-setting. Participants encouraged to use a food diary. Control group: Delayed intervention	10 weeks	The intervention group had a significantly greater reduction in weight (p = .003) and BMI z-score (p = .014) than the control group. Significant improvement in ACQ score in the intervention group compared to control group (p = .004). ERV significantly increased in the intervention group, however difference between groups was not significant (p = .355) within or between groups. PAQLQ symptom subscale and PAQLQ emotional subscales significantly improved within the intervention group (p = .038; p = .02) but was not significantly different between groups.	Weight outcome: 0.45 Lung function: -0.72	Diet-induced weight loss can improve lung function, asthma control and quality of life.
Luna-Pech (2014)	Intervention group, n =26 Control group, n = 25. Aged 12-16 years, BMI ≥ 95th percentile, asthma	Intervention group: Nutritional plan tailored to individual energy needs, feeding habits and preferences (10-15% proteins, 50-60% carbohydrate, 25-30% fat). Calorie	7 months	Significant BMI z-score reduction in the intervention group compared to the control group (p =.01) AR-QOL total score significantly improved in intervention group compared to controls (p =.001). Improvement was which was	Weight outcome: -2.01	Normocaloric diet in obese adolescents living with asthma was associated with reduced BMI z-score and improvement in AR-QOL and aspects of asthma control. Dietary programs

	established according to GINA diagnostic guidelines that was in a stable phase.	intake divided over meals (breakfast: 25%, lunch: 30%, snack: 15-20%, dinner 25-30%). 24-hour dietary recall diary. Control group: free diet, 24-hour dietary recall diary and biweekly follow up asthma check.		found to correlate with BMI z-score (*p* =.01). Intervention group had significantly fewer acute asthma attacks that required medication (*p* =.02) and night time awakenings (*p* =.001).		may offer the role of complementary non-pharmacological therapy.
Martin (2016)	Intervention group, n = 46. Aged 5 – 12 years old, BMI > 85%, self-reported physician-diagnosed asthma.	Intervention group: 40-hour combined asthma/obesity education taught during 12 monthly, 60-minute home visits. Topics taught in order of families' interests and needs. Behaviour change plans were reviewed and revised each visit and families taught self-management skills.	12 months	Child BMI z-score and BMI percentile significantly reduced after intervention (*p* =.002; *p* =.011). Significant improvements were also found in the following asthma outcomes: cACT (*p* =.013), uncontrolled night time awakenings (*p* =.041), activity limitations (*p* =.002), ED/ hospitalisation in past year (*p* =.003), asthma self-efficacy (*p* =.006) and child sleep disordered breathing (*p* =.027).	Weight outcome: -0.26 Asthma control: 0.47	A home asthma-obesity intervention has the potential to improve asthma and weight outcomes in young people living with asthma. Further research and interventions should consider social, behavioural and environmental contributors to asthma and obesity.

				No significant improvement was found in self-reported physical activity, screen time and observed obesogenic food in the home.		
Van Leeuwen (2014)	Intervention group, n = 20 Aged 8 – 18 years, BMI ≥ 25kg/m^2, paediatrician diagnosed asthma, ≥10% exercise-induced fall in FEV_1, clinical stable asthma.	Intervention group: Dietary intervention aided by a nutritional chart for age. Families encouraged to have three meals per day, normalise portion sizes and ≤2 snacks per day. Families contacted weekly by telephone to motivate them.	6 weeks	Significant reduction in weight, BMI and BMI z-score (all *p* =.01) and the maximum exercise-induced fall in FEV_1 (*p* =.01). Significant correlation between reduced BMI z-score and reduced percentage exercise-induced fall in FEV_1 in 17 children who achieved significant weight loss (*p* =.03). Overall PAQOL score found to significantly improve after diet (*p* =.01).	Weight outcome: -0.43 Lung function: -0.14 – 0.15 Inflammation: 0.02	Dietary induced weight loss in adolescents living with asthma and overweight/ obesity can significantly reduce the severity of exercise-induced bronchoconstriction and improve their quality of life.
Willeboordse (2016)	Intervention group, n = 43 Control group, n = 44 Aged 6 – 16 years, overweight/ obese according to Dutch BMI –	Intervention group: Multifactorial weight intervention: 18 lifestyle sessions, ten parental sessions, eight individual sessions, and regular sports sessions (60 minutes. 0-6 months: twice a week. 6-18	18 months	BMI-SDS reduction occurred in both the intervention group (*p* < .01) and control group (*p* < .01). There was no effect of group allocation. FEV_1 significantly improved in intervention group (*p* < .05) and control group (*p* <.05). No	Weight outcome: -0.29 Lung function: 0.51 – 1.06 Inflammation: -0.06	Clinically relevant improvements in weight, lung function and asthma features were found in both intervention and control group, suggesting weight management can be clinically beneficial

	SDS reference charts (≥1.1), clinical asthma diagnosis or high risk of developing asthma (family history).	months: three times a month and encouragement of additional activity). Control group: Usual asthma care (29 participants reported seeking weight management support during intervention).		significant differences found between groups ($p \geq .05$). Improvement in FVC% predicted was significantly greater in the intervention group than control group ($p < .05$). No other changes in lung function differed. The intervention group had significant improvements in PAQLQ score ($p < .001$) and cACT ($p < .05$), but the differences between groups were not significantly different. No significant improvement was found in daily step count or dietary intake.		for young people with asthma.

ACQ, asthma control questionnaire; ACT, asthma control test; AR-QOL, asthma-related quality of life; cACT, childhood asthma control test; ERV, expiratory research volume; FeNO, fractional exhaled nitric oxide; FEV, forced expiratory volume; FEV1, forced expiratory volume in one second; FEV1%, percent-predicted forced expiratory capacity in 1 second; FVC%, percent-predicted forced vital capacity; IL-6, interleukin 6; IL-8, interleukin 8; BMI, body mass index; BMI-SDS, standardised BMI; PAQLQ, paediatric asthma quality of life questionnaire; PedsQL, pediatric quality of life inventory; PedsQL-AM, pediatric quality of life inventory asthma module; TNF-alpha, tumour necrosis factor alpha.

2.4.7 Use of Theory

Only two of the eight interventions reported using theory to guide intervention development (see Table 6: Martin et al., 2016; Willeboordse et al., 2016). The Social Cognitive Theory (Bandura, 1977) was reported by Martin et al. (2016) as a theoretical basis of the intervention and used to select/ develop intervention techniques. Willeboordse et al. (2016) reported that the Health Counselling Model (Gerards & Borgers, 2006) was used to guide the intervention. A combination of the Stages of Change Model (Prochaska, 2005), Theory of Planned Behaviour (Ajzen, 1991), Social Cognitive Theory (Bandura, 1977) and Relapse Prevention Model (Marlatt & George, 1984) were reported to inform the development of intervention techniques.

Table 6: Summary of intervention's use of theory and theoretical base

Item No.	**Item**	**Martin et al (2016)**	**Willeboordse et al (2016)**
1	*Theory/model of behaviour mentioned*	Yes: Warnecke model for population health disparities, Social Cognitive Theory.	Yes: Health counselling model, Stages of Change Model, Theory of Planned Behaviour, Relapse Prevention Model.
2	*Targeted construct mentioned as predictor of behaviour*	No	No
3	*Intervention based on single theory*	Yes: Social Cognitive Theory	No: Health counselling model, Stages of Change Model, Theory of Planned Behaviour, Relapse Prevention Model are "imbedded".
4	*Theory/ predictors used to select recipients for the intervention*	No	No
5	*Theory/ predictors used to select/develop intervention techniques*	Yes: Social Cognitive Theory	Yes: Health counselling model, Stages of Change Model, Theory of Planned Behaviour,

			Relapse Prevention Model.
6	*Theory/ predictors used to tailor intervention techniques to recipients*	Don't know	Don't know
7	*All intervention techniques are explicitly linked to at least one theory-relevant construct/ predictor*	No	No
8	*At least one, but not all, of the intervention techniques are explicitly linked to at least one theory-relevant construct/ predictor*	No	No
9	*Group of techniques are linked to a group of constructs/ predictors*	No	No
10	*All theory-relevant constructs/predictors are explicitly linked to at least one intervention technique*	No	No
11	*At least one, but not all, of the theory relevant constructs/predictors are explicitly linked to at least one intervention technique*	Don't know	Don't know
12	*Theory-relevant constructs/ predictors are measured*	No	No
13	*Quality of Measures*	Don't know	No
14	*Randomization of participants to condition*	No	Yes
15	*Changes in measured theory-relevant constructs/ predictor*	Don't know	No
16	*Mediational analysis of construct/s / predictors*	Don't know	No
17	*Results discussed in relation to theory*	No	No
18	*Appropriate support for theory*	No	No
19	*Results used to refine theory*	No	No

2.4.8 Mode of Delivery

There were five different modes of intervention delivery identified in the included articles (see Table 7). Individual family sessions (n = 5) were the most common mode of delivery. Other modes of delivery included group-based sessions (n = 3), individual child sessions (n = 3), telephone-mediated delivery (n = 3) and workbook and homework tasks (n = 1). Four interventions used only one intervention format, while the remaining four interventions used two or more formats (Fedele, 2013; Jensen, 2013; van Leeuwen, 2014; Willeboordse, 2016). Willeboordse and colleagues (2016) provided four different modes of intervention delivery and was the only intervention to provide ≥3 formats.

A range of nine professionals delivered the interventions. Dieticians were the most frequently used professional (n = 5), followed by the use of psychologists (n = 2) (Fedele et al., 2018; Willeboordse et al., 2016). The following professionals were only used in one intervention: a

physician (Bseikri et al., 2018), physical education expert (El-Kader et al., 2013), graduate-level psychology students (Fedele et al., 2018), a certified nutritionist (Jensen et al., 2013), community health workers (Martin et al., 2016), a paediatric physiotherapist or paediatric sport instructor (Willeboordse et al., 2016). The use of only one professional to deliver the intervention content occurred in four interventions (Jensen et al., 2013; Luna-Pech et al., 2014; Martin et al., 2016; van Leeuwen et al., 2014). Three other interventions used a combination of two professionals to delivery intervention content (Bseikri et al., 2018; El-Kadar et al., 2013; Fedele et al., 2018), while one intervention used four (Willeboordse et al., 2016).

Table 7: Summary of intervention mode of delivery

	Intervention format	**Source of the intervention**
Bseikri (2018)	Group-based sessions	Registered dietician and physician
El-Kader (2013)**	Group-based sessions	Dietician and physical education expert
Fedele (2018)	Group-based sessions, individual family sessions	Doctoral level psychologists or trained graduate level psychology students who had undergone 12 hours of training
Jensen (2013)**	Individual family sessions (inferred), telephone-mediated	Accredited Practising Dietitian
Luna-Pech (2014)**	Individual family sessions	Certified nutritionist
Martin (2016)*	Individual family sessions	Community Health Workers
Van Leeuwen (2014)*	Individual family sessions (inferred), telephone-mediated	Certified dietician
Willeboordse (2016)**	Group-based sessions, individual child sessions, workbook and homework tasks, additional telephone-mediated consultations with child and/or parent if experiencing severe problems with weight reduction (additional support stated in protocol)	Paediatric physiotherapist or paediatric sport instructor, dietician and psychologist (interventionists stated in protocol)

**Significant between-group differences at baseline on weight and/ or asthma outcomes
*Significant intervention effect on weight and/ or asthma outcomes in single arm study

2.4.9 BCTS

Of the 93 clustered techniques on the BCT taxonomy v1 (Michie et al., 2013), a total number of 29 BCTs were identified across all of the included interventions (see Table 8). A range of two to

22 BCTs was described in each intervention. The average number of BCTs identified per intervention was 8.4. The most frequently reported BCTs across all 8 interventions were: 4.1 Instruction on how to perform behaviour (n = 7), 2.3 self-monitoring of behaviour (n = 5), 6.1 Demonstration of the behaviour (n = 5), 8.1 Behavioural practice/ rehearsal (n = 5), 3.1 Social support (unspecified) (n = 4). 15 BCTs were only observed once across all interventions: 1.7 Review outcome goal(s), 2.1 Monitoring of behaviour by others without feedback, 2.2 Feedback on behaviour, 2.7 Feedback on outcome(s) of behaviour, 5.4 Monitoring of emotional consequences, 5.6 Information about emotional consequences, 6.2 Social Comparison, 7.3 Reduce prompts/ cues, 10.4 Social reward, 10.6 Non-specific incentive, 10.8 Incentive (outcome), 11.1 Pharmacological support, 11.2 Reduce negative emotions, 12.1 Restructuring the physical environment, 13.2 Framing/reframing.

Of the interventions found to have significant group allocation effects (El-Kader et al., 2013; Jensen et al., 2013; Luna-Pech et al., 2014; Martin et al., 2016; van Leeuwan et al., 2014; Wildboordse et al., 2016), reported BCTs ranged from two to 22, with a mean of 8.2 BCTs identified per intervention. The most frequently described BCTs in the effective interventions were: 4.1 Instruction on how to perform behaviour (n = 5), 2.3 Self-monitoring of behaviour (n = 2), 3.1 Social support (unspecified) (n= 3), 6.1 Demonstration of the behaviour (n= 3), and 8.1 Behavioural practice/ rehearsal (n = 3).

BCTs reported in interventions that were found to have no between-group differences ranged from five to 13 (Bseikri et al., 2018; Fedele et al., 2018), with a mean number of nine observed per intervention. The most frequently used BCTs in these interventions were: 2.3 self-monitoring of behaviour (n = 2), 4.1 Instruction on how to perform behaviour (n = 3), 6.1 Demonstration of the behaviour (n = 2), and 8.1 Behavioural practice/ rehearsal (n = 2).

Table 8: The BCTs identified in the interventions

Group	BCT identified	Bseikri (2018)	El-Kader (2013)**	Fedele (2018)	Jensen (2013)**	Luna-Pech (2014)**	Martin (2016)*	Van Leeuwen (2014)*	Willeboordse (2016)**
Group 1: Goals and Planning	1.1 Goal setting (behaviour)			■			■		■
	1.2 Problem solving			■	■		■		
	1.3 Goal setting (outcome)			■	■				■
	1.4 Action planning						■		■
	1.5 Review behaviour goal(s)			■		■	■		
	1.7 Review outcome goal(s)								■
Group 2: Feedback and Monitoring	2.1 Monitoring of behaviour by others without feedback				■				
	2.2 Feedback on behaviour						■		
	2.3 Self-monitoring of behaviour	■		■	■	■	■		■
	2.5 Monitoring outcome(s) of behaviour by others without feedback		■						■
	2.7 Feedback on outcome(s) of behaviour			■					
Group 3: Social Support	3.1 Social support (unspecified)			■			■	■	■
Group 4: Shaping Knowledge	4.1 Instruction on how to perform behaviour	■	■	■	■	■		■	■
Group 5: Natural Consequences	5.1 Information about health consequences			■			■		■
	5.4 Monitoring of emotional consequences								■

	5.6 Information about emotional consequences								■
Group 6: Comparison of Behaviour	6.1 Demonstration of the behaviour	■	■	■	■				■
	6.2 Social Comparison								■
Group 7: Associations	7.3 Reduce prompts/ cues								■
Group 8: Repetition and Substitution	8.1 Behavioural practice/ rehearsal	■	■	■	■				■
	8.7 Graded tasks		■	■					■
Group 9: Comparison of outcomes	9.1 Credible source	■	■						■
	10.4 Social reward								■
	10.6 Non-specific incentive								■
	10.8 Incentive (outcome)								■
Group 11: Regulation	11.1 Pharmacological support								■
	11.2 Reduce negative emotions			■					
Group 12: Antecedents	12.1 Restructuring the physical environment						■		
Group 13: Identity	13.2 Framing/reframing								■
	Total BCTs used	5	6	13	7	3	9	2	22

**Significant between-group differences at baseline on weight and/ or asthma outcomes
*Significant intervention effect on weight and/ or asthma outcomes in single arm study
Shaded cells indicate observed BCT.

2.5 Discussion

To the authors' knowledge, this is the first systematic review to build on previous literature by identifying the use of theory, mode of delivery, and the BCTs used in paediatric asthma weight interventions. This review found evidence to support the use of weight management interventions to reduce weight and improve asthma outcomes in children living with asthma. Across all of the interventions, five theories, five modes of delivery and nine interventionists, and 29 BCTs were used. The most frequently observed BCTs in studies with significant group allocation effect were instruction on how to perform behaviour, self-monitoring of behaviour, social support (unspecified), demonstration of the behaviour, and behavioural practice/ rehearsal. Nevertheless, which intervention characteristics are associated with intervention effectiveness remains unclear due to limited reporting of theory and BCTs, and difficulty in identifying combinations of the mode of delivery and BCTs owing to similarity across all interventions.

The finding of limited theory use is in line with previous research that has highlighted the limited use and description of theory in intervention design (Prestwich et al., 2014; Marques et al., 2016). Out of the eight included studies, only two (Martin et al., 2016; Willeboordse et al., 2016) reported the use of theory: Health counselling model, Stages of Change Model, Theory of Planned Behaviour, Relapse Prevention Model, and Social Cognitive Theory. However, there was little explicit description of how they were integrated or used to develop intervention components. As a result, it was difficult to extrapolate if constructs were linked to the active ingredients used in interventions without inferring. This finding supports previous research, as Prestwich and colleagues (2014) found that 90% of interventions which reported a theoretical base did not explicitly report links between BCTs used and theoretical constructs. Without being explicitly reported, it is unclear how theory has been used to guide the selection of BCTs in these interventions. Additionally, the use of relevant theory in intervention design is crucial as theory can used to predict behaviour and guide intervention development (Moore & Evans, 2017). Despite this, only one study discussed their rationale behind theory selection (Martin et al., 2016). It is possible that the choice of theory limited intervention design for Willeboordse (2016) and contributed to reduced group allocation differences. Further concerns also arise as the evaluation of theory used in interventions was not reported. The evaluation of changes in theoretical constructs as well as the anticipated health outcomes is strongly recommended to build an evidence base of which underlying mechanisms of action may or may not mediate change (Moore & Evans, 2017). Future paediatric asthma weight management interventions

need more thorough reporting and evaluation of theory to develop our understanding of the causal pathways that lead to behaviour change and weight and asthma outcomes.

The use of five different modes of intervention delivery was identified in the included studies. Individual family sessions were the most frequently used format of intervention delivery in the studies found to have significant between-group differences that favoured the intervention group. It is possible that young people may be more likely to benefit from weight management support when the context of the family is also considered, such as parental beliefs around food and cultural perceptions of weight (Potter et al., 2018; Martinez et al., 2017). Additionally, individual family weight management support may offer an opportunity to personalise intervention plans and feedback (Hagger & Luszyczynska, 2014). Nevertheless, following the evaluation of intervention acceptability, Fedele and colleagues (2018) recommended that individual family intervention should occur through home visits to reduce travel and barriers to attendance. Thus, consideration needs to be given to the cost-effectiveness and practicality of individual family intervention in different settings.

It is more challenging to infer how the source of intervention delivery may have moderated intervention effectiveness in this systematic review. Nine different professionals were used across the interventions to deliver intervention content, with dieticians the most frequently used. However, as seven of the professionals were only used once, it is difficult to synthesise the effectiveness of the intervention sources. It may be that a variety of professionals can provide effective weight management support in this population (Samdal et al., 2017). Additionally, as only a small number of studies were used, it may not be possible to find associations between intervention source and intervention effectiveness due to the interaction of other intervention characteristics. Moore and Evans (2017) believe that a broader understanding of the contextual factors and how they can influence intervention delivery is needed. The use of a taxonomy and reporting checklists for intervention contexts has been suggested to provide more transparent descriptions of interventions and aid the replication of results in different settings (Pfadenhauer et al., 2017; Hoffman et al., 2014).

There was a similarity in the BCTs used in the interventions found with and without between-group differences. Commonly used BCTs across all studies included ‘instruction on how to perform behaviour’, ‘self-monitoring of behaviour’, ‘demonstration of the behaviour’, ‘behavioural practice/ rehearsal’ and ‘social support (unspecified)’. There was a large range in

the number of BCTs observed in the studies and higher mean number of BCTs used in the interventions with no significant group allocation effect. This contrasts with previous research that suggests a greater number of BCTs used in an intervention is associated with a larger effect size (Samdal et al., 2017). One reason for this may be that it is possible BCTs also occurred within the control groups and minimised the effect of group allocation. The use of exercise and nutrition classes (Bseikri et al., 2018) and health education classes which included homework tasks (Fedele et al., 2018) may help to explain why significant differences did not occur between the intervention and control group in these studies. Similarly, Willeboordse (2016) reported that 29 participants in the control group received professional support to facilitate weight reduction during the intervention period which may explain no between-group differences in weight outcomes. Nevertheless, this highlights the importance of identifying the most effective BCTs for a specific behaviour change and population. Thus, using a smaller number of efficacious BCTs may be more practical and cost-effective. Furthermore, it was challenging to identify combinations of BCTs used in interventions with or without between-group differences. This may be due to differences in BCT delivery despite similarity in BCTs applied (Mohr, Cuijpers & Lehman, 2011; Ogden, 2016), BCTs interacting, or variation in populations and settings (Michie et al., 2018). It should also be considered that potentially effective intervention BCTs have not been identified as a result of insufficient detail reported. It is of great importance that precise specification of interventions is made publicly accessible. The use reporting guidelines, such as the CONSORT (Schulz et al., 2010) and TIDieR (Hoffmann et al., 2014), or the availability of intervention protocols, will aid future assessment of interventions components and their effectiveness.

2.6 Limitations

The identification of theory, mode of delivery and BCTs within studies and their synthesis with intervention outcomes should be interpreted with caution. Only a small number of interventions were eligible to be included in this systematic review. Most of the interventions that were included had a short duration and were under 4 months in length, whilst only one study reported data from a long-term follow-up (Fedele et al., 2018). An understanding of the behavioural outcomes of the interventions is also limited due to the narrow focus of the included studies and the absence of behavioural outcome data. Additionally, variation across participant demographics, participant eligibility criteria, control group conditions and the inclusion of control groups needs to be considered when interpreting the findings. Such

variation in study designs and the contexts in which interventions occur can create challenges to making comparisons across the studies and generalisation of findings.

It is also important to acknowledge that the reporting of intervention characteristics was at times limited. Interventions may have incorporated additional theory, modes of delivery and BCTs that have not been reported within the text. Use of theory, mode of delivery and BCTs were only coded for when they could be explicitly identified within the texts. Similarly, assessment bias could have influenced the identification of the use of theory, mode of delivery and BCTs due to subjectivity in coding. To reduce this effect, the use of theory and BCTs were independently coded by two researchers and any differences were resolved through discussion with two other researchers.

2.7 Conclusion and recommendations

So far, paediatric weight management interventions in asthma have been useful in establishing the potential for weight reduction and improving asthma outcomes. Nevertheless, reproducing findings in different settings remains challenging due to the limited description of intervention characteristics and the evaluation of interventions. Future paediatric weight management interventions must follow reporting guidelines, such as the CONSORT (Schulz et al., 2010) and TIDieR (Hoffmann et al., 2014). The use of reporting guidelines will enhance the transparency of interventions. Thus, researchers and clinicians will be able to develop an understanding of how useful findings are and how to reproduce interventions in their own setting and population. It is of utmost importance that both intervention protocols and findings are made publicly accessible and include the rationale behind intervention development, how theory has been applied, the mode of delivery and BCTs. Furthermore, the inclusion of standardised terminology will facilitate the comparison of interventions, and enable evaluation and the development of an evidence-base of how best to mediate paediatric weight and asthma outcomes. While the effectiveness of intervention components is not clear, it is not possible at this stage to recommend approaches to paediatric weight management interventions in asthma. However, this review highlights the need for greater transparency in intervention reporting to increase our understanding of how to optimise the weight management support provided in the future.

In the next chapter presents findings from a qualitative study exploring the views and experiences of weight management in families living with asthma. This is followed by findings from the healthcare professional qualitative study in Chapter 4.

CHAPTER 3

The Views and Experiences of Weight Management in Families living with Paediatric Asthma

3.1 Introduction

The previous chapter reported a systematic review of weight management interventions for children living with asthma. Findings revealed that weight management interventions have the potential for weight reduction and improving asthma outcomes in paediatric asthma. However, understanding of how to optimise weight management support in this population is still limited. The following two chapters will present findings from qualitative studies exploring families' and healthcare professionals' (HCPs) own views and experiences of weight management in families living with paediatric asthma.

As outlined in Chapter 1, there are several barriers to families seeking and engaging in weight management due to additional challenges created by asthma. However, to date, there has been little research about families' own experiences of weight management whilst living with asthma, or about how families wish to be supported to manage a healthy weight.

Tailoring weight management support to the needs of families of children who are living with asthma may provide an opportunity to better engage families with behavioural change. Literature has suggested that those living with respiratory disorders wish for the subjective experience of their illness to be recognised by HCPs (Carel et al., 2015). HCPs who have shown empathy for families' experiences of living with asthma were able to develop a stronger patient-physician relationship and families were more receptive to advice provided (Peláez et al., 2015). As increased weight is associated with worse asthma outcomes (Forno et al., 2017), HCPs can support families' motivation to manage weight and their satisfaction with care if weight management is discussed as a method to improve asthma control (McPherson et al., 2016; Alexander et al., 2018). Nevertheless, more research is needed to develop an understanding of how best to do this during time-limited consultations (Bradbury et al., 2018).

3.2 Aim and Objectives

Greater knowledge of how families living with asthma engage in weight management is needed to enrich our understanding and aid in the development of tailored support for this population. This research aimed to examine the experiences and challenges that parents and young people

living with asthma have with weight management and explore the families' views on the best ways to support healthy weight management for their children.

3.3 Methods

3.3.1 Design

The study employed a qualitative methodology with individual, semi-structured interviews. This method allowed for a flexible approach to data collection to ensure that an in-depth narrative of the topics of interest were collected, whilst allowing for other areas important to the participant to arise (Jamshed, 2014). This approach is in line with the critical realist paradigm adopted in this thesis, which accepts that there are varying accounts of any phenomenon (Maxwell & Mittapalli, 2010). Critical realists argue that knowledge can be gained through observable behaviour or events, however this can only capture a small part of reality and our understanding may be misled by our theoretical resources and interests (McEvoy & Richards, 2006). Instead, it is necessary to keep searching for knowledge about causal mechanisms. The use of qualitative methods can help assist researchers to gain access to deeper explanation and understanding of why patterns of behaviour occur (McEvoy & Richards, 2006).

3.3.2 Sample and Recruitment

Healthy weight and overweight young people aged 8 – 18 years living with asthma, and their parents, were purposively selected to ensure variation in views and experiences and to enable identification of differences between healthy and overweight groups. Recruitment commenced following a favourable review from a local University Research Ethics Committee (#195-2017-RC) and NHS Research Ethics Committee (#17/WM/0293). Due to the sensitive nature of discussing weight with young people and families, multiple avenues of recruitment were used to increase the likelihood of participation and ensure a variety of perspectives were brought to the study.

In asthma clinic: Eligible participants were identified and initially introduced to the study by healthcare professionals at a specialist Children's hospital. Clinic appointments were also screened using the study eligibility criteria so that the researcher could be present on the day to speak with potential participants if required. In cases where eligible families expressed an interest in the study, they were encouraged to speak with the researcher after their clinic appointment, who discussed participation with them and provided information sheets containing details about the study and the researcher's contact details. Invitation letters were

addressed to parents (see Appendix A), while information sheets were created for parents and children using age appropriate language (see Appendix B and Appendix C).

Online: The study was advertised on a staff online portal at a local University and staff members were provided with the researchers' contact details. Parents who had participated in the quantitative studies (Chapter 5 and Chapter 6) were also invited to this study in later attempts to increase recruitment. Potential participants contacted the researcher via email or telephone to receive further information. At this point, participants confirmed their eligibility and were provided with information sheets and the opportunity to ask further questions. Potential participants contacted the researcher via email or telephone to arrange a time for a one-to-one interview.

3.3.3 Data Collection

Interviews were conducted face-to-face in a private and quiet location (e.g. at the hospital, at the participant's home) or over the telephone, in accordance with participant preference. The aim was to facilitate convenience and comfort for the participant to enable the quality and depth of data required for qualitative research. Participants were invited to take part in one-to-one interviews to allow for deeper insights into participant experiences (Pope et al., 2002), however young people were given the option to have parents present if they wished. Young Person 4 was the only participant to have a parent present during her interview. The establishment of rapport with parents and young people was necessary to support communication about sensitive and complex issues in order to collect rich data (Drew et al., 2010). To assist the development of rapport, warmth and interest were shown in the participants as well as 'warm-up' questions (Kirk et al., 2007). Steps were taken to overcome the unique challenges of interviewing young people, such as adapting the difficulty of questions (Curtin, 2001) and "playing dumb" to help elicit understanding of experiences (Tammivaara & Enright, 1986).

Before the interviews commenced, information about the research was provided and participants were given an opportunity to ask questions about the research topic and interview process. Afterwards, informed consent, assent and demographic data were obtained. Initially, 'grand tour' questions were used as an ice-breaker to open up issues that would be discussed further in the interview (Jason & Glenwick, 2016). This was followed by an interview itinerary of open-ended questions (see Appendix D and Appendix E). Questions focused on how

participants felt about the young person's weight, how weight was understood in the context of asthma, how participants felt discussing weight with health professionals, the unique difficulties families of young people living with asthma encountered when trying to manage weight and families' views on the best ways to support weight management. Open-ended questions supported the participant to discuss their own relevant and meaningful experiences (Pope et al., 2002). Subsequent questions were tailored to each individual response and included prompts so that areas of interest could be delved into further to help understand individuals' understanding of their experience (Rosenthal, 2016). Interviews lasted between 40-90 minutes. Each participant received a £10 voucher to thank them for their time. To ensure that the experiences of ethnic minority groups were included, the use of an interpreter was offered. Only Parent 2 needed the use of an interpreter and chose to be assisted during the interview by her non-participating eldest child.

3.3.4 Data Analysis

Interviews were audio-recorded, transcribed verbatim and anonymised. Data were analysed using the Framework method as specified by Gale et al (2012). The thematic Framework method was selected as it facilitates comparison of data both within and across groups by case and by code (Ritchie and Spencer, 1994). This allowed for the comparison of weight management experiences between parents and children of a healthy weight and those who were overweight, alongside other emerging concepts. The detailed procedure provided by Gale and colleagues (2012) of familiarisation, coding, development of an analytical framework, indexing and interpretation was followed. Transcripts were read through multiple times alongside a reflective log that was created to develop an understanding of each interview. Any notes or thoughts were noted in the margin of transcripts. After familiarisation, the transcripts went through a process of being coded passage-by-passage to ensure an inductive, data-driven approach to the development of themes (for an example see Appendix F). Any passage of text identified as meaningful was allocated a code. After the first four transcripts were coded, codes were listed, compared and grouped into categories to develop an initial analytical framework. This process was repeated after coding the next four transcripts to revise the original framework and incorporate new codes. Several iterations of this process were carried out until the last transcript was coded. Codes that were grouped into categories formed the final thematic framework. NVivo software V12 (QSR International) was used to assist the application of the final analytical framework to all transcripts and to support retrieval of data. Following this, data were charted into a matrix using a spreadsheet on Microsoft Excel. The matrix

contained one row per participant and one column per code. Data from each category were summarised while retaining their original meaning and placed into the matrix alongside quotes of interest. Once in the matrix, data were analysed using thematic analysis, an approach widely used in applied health research (Braun and Clarke, 2006; Braun and Clarke, 2014). Strategies were taken to ensure trustworthiness in the findings. The doctoral researcher kept a "reflexive commentary" of initial impressions of data, had regular debriefing sessions with members of the research team to discuss and develop ideas, and thick description provided of the issue of interest and the context in which it is being studied (Shenton, 2004).

3.3.5 Reflexive Account

To maintain rigour in their work, qualitative researchers are encouraged to recognise and draw attention to the potential influences on data generation and analysis; a practice which aims to strengthen and maintain trustworthiness in the research findings (LaBlanca, 2011). Through the use of reflexive practice, researchers are thus encouraged to examine their own role in data collection and interpretation (Finley, 2002). As such, reflexivity supports researchers to develop awareness of preconceptions related to, and generated from their own lived experience (Attia & Edge, 2017; Finlay, 2002). The following section provides my own reflexive account of data collection and interpretation, including how my own views and behaviours may have influenced participants' responses.

As a method of recruitment for this study, I spent time in a local paediatric respiratory department. At times, the healthcare professionals asked me to speak to eligible participants in the waiting room or come into consultation rooms to introduce the study. Although the families had consented to be approached, I worried about creating feelings of being 'ambushed' or heightening what may already be an uncomfortable experience for them. This worry often eased as the conversation progressed, during which time some families were happy to talk about their experiences with asthma, weight and their asthma care. Despite trying to appear informal, friendly and addressing concerns raised, I perceived other families to view talking to me about the research as a formality after being asked by their healthcare professional. During some of these conversations, parents questioned why they were being targeted or spoke about the difficulties of taking part. It may be that despite attempts to build rapport and recruit a range of participants, it was only those who were interested in the topic and wanted to share their experiences or perceived it to be easy to do so who volunteered, while the views and experiences of others were missed.

Although conducting interviews was usually an enjoyable experience, some felt challenging as an inexperienced qualitative researcher at the beginning. Some families for example, asked for advice surrounding their child's care or believed I could directly influence policy at the hospital. In these instances, I had to explain that I had no direct access to young people's medical notes and reinforced that my role as a researcher was separate from those providing care in the respiratory department. While I wanted to explore families' experiences and beliefs on the research topic, it became clear that some families were dissatisfied with their asthma care and used the opportunity to share their frustrations. In other instances, it became clear that some young people struggled to elaborate on the interview topic or answered in a way that they believed would be viewed positively. It is possible that these actions were related to sensitivity of the topic of weight, or from a power imbalance between the researcher and the participant. Attempts were actively made to reduce power inequalities, such as engaging in informal conversation before the interview, letting young people choose their preferred interview time and location, and sitting with the young people at their level (Kutrovátz, 2017; Morrow & Richards, 1996). It was fulfilling throughout this experience to gain confidence in my ability to interview and, in turn, perceive the interview topic to be more thoroughly explored.

It was also hard not to reflect on families' experiences with paediatric asthma in light of my own childhood experience, living with diabetes. Experiences, such as dissatisfaction with care for example, anticipated negative peer judgement, and uncertainty in how to balance illness control with social or educational activities were all familiar topics to me. In an attempt to suspend or bracket these similarities, I tried to bring forward this lived experience and contemplate how it could influence my interpretation of the data (Tufford & Newman, 2012). The use of a reflexive diary and dialogue with peers and family helped to aid this. Other strategies I used to help ensure participants had their own identity included regular discussion and development of ideas with colleagues and at respiratory research meetings at the local paediatric hospital. However, it must always be considered that a different researcher may have interpreted different meanings from the data and pursued different lines of inquiry in the quantitative research in this thesis.

3.4. Findings

3.4.1. Participants

The sample, a total of 18 participants, included 9 parents (see Table 9) and their children (n = 9, see table 10) took part in interviews.

Table 9: Parent participant characteristics

Participant number	Age	Gender	Child age	Child weight category	Age of asthma diagnosis (years)	Ethnicity	Child
Parent 1	38	Female	16	Overweight	5	Pakistani	YP1
Parent 2	53	Female	14	Overweight	2	Bangladeshi	YP2
Parent 3	42	Female	11	Overweight	4	White British	YP3
Parent 4	35	Female	8	Healthy weight	<1	White British	YP4
Parent 5	37	Female	12	Healthy weight	5	White British	YP5
Parent 6	44	Male	16	Healthy weight	6	Pakistani	YP6
Parent 7	36	Female	12	Healthy weight	<1	White British	YP7
Parent 8	53	Female	15	Healthy weight (previously overweight)	2	White British	YP8
Parent 9	46	Female	11	Overweight	5	White British	YP9

Table 10: Child participant characteristics

Participant number	Age	Gender	Weight category	Age of diagnosis	Ethnicity	Parent
Young Person 1	16	Female	Overweight	5	Pakistani	P1
Young Person 2	14	Female	Overweight	2	Bangladeshi	P2
Young Person 3	11	Male	Overweight	4	White British	P3
Young Person 4	8	Female	Healthy weight	<1	White British	P4
Young Person 5	12	Male	Healthy weight	5	White British	P5
Young Person 6	16	Female	Healthy weight	6	Pakistani	P6
Young Person 7	12	Male	Healthy weight	<1	White British	P7
Young Person 8	15	Male	Healthy weight (previously overweight)	2	White British	P8
Young Person 9	11	Male	Overweight	5	White British	P9

3.4.2 Themes

Data analysis generated four core themes: 1) beliefs about weight management, 2) beliefs about asthma management, 3) context and resources, and 4) the role of professionals in supporting weight management. The themes are presented below alongside extracts of verbatim data to illustrate key points:

3.4.2.1 **Beliefs about Weight Management**

Beliefs about excess weight

Parents expressed concern about young people's self-esteem regarding their weight and worried that young people would "put themselves down" (Parent 1) by comparing themselves with peers of a healthy weight. This negative self-concept in young people living with asthma and overweight was supported by one young person who claimed that he would "feel better" (Young Person 9) about himself if he lost weight. However, discussing child weight without stigmatising young people was considered a challenge. One parent, for example, felt disinclined to discuss her child's weight with a healthcare professional for fear that drawing attention to weight would have negative consequences for her child's self-esteem. She worried that making an issue of her child's weight could lead to a disordered relationship with food:

> "I don't want him to feel like, 'I've got to go on a diet because I'm big.' He's only 12 years old. I don't want him to think along those lines because then that could turn into starving himself and having an eating disorder." (Parent 3)

In contrast, other parents highlighted the importance of encouraging young people to "accept and be confident" (Parent 6) in their own bodies as opposed to comparing themselves with images they viewed on social media. These parents placed less emphasis on their child's appearance, and more on the longer-term health consequences of excess weight, such as type 2 diabetes and heart disease. As one parent described, young people need support to understand the importance of weight management for physical health as well as body image:

> "I would work with Jessica to look at that and try and address that in a positive way, but not for her to look like something that the world says she should look like, but for her to be healthy." (Parent 6)

Beliefs about eating

Food choices were perceived by families to influence young people's asthma and allergy outcomes. Trial and error was described as the most common method of learning which foods influenced asthma symptoms. One parent kept a food diary of her child's food intake to help make sense of "what he is eating and what symptoms he's got" (Parent 5). Families described nuts, seeds, wheat, dairy and high sugar foods and drinks as those associated with "wheezing and coughing" (Parent 4). Subsequently, diet modification was described as a technique used to gain control over the young person's asthma. Most families who perceived there to be an asthma-diet relationship checked ingredient lists before consuming products and "restricted" (Young Person 6) foods that had previously been associated with asthma symptoms. In contrast, one parent overhauled her child's diet and introduced a vegan lifestyle:

> "My mom because she was like, if you become a vegan it will help you more with growing up as in like your body, your asthma and yeah stuff like that." (Young Person 5)

Although some parents reported an increased responsibility to monitor food associated with asthma symptoms, they doubted that a food-related asthma threat would act as a deterrent to the consumption of unhealthy food by young people. This was supported by Young Person 5, who expressed reluctance to maintain a "strict" vegan diet despite observing improvement in asthma symptoms. However, young people were motivated to make smaller alterations to their diet to avoid future exacerbations:

> "I know if I eat all that heavy unhealthy stuff, my asthma is going to flare up. If I have a fizzy drink, that another thing that makes my asthma flare up *[…]* I know to stay away from it and it's fine for me because it's going to be me who gets affected by it at the end of the day." (Young Person 1)

It was clear then, that for some families, engagement in diet-related weight management depended on whether they associated negative asthma outcomes with particular foods. For one young person, asthma symptoms experienced after accidentally eating nuts in a "health bar" (Young Person 6) created a reluctance to eat healthy foods, whilst other families limited unhealthy foods, such as chocolate, after noticing symptoms: "The fact that most healthy food has nuts in it, just the fact that I can't eat them if I wanted to" (Young Person 6).

Participants demonstrated an understanding of the rationale for eating healthily and believed balancing food groups was an important part of weight maintenance. Parents were encouraged to teach young people the importance of eating balanced food groups, such as cakes and sweets, with fruit and vegetables. Despite feeling a responsibility to provide healthy food for their children, some parents described feelings of guilt for choosing nutritious meals over young people's preferred foods: "you do feel a bit cruel" (Parent 8). Unhealthy food was not restricted by some parents in an attempt to reduce food cravings whilst others did not want to deny young people and the rest of the family the enjoyment of desired foods. Providing home-cooked meals was used as a strategy to "compensate" (Parent 3) for "cheat days" (Parent 1). Meanwhile, despite the health benefits of healthy food, Young Person 8 preferred choosing unhealthy foods when sad or ill because "unhealthy foods make you feel a bit better." (Young Person 8).

Participating young males also associated healthy eating with enhanced sporting ability. Although there appeared to be gaps in knowledge between nutrition and exercise, young people were motivated to eat more healthily by friends who suggested that it would support "stamina and strength" (Young Person 3).

Beliefs about physical activity

Young people's ability to engage in physical activity whilst living with asthma was perceived to be limited, as demonstrated by Parent 1: "with her asthma, obviously, she can't do too much." Families described how intense or prolonged exercise experiences had exacerbated asthma during or after physical activity. These barriers to exercise were heightened during times of poorer asthma control and excess weight, as young people were described as "battling against" (Parent 3) themselves. As a consequence, young people felt reluctant to engage in vigorous exercise activities, as they doubted their capability and anticipated dyspnea: "I feel like I'm just going to be standing there using my inhaler" (Young Person 9). One young person felt "held back" (Young Person 7) and discouraged from exercising because it was "at the cost of pain"

(Young Person 7) from asthma exacerbation. Difficulty in overcoming these asthma exercise barriers meant that some families did not believe young people could exercise or manage their weight whilst they were living with asthma:

> "I thought it's not our fault he needs to exercise a bit. He can't do much because of his asthma but I don't know if he can grow out of asthma, he might, I don't know." (Parent 9).

Similarly, Young Person 8 shared that he had previously engaged in less exercise due to a belief that he "couldn't do" physical activity (Young Person 8). Yet, overtime Young Person 8 believed that the confines of asthma on physical activity stemmed from decreased motivation due to its difficulty as opposed to limited capability:

> "Actually, it's a lot of work and I'd get out of breath easily and I decided it wasn't worth putting much effort towards it." (Young Person 8)

Families perceived exercise to be a threat to asthma control thus creating obstacles to physical activity engagement and weight management. Parents restricted physical activity to reduce the immediate threat of asthma exacerbation: "he wasn't doing much exercise really 'cause we were worried about provoking his asthma" (Parent 8). However, the degrees of restriction varied between families. Some parents restricted exercise duration or opportunities due to perceptions of capability; others were more cautious about encouraging physical activity in their child with asthma as opposed to their other healthy children. The perceived necessity of managing asthma risks increased with asthma severity, which created greater sedentary behaviours and barriers to weight management:

> "Mum is quite careful with her now. She tells her not to do much and just sit and watch TV or go on her phone and Mum gets everything for her. She'll bring her food to her. She'll do everything." (Parent 2)

Young people also viewed reducing physical activity duration or intensity as a way to manage asthma, yet they tended to provide more negative accounts of activity limitation than parents. Parents often described young people as "taking it in their stride" (Parent 3), however restricting exercise intensity often created feelings of frustration and demotivation in young people who felt that they couldn't achieve their full potential: "It just doesn't feel good because I want to play football and I'm quite competitive" (Young Person 5). Physical activity was often viewed as an opportunity for socialising. Yet, not being able to keep up with peers, having to use inhalers during physical activity and being told to go inside or to rest by teachers resulted in young people feeling "different to everyone else" (Young Person 9). Nevertheless, young

people preferred to exercise within the perceived limits of asthma, as exercise-induced bronchoconstriction could lead to self-imposed restriction and more limitations:

> "If you do too many bad things it will cause your asthma to play up and you need more control over what you do, like if you are not allowed to run as much or you won't be able to do as many things as you want to do because it controls everything that you do.' (Young Person 5)

Families took pharmacological steps which enabled weight management behaviours, such as the use of inhalers, before or during activity. Asthma medication allowed young people to exert themselves more during activity. Yet, some young people's ability to engage in exercise was reduced due to uncertainty of the correct inhaler technique or families not being informed that the use of asthma medication before physical activity could aid exercise:

> "We didn't think they were allowed to have it. We were worried about what it would do if his asthma wasn't playing up because of the increased heart rate, obviously. Things like that would have been really important to know way back when it all started." (Parent 7)

3.4.2.2 Beliefs about Asthma Management

Beliefs about Capabilities

Parents expressed doubt and anxiety over their ability to manage their child's asthma. Participants struggled to achieve a balance between managing asthma and other life demands, such as caring for other members of the family, which added to their concerns that they would "slip one day" (Parent 1) and be unable to provide adequate asthma support. For example, reminding young people to take medication was considered important and parents blamed themselves if they failed to do so. Nevertheless, achieving asthma control was sometimes perceived to be out of the parents' control, as there was a tendency for parents to externally attribute the locus of control of asthma symptoms: "anything could trigger it and you never knew why it was happening." (Parent 2). For some parents, worry about an external locus for control to asthma symptoms evolved into hypervigilant monitoring of children's asthma symptoms in which parents mentally prepared for asthma symptoms:

> "When you're a parent, you can't sleep because you're so scared that something is going to happen and you can hear him struggling to breathe." (Parent 7)

> "I say, 'Alright, you carry on' but then, at the back of my head, I am thinking, 'Oh, my God, what if her asthma gets worse and I have to phone an ambulance.'" (Parent 1)

A sense of isolation in managing asthma between asthma appointments enhanced parents' asthma-related anxiety. Some parents did not feel equipped to make decisions independently on how to treat severe asthma exacerbations, of which the emotional burden led to "symptoms of a heart attack" in one parent (Parent 2). Yet, accessing help outside of appointments for some felt like a battle. There was a sense of invalidation and perceived "overcautious" (Parent 7) parenting when seeking emergency care. Uncertainty in caregiving and subsequent inaccessibility to asthma support was suggested to lead to "overly protective" (Parent 7) parenting to reduce the risk of asthma exacerbation, such as the restriction of physical activity opportunities.

Parents placed importance on the balance between parental assistance with asthma management and transferring asthma care to the young person. Managing asthma was perceived to be a task for the whole family in which young people went through "a bit of a learning curve" (Parent 5) before living with and managing asthma was recognised as a normal way of life. Meanwhile, parents adopted the role of reminding and encouraging young people to take their inhalers and checking when new medication prescriptions were needed. Most parents recognised a need to incrementally transfer asthma care to their child in line with their increasing independence as they matured. Young people appreciated the opportunity to "deal with it *[asthma]* independently" (Young Person 5), yet they acknowledged that a reduction in support led to the development of bad habits, such as using medication incorrectly to save time. The level of autonomy assigned to young people varied, with some parents reluctant to transfer asthma care responsibilities when they believed that young people would not adhere without their support: "Like I say, I don't think he's almost realised how critical it can be" (Parent 7). Transferring responsibilities too soon was thus thought to cause suboptimal asthma control, again presenting a barrier to exercise-related weight management.

Families shared concerns that schools represented an increased risk to asthma control due to poor asthma management. Parents expressed doubt in teachers' abilities to detect asthma symptoms or remember which children were living with asthma, as first aid trained teachers or nurses on-site removed "some of the responsibility" (Parent 7). After experiencing insufficient asthma care, parents feared that schools lacked adequate asthma knowledge and did not perceive asthma to be a serious illness. Parents shared their frustration at school medication policies that restricted access to medication, during school time or physical lessons, as they presented a challenge to asthma management: "If he needs his inhaler, he needs his inhaler

and he can't wait an hour" (Parent 3). Families who experienced teachers who did not believe reports of young people's asthma symptoms or were unsympathetic to the difficulties caused by asthma, such as exercise-induced bronchoconstriction, perceived greater risks to young people's asthma during school time: "The teacher was saying things to him like, 'You'll be fine. Come on. It's good for you'" (Parent 7). This created uncertainty in transferring asthma care to schools, as parents had "no control" (Parent 7) over their child receiving support: "I'd be worried then all day and thinking, 'Are they going to give him his inhalers when he needs them?'" (Parent 3). Such experiences and beliefs increased the perceived necessity of physical activity management and fed into parents' motivation to encourage their children to exercise: "In school, I think there was *[a]* time we told her not to do any P.E." (Parent 2).

Strategies implemented by schools to reduce risks related to asthma lessened families' concerns about young people's safety. For example, young people who carried an inhaler on their person provided a source of comfort to families. Having an asthma care plan and an empathetic teacher that children could talk to also helped families to feel that young people were "safe" (Young Person 7) during school hours. Confidence in schools developed further when schools were in communication with hospitals or health professionals as it improved their understanding about asthma limitations. Following school-health professional communication, parents described positive experiences of teachers monitoring children's breathing and providing assistance for young people. However, in one case a school's efforts to reduce travel around the school served to increase sedentary behaviours and reduce weight management engagement:

> "When she's really bad with her asthma, so the head of the general offices, they are going to take her up there. She just sits there through the lessons. Come to her and she can work from there because they know that she can't move." (Parent 1)

Medication Beliefs

Parents highlighted their reliance on asthma medication to manage their child's condition: "It's something he needs to help him breathe and by not having it, there is nothing else" (Parent 7). For some, the necessity of using asthma medication meant that they had not checked the medication for any potential side effects. Positive results following the use of new asthma medication provided hope that young people's asthma control would not deteriorate and it would "prevent" future hospitalisation (Parent 2). Although, for some parents there was an ongoing sense of fear in the uncertainty that medication would maintain asthma control:

> "I think that since he's been on this new one… I'm frightened to say too much because I don't want him to go backwards... but since he's been on that, he's improved. He's improved a lot." (Parent 3)

Despite trying to emphasise the importance of medication adherence to young people, some parents did not believe that their guidance was effective: "kids listen to you so much but they often think you're over-exaggerating things" (Parent 7). Instead, consultations with HCPs were used as an opportunity to discuss their child's non-adherence as HCPs represented a greater authority figure for healthcare behaviours. Negative health comparisons to other young people who did not adhere to medication and the provision of adherence cues, such as devices with alarms and devices that recorded medication administration, were thought to help to improve young people's adherence. One parent also highlighted the incentive of weight management as an aid to adherence, as medication can enhance the child's capability to engage in exercise:

> "*Asthma consultant* sat her down and said, 'Look, you've got two options. If you have your asthma, you have your asthma, you have to have your steroids. If you don't take your steroids, you can't move from one sofa to another sofa because you can't walk, you can't breathe, you can't do anything. And if you can't do that, you will be sitting in one place, you will put on more weight. With steroids, if you are eating with steroids but you can move [*it*] is better." (Parent 1)

Negotiating a balance between asthma control and weight management was reported to be challenging, particularly in relation to some types of asthma medication. Families expressed concern that the use of over-medication "brought more side effects and more problems" (Parent 2). More commonly, increased appetite and weight gain was a treatment concern highlighted by six parents. For some, managing child weight whilst taking medication was "an ongoing battle" (Parent 3). However, for other participants there was a sense of hopelessness in achieving weight management whilst young people were still using steroids: "It's like a vicious cycle, he can't lose the weight" (Parent 9).

Young people's reactions to the side-effects of asthma medication were a cause for concern. Parent 1, for example, believed that steroid use generated feelings of "anger" in her child due to weight gain as a treatment consequence. As a result, the young person started cooking her meals from scratch and calorie counting to minimise her intake. However, ambivalence around the ability to manage weight whilst using asthma medication and beliefs that young people will "just put on weight anyway" (Parent 1) may create inconsistent eating behaviours in young people. Thus, excess weight may be indirectly linked to asthma medication when increased eating occurs to regulate the emotional response to treatment:

> "She will have nothing at all apart from water. Have her tablets, 'no I've already had my tablets. I've already had calories, I've done this.' You know, some days she is like, "OK, I'm just going to eat and eat and eat and eat". You know, you have two faces." (Parent 1)

> "Maybe then, maybe they don't make her put weight on maybe. Because she's angry and she's eating all sorts of junk and making herself fat. It's mainly… it's all in the head." (Parent 1)

Despite examples of asthma control being prioritised over weight management, non-adherence was discussed as a strategy used by young people to avoid anticipated weight gain: "She's like 'I'm fat' *[…]* then I'll notice she'll miss the steroids" (Parent 1). This was mirrored in parents' own sense of remorse at decreased health-seeking behaviours that stemmed from the fear of anticipated weight gain as a consequence of receiving steroids: "I still obviously wouldn't have not gone to the doctor. I just would have left it a bit longer just to make sure that, you know, he didn't get better" (Parent 8). Contrasting examples of priorities in weight management and asthma control between asthma treatment and exercise raise questions about whether there are differences in participant beliefs. Such differences in perceived locus of control, ease at overcoming weight management barriers, or the possibility of utilising different methods to control asthma (such as non-pharmacologic management) may influence approaches to weight management.

Context and Resources

An obesogenic environment

Families acknowledged that they lived in an obesogenic society and exposure to unhealthy foods presented a challenge to weight management. Being in the presence of others eating unhealthily was described as "difficult" (Young Person 1) and "a bit sad in a way" (Young Person 8) because young people often felt they wanted to share in the "satisfaction" (Young Person 1) these kinds of food provided. Parents continued to encourage healthy eating as young people matured, though it was recognised by both parents and young people that the responsibility to eat healthily transferred to the young person themselves as they gained more independence.

Parents highlighted that the home environment offered an opportunity to covertly influence young people's dietary intake and promote weight management. Parents reduced the availability of unhealthy foods at home and ensured that healthy food, such as fruit, was always accessible. To encourage young people to eat healthily, parents tried to make healthier versions

of their preferred foods. Time and organisation were seen as barriers to this. However, a few parents suggested that looking for healthy recipes and cooking together as a family created excitement, a chance to teach young people about nutrition and did not single out children who were overweight. Catering to other family illnesses, such as diabetes or food intolerances, provided another incentive for the whole family to adapt and normalise a healthy diet. Nevertheless, the cultural context of the home was also seen as important to weight management. For example, removing all unhealthy food was perceived as unrealistic for some of the participating Asian parents whose cultural identity was entangled with the ability to provide a variety of dishes for guests.

Community-based weight management support

A lack of weight management support was identified by three of the five parents whose children had experienced overweight. Experiences of HCPs recommending weight management but not referring or signposting to support services meant that some parents didn't "know where to turn to" (Parent 9) for help. Families left medical appointments feeling "naïve" (Parent 9) for expecting weight management support to exist within the community. Instead of feeling validated for seeking services that were needed, families felt a responsibility to manage weight by themselves.

The practicalities of accessing existing weight management facilities were also discussed, with safety, time and money frequently cited as barriers. Some families overcame these difficulties by supporting their child to engage in exercise through the provision of transport to, or money for gyms or sports clubs: "I don't want to be a barrier for them. They like it, so yeah" (Parent 6). In contrast, for other parents accessing weight management resources would be at the deficit of providing basic needs for their family: "just a journey for somebody, that'll be a meal on the table for them" (Parent 1). Concerns about the practicalities of accessing weight management support was enhanced by the perception that resources may be wasted if young people do not want to go, highlighting that there may be wider barriers to existing weight management services, such as young people's motivation:

> "What's the point if I've got to travel and he doesn't want to go there anyway? Even if it's like three lessons, somebody has to pay for that so it's kind of a waste of money in a way, do you what I mean?" (Parent 9)

Environmental exercise context and resources

The risks to asthma control changed with the seasons, therefore constantly appraising the environment was considered to be part of living with asthma. Environmental factors, such as cold air in the winter and pollen in summer months, were perceived as obstacles to young people achieving asthma control whilst outside: "I couldn't stop coughing *[…]* I think it hurts me more in winter" (Young Person 7). As a result, fear arose with the changing seasons: "I'm so scared, the winter is coming" (Parent 1). This was something families sought to resolve. One parent provided a scarf to go around her daughters' neck whilst many ceased outdoor activities in winter months. Reassurance from avoiding seasonal triggers meant families were more sedentary during months that were perceived to carry a risk to asthma control and engaged less in outdoor physical activities:

> "You just think, 'Fine, let's just stay in.' I carry on doing work at home and the kids are on the computers *[…]* He's indoors. He's warm. His inhalers are there. I can see that he's okay. That can be nice." (Parent 7)

Young people's environmental risk assessment for exercising was also thought to be context-dependent on the perceived social outcomes. Exercising as a family for example, provided opportunities to socialise and offered a "team" (Young Person 8) to help motivate young people to engage in weight management. Young people felt encouraged by the knowledge that parents wouldn't judge breathlessness during activity and understood if they needed a break. However, families expressed a difficulty in engaging young people in family activities: "he says 'I can't breathe' and would rather be on his computer" (Parent 9). It was thought that family exercise should be promoted by HCPs as having a positive "impact on the whole family" (Parent 6) and as a way to avoid "singling out" (Parent 4) young people. Parents wished for HCPs to provide ideas for fun family activities to remove the perception of it being exercise and offer incentives for engagement which could motivate young people.

Undesirable social outcomes due to the perceived salience of breathlessness and excess weight created a reluctance to engage in physical activity around peers. Young people felt self-conscious of peers watching whilst exercising and in changing rooms due to the lack of privacy offered. For one young person living with a healthy weight, social comparisons to friends who had experienced weight-focused bullying created motivation to exercise and maintain weight. However, for some young people, weight-focused bullying and exercise-induced bronchoconstriction generated exercise avoidant behaviours. Young people felt a sense of embarrassment when peers attributed their difficulty in exercise and their weight to being

"unfit" and "lazy" (Young Person 9). Young people's confidence in exercising around peers was thought to increase if peers understood that asthma created physical activity barriers and breathlessness. One young person also felt that shame during exercise could be eased if peers understood that excess weight was a consequence of living with asthma, as medicalising weight would reduce weight stigma and personal weight management responsibility:

> "They would laugh at me, say I'm trying to make up excuses, they say I'm too fat or something like that *[…]* Maybe that people would understand that I'm not too fat and then maybe people would understand yeah, he's not fat, he just has asthma." (Young Person 9)

In comparison, instead of reducing physical activity due to breathlessness, one parent stated that her son normalised breathlessness and did not treat asthma symptoms when they arose: "He had an asthma attack going up the mountain but didn't tell anyone" (Parent 7). Parent 7 believed that young people anticipated feeling different, or being treated differently, due to using asthma medication during activity. As a result, worry about asthma stigma had consequences on his illness management, a factor that could influence asthma control and exercise engagement:

> "He'll just think, 'My chest is a bit tight. I'll sort it out later.' I guess it's hard for him because none of his close friends are asthmatic." (Parent 7)

3.4.2.4 The Role of Professionals in Supporting Weight Management

HCP Support with weight management

Participants expressed how medicalised control of asthma was prioritised in healthcare appointments. Short consultation times often meant that appointments felt "rushed" (Parent 7) which only allowed time for asthma medication to be discussed. Families who experienced more severe asthma symptoms were accepting of weight management advice not being provided, as asthma control was seen to be of greater importance: "Their weight is the last thing you're worried about. It's a matter of keeping that person alive" (Parent 2). In comparison, families who had better asthma control valued the opportunity to use appointments to discuss additional methods to optimise asthma control. There was a sense of awareness and irritation that appointments were not being utilised fully:

> "I had a look at the health plan *[…]* on the back, there were different sections about exercise. They were just left. We haven't even completed them and so they'd only fill them in if it's related to the inhaler and then you feel like you're shoved out of the door." (Parent 7)

These families desired holistic asthma reviews which considered "the whole picture" (Parent 6) of factors that could influence asthma control. Holistic management offered an opportunity to gain more control over asthma symptoms alongside the "long-term gratification with a healthy lifestyle" (Parent 5). Families where children were not overweight were disappointed in the asthma care that they had received due to limited or no information being provided on asthma's relationship with diet, exercise or weight. In these families, it was felt important for HCPs to "highlight the relationship" (Parent 6) between asthma and obesity so that they could "catch" (Parent 8) and prevent excess weight before it increased in the future. Despite these families' desiring weight management education, it was only families who were experiencing asthma and living with overweight who had discussed the asthma-obesity relationship with HCPs. As already highlighted, many families felt invalidated for seeking support due to a dismissive approach that stemmed from little practical advice and the perception that weight management responsibility was placed on the family:

> "I just decided that they weren't really interested so I would like try and deal with it myself. I felt I could. I just wanted extra support." (Parent 8).

One parent believed that HCPs should consider families' preferences for asthma management and support different philosophies to healthcare. Holistic management was viewed by one family as an opportunity to reduce reliance on asthma medication

Talking about weight with a HCP

Young people were reluctant to talk about weight with HCPs, as six of the participating young people described it as an "uncomfortable" (Young Person 7) topic. One young person perceived it to be inappropriate to raise the topic of weight during an asthma review, whilst another parent sought to engage in weight management conversations without the presence of her child. The stigmatised nature of obesity created feelings of "embarrassment" (Young Person 9) when seeking support during consultations due to a sense of personal responsibility and anticipated blame from HCPs:

> "They could be like not that nice like if they maybe laugh at me, criticise me, say it's my fault, I have asthma, I shouldn't be fat." (Young Person 9)

> "I'm kind of feeling ashamed that he's like that, do you know what I mean, it's kind of embarrassing that he's got that size *[…]* I felt like it's all my fault." (Parent 9)

Developing families' understanding of the influence of overweight on physical health and asthma helped to ease the difficulty of the conversation: "Weight's probably part of the physical well-being *[…]* that's what you're there for" (Young Person 8). The use of aids, such as statistics that showed an increased obesity risk in asthma, was thought helpful to remove perceived blame and create an environment in which families would be more receptive to weight management conversations:

> "If it's just one of those things that you have to deal with when you've got asthma or you might have to deal with, you know, then maybe it might be easier to approach the weight problem." (Parent 8)

The importance of good physician-family communication was also emphasised. Young people were more satisfied with HCPs who built a rapport with them, as this facilitated trust and less perceived judgement. HCPs who "slowly" (Young Person 1) eased into weight management conversations whilst using sensitive language and avoiding terminology such as "fat" (Parent 2) were suggested to create a more supportive environment. The use of "motivating language" (Young Person 7) and positive message framing in connection to asthma improvements were also suggested to "empower" (Parent 6) families more than information provided on the deficits of excess weight. While discussing the asthma-obesity relationship, it was identified as important to use age-appropriate language. Older young people expressed a desire to gain a deeper understanding and to be acknowledged as having a responsibility for asthma self-management, while more complex terminology caused younger participants to "think the worst automatically" (Young Person 7).

Families wanted HCPs to go beyond just raising the topic of weight, as doing so without providing practical advice or referral to support services was viewed as futile. Families suggested that weight should be regularly monitored as an incentive to engage in weight management behaviours and reinforced by HCP's recognition of improvements: "When you can see something working, then you're more likely to want to go back" (Parent 2). However, young people worried that weight management support with HCPs would result in "drastic changes" (Young Person 8) and "less of a choice" (Young Person 7) over lifestyle. Families desired for weight management to be personalised to minimise disruption and include realistic targets and aims to further increase motivation and maintenance.

Dietary knowledge

Dietary knowledge had been gained at school or at home for most young people. Parental dietary knowledge was self-taught from the internet or their own childhood experiences. Parents used this knowledge to "grab the bull by the horns" (Parent 8) and teach young people "how important a healthy diet is" (Parent 7). While one parent worried that referral to a dietician would create negative perceptions of self in her child, most families perceived dieticians as a useful tool for "information gathering" (Parent 1) that would help them to develop a greater understanding of how to regulate food choices. Following referral to a dietician and receiving dietary education and practical advice, one family felt better prepared to make changes to their lifestyle to support weight management.

Knowledge of an asthma-diet relationship appeared to be poor and had been learned through families' own experiences. As the asthma outcomes caused by diet were perceived to be "serious" (Parent 6), a few families were surprised that the relationship between diet and asthma had not been discussed during medical consultations: "I don't even know if they know my [diet-related] anaphylaxis has caused asthma attacks" (Young Person 6). Confidence in monitoring asthma was thought to increase where families had a better understanding of the asthma-diet interaction. As a result, some families were disappointed that the impact of different foods on asthma had not been discussed when asthma was first diagnosed. Furthermore, families believed that they would be more likely to "buy certain foods or adopt certain habits" that could aid weight management if HCPs provided dietary information that was linked to asthma symptom improvement (Parent 5):

> "They could've said 'These foods might trigger your asthma' and that would've been more helpful so then I know to avoid them or have a certain awareness of how much I'm taking." (Young Person 6)

Exercise Knowledge

Families described recommendations from HCPs regarding exercise engagement to assist asthma control and weight management however, only a few HCPs had also provided practical advice about different types of exercise. As a result, participants believed that their knowledge of physical activity in the context of asthma was underdeveloped, which led to increased concern around exercise engagement. The perception of decreased exercise knowledge and uncertainty as to which types of exercise were "asthma friendly" (Young Person 6) acted as a barrier to physical activity and weight management engagement.

Greater practical exercise knowledge and support were thought to help bridge the gap between exercise concerns and exercise engagement. Families suggested HCP provision of a "safe" exercise plan with targets to "push" (Young Person 9) young people towards more challenging exercises would increase families' confidence in exercise engagement. An achievable exercise plan tailored to the young person's physical ability was thus thought to be key to improving weight management through exercise participation:

> "If they did have advice it would have been helpful on what type of stuff you could do and how to see where you are. Like a programme that would help towards everything, like a training programme to start doing this, then you might be able to start doing this and then increase lung capacity and so on, actually progress, you know, that would have been helpful." (Young Person 8)

To enhance some families' exercise self-efficacy, practical exercise experience with HCPs was thought to be necessary. The opportunity to exercise with a HCP was suggested to provide a safe environment for young people to become familiar with their exercise limitations before moving on to "normal exercise" environments (Parent 8). Improving exercise self-efficacy may also provide an opportunity to address parents' perception of risk in exercise, as parents' "protective" behaviour (Young Person 6) may restrict young people's weight management exercise opportunities. Only one family had the experience of practical exercise guidance from a physiotherapist. It was evident that HCP support tailored to the experiences of asthma, such as learning to correctly interpret breathlessness, was beneficial to help reduce asthma-specific concerns and increase young people's motivation to exercise:

> "She got my confidence back actually too. Like, it's OK if I do get out of breath because I know that now that I'm not going to go into an asthma attack. I'll be out of breath, nothing else. So, I've got that, you know, I know that if I do get out of breath, I'm not as worried as I used to be." (Young Person 1)

It was thought to be necessary to develop families' understanding of how exercise can lead to improvements in lung function and asthma control to help motivate exercise engagement and weight management. Some young people shared examples of how their asthma symptoms and exercise capacity improved after engaging in more exercise: "I do more sports so my lungs have got more used to working and got stronger" (Young Person 8). Families believed that sharing peers' accounts of positive exercise outcomes would help other families to understand that exercise would "do them good as opposed to do them harm" (Parent 8) and motivate them to engage the physical activity. Nevertheless, it was recognised that families' exercise concerns may be deep-rooted and so HCPs would need to "constantly remind" (Young Person 5) families

of the benefits of exercise for asthma control, over time, to help improve families' beliefs about exercise capacities and reinforce behaviour change.

Intervention

There was uncertainty surrounding who should provide weight management support. This perhaps evolved from family ambiguity in beliefs around weight management responsibility and whether excess weight was a physical health concern. Some participants considered weight management to be a public health issue outside of the doctors' role. Other participants perceived weight management support to be the most effective when provided by a multi-agency team of HCPs who could bring varying specialties. Someone who had experience of working with "children with asthma" (Parent 5) and who could bring "an element to make it quite fun" (Parent 5) was understood to be vital to promote engagement in this population.

To facilitate ongoing support, it was considered important to make access to weight management services as convenient as possible. The delivery of weight management support "in the community" (Parent 9) was preferred as it would reduce travelling and disruption to "homework time" (Parent 7) and other life demands. Embedding services within the local community was also seen as a way to reduce negative, medicalised connotations that created concern about accessing weight management support: "You associate hospital with feeling ill, kind of bad feelings." (Young Person 6). Despite recognising the difficulty of travelling, some families considered the availability of support to be more important than the location:

> "I think if someone wants it, they will travel. If they think it's a priority, they'll make the effort to go there. It could be the hospital but it's a matter of anything; just so that it can happen." (Parent 2)

Families further suggested online resources, mobile applications or mailing lists as practical solutions, facilitating access to materials at any time or location. It was suggested that information delivered this way could easily be tailored to age and made more "colourful and interesting" (Parent 7) to help increase engagement. Yet, some participants were concerned that online information may not be from a reliable source of medical knowledge and therefore not as "powerful" (Parent 5) as that received from a HCP. Online information was perceived to present barriers to engagement, as it would not be personalised to the families' circumstances and delivered in a way in which they understand:

> "I can ask lots of questions but online, it may be a lie but you may get things that aren't answers. If you can have a face to face conversation, then you could ask questions." (Young Person 9)

As a solution, families suggested the development of an asthma-specific weight management group, based in the community that went beyond the treatment of physical symptoms. It was acknowledged that HCPs would be needed to oversee such groups, as they could monitor what information was shared between families and provide "medical knowledge" (Young Person 6). Illness management, such as medication and strategies to help manage anxiety, as well as information on diet and exercise were suggested to be important components. "Cooking" and "sports-related" (Parent 5) activities could be integrated to make it "less formal and more like a club" (Young Person 6). Partaking in weight management activities, such as exercise, among peers with asthma was thought to be important to help motivate young people:

> "It would be a bit more, possibly competitive, you'd be on similar levels and you'd actually, you'd all think, we'd all become better." (Young Person 8)

An asthma-specific weight management group was further viewed as an opportunity to receive practical as well as emotional support; a vital component of care missing from asthma consultations. The development of an asthma-specific weight management group was thought to reduce the perception of isolation in asthma and enable families to feel part of a larger community who were also struggling with the same challenges. Such community facilitated an opportunity to share the knowledge and the lived experience of paediatric asthma and weight management:

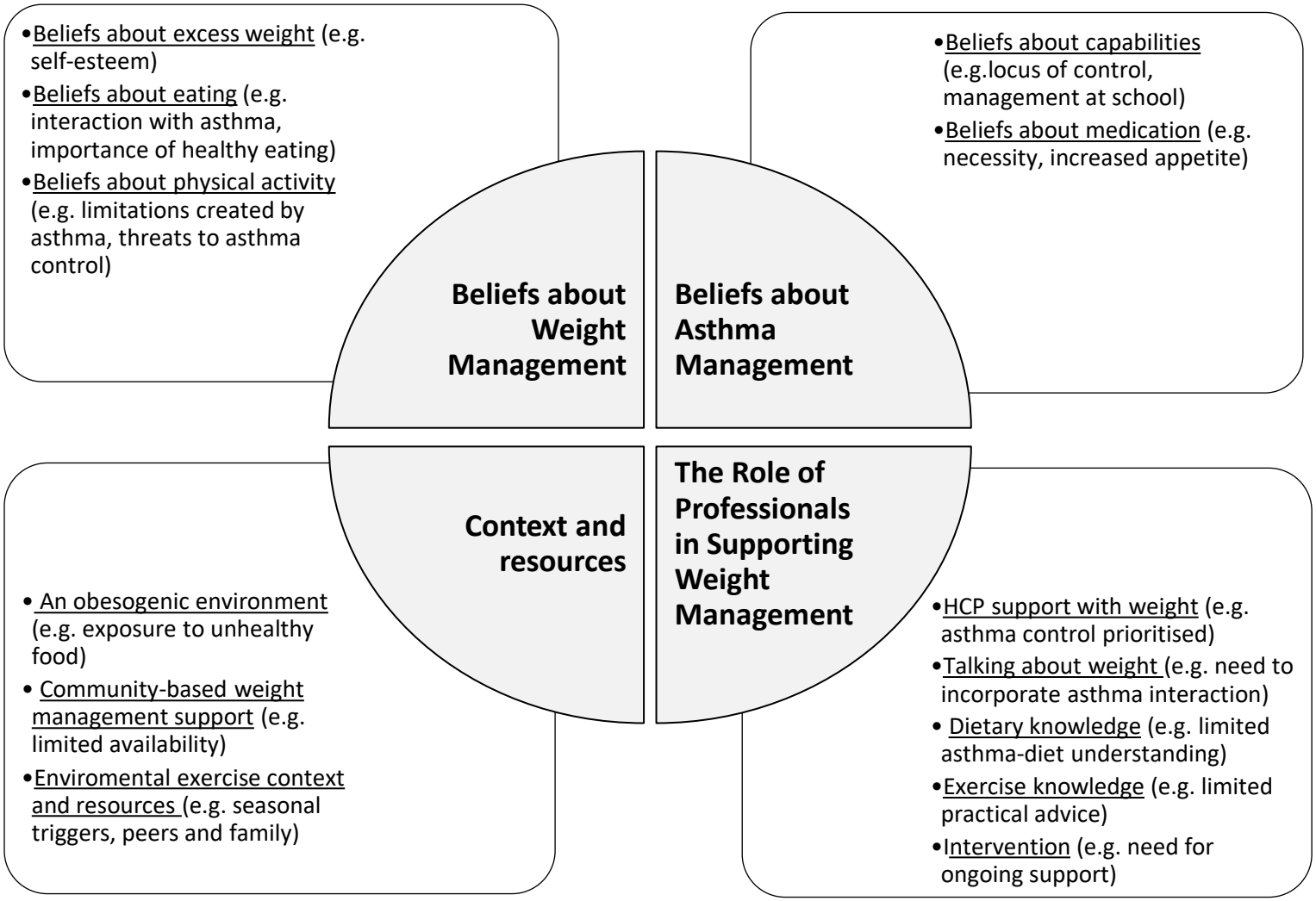
> "You could learn from all the different things that everyone's been through and discovered along the way because that's what it is. You're just discovering things along the way." (Parent 7)

Exposure to other families living with asthma who had been able to manage child weight was thought to provide "inspirational" (Young Person 6) role modelling for families. To help facilitate behaviour change and increase self-efficacy, it was suggested that a "mentoring scheme" (Parent 6) could be developed where families living with asthma provided peer support: "your attitude can change like if you saw other people doing similar stuff" (Young Person 8). However, there were differences in beliefs about how comfortable some young people would be talking to others, as some did not want to talk to strangers whilst others felt talking about asthma would be easier with people who had experienced the same difficulties.

3.5 Discussion

The views and experiences discussed by families' in this study shed insight on the multifaceted challenges of weight management faced by young people living with asthma. These findings suggest that factors specific to asthma can influence weight management. In general, families' engagement in healthy weight management behaviours are contingent with their beliefs about asthma control. Thus, the management of asthma and weight appeared to be inter-dependent making it difficult to consider one without the other. Families' perceptions of how a young person's weight impacts on their asthma risk or control is therefore likely to be fundamental to understanding their readiness to engage in weight management behaviours. The findings of this research have been summarised in Figure 2.

Figure 2: An illustrative diagram of qualitative findings.



The findings suggest that families of children living with asthma consider the asthma outcomes of weight management behaviours and modify their engagement based on their asthma outcome beliefs. This is consistent with previous literature highlighting families' adjustment of diet and leisure activity as a method to maintain asthma control (Farnesi et al., 2019). Farnesi and colleagues (2019) found that healthy food was used as a tool to improve asthma control whilst exercise was restricted if considered to exacerbate asthma symptoms. Likewise, Garbutt (2017) reported the use of natural remedies, such as honey, to control asthma symptoms as an alternate to asthma medication. Similar lifestyle adjustments have also been found in the management of other long term conditions. Parents of children living with type 1 diabetes for example, discuss increasing dietary intake and encouraging less child activity so that young people can maintain glycaemic control during exercise (Blake et al., 2018). Nevertheless, the Global Initiative for Asthma (GINA, 2020) warns that avoidance of strenuous activity as an attempt to control asthma will increase the risk of obesity. It may be important then, for HCPs to consider families' exercise self-efficacy beliefs when managing children's weight. Rotter (1990) theorised that the expectation of action depended on individuals' beliefs about the outcome. Thus, families with low exercise self-efficacy beliefs may have increased anticipation of asthma exacerbation and decreased exercise engagement. HCPs need to work with families to increase their exercise self-efficacy in order to facilitate behaviour change and engagement in exercise. Programmes that have worked to improve families' self-efficacy have shown improvements in their engagement in exercise, physical fitness and a reduction in their body mass index (Latorre-Román et al 2015; Suorsa et al., 2015).

Families' described uncertainty in parents', young people's and schools' ability to manage asthma. At times, an external locus of control was attributed to asthma symptoms and parents worried about the safety of their child. This mirrored the sense of helplessness and fear in managing asthma symptoms that has been identified in previous literature (Chen et al., 2015). For some parents in the current study, this appeared to create asthma-related anxiety and hypervigilance of young people's asthma symptoms. Hypervigilance and asthma-related anxiety have been associated with parents and young people avoiding situations interpreted to be a threat to asthma control (Dudeney et al., 2017; Sicouri et al., 2017; Shaw et al., 2020). Bruzzese and colleagues (2017) found asthma-related anxiety to be associated with strategies to prevent asthma symptoms before they occur. Such avoidance and preventative steps may influence weight management if they include reducing or limiting exercise opportunities. As families' experiences of asthma management led to feelings of asthma-related anxiety, families required

more support from HCPs to identify situations that provoke anxiety and learn strategies to respond. It may be beneficial for multi-agency support in some cases, as referral to psychologists can provide a more specialised service outside of a time-restricted consultation. The provision of contact information for asthma support outside of asthma consultations may also help to reduce feelings of isolation and caregivers' emotional burden.

This research also found that parents were frustrated at poor asthma management in schools and worried about young people receiving inappropriate asthma management whilst exercising, as consistent with previous findings (Kornblit et al., 2018). Guidelines in England state that HCPs should communicate with schools, provide training for school staff members where necessary and identify a staff member to support a child with a medical condition (Department of Education: DfE, 2014). Additionally, guidelines state that children are legally allowed to carry prescribed drugs on their person (DfE, 2014). However, the reports from participants in this current study suggest that these guidelines are not always implemented effectively (e.g. teachers' inability to detect asthma symptoms, restricted access to medication during school hours). Altering school policies so that children can carry inhalers with them at all times may ease families' anxiety about access to medication and increased physical activity participation.

Similar to previous literature (De Simoni et al., 2017), participants reported increased appetite and weight gain as a consequence of asthma treatments. This weight gain was described as creating negative emotions leading to inconsistent eating behaviours, non-adherence and decreased help-seeking behaviours. Inconsistent eating behaviours in paediatric asthma may develop as a strategy to manage the weight gain resulting from asthma medication. Alternatively, anger and frustration caused by weight gain may also lead to emotional eating and sedentary behaviours. Previous research has reported that young people living with asthma are more likely to diet, skip meals and eat when sad compared to their peers' (Moreau et al., 2009). Non-adherence and decreased help-seeking behaviours were discussed by participants in this study as a method to avoid the negative consequences of asthma treatment such as weight gain. It is possible that such techniques increase the risk of suboptimal asthma control, increased physical activity limitations and excess weight (Holderness et al., 2017). Non-adherence and decreased help-seeking may be more likely if families believe other methods of asthma control, such as exercise reduction, to be appropriate (Jago et al., 2016). Alternatively, asthma control and adherence may not be prioritised if young people anticipate peers to be

less accepting of overweight/ obesity than asthma symptoms (Hughes et al., 2017). Young people's self-concept is of importance during adolescence (Romund et al., 2016). Identifying and incorporating young people's perceptions of peer acceptance whilst living with asthma may help to make asthma treatment plans and weight management more meaningful for young people. To incentivise adherence, HCPs could also try and develop families understanding of how asthma treatment can facilitate weight management behaviours, such as exercise. Alongside this, negative health comparisons with others who have suboptimal asthma control can elicit self-reflection on young people's illness and motivate asthma management (Allen-Collinson et al., 2016). Further research into why the prioritisation of weight management and asthma control may differ according to young people would help to develop a more comprehensive understanding of how to tailor support to different environments or situations.

Families reported environmental challenges that created barriers to weight management, such as the obesogenic food environment, lack of weight management services and the risk assessment of exercise environments. This supports previous findings that the obesogenic environment can influence dietary choices at a micro- and macro-level (Lakerveld et al., 2018), whilst limited services leave families without weight management support (Clarke et al., 2018). Participants in the current study identified that sedentary behaviours increased when avoiding seasonal asthma triggers. As a result, weight management may become more challenging during months perceived to carry a risk to asthma control. It is also possible that a perpetuating cycle of seasonal asthma symptoms, outdoor physical activity avoidance and weight gain can develop as young people living with asthma and overweight have an increased risk of seasonal asthma exacerbation (Schatz et al., 2013). It may be beneficial for HCPs to recommend that families explore indoor activity opportunities during months that are perceived to carry an increased risk to asthma control, as recommended by the Global Initiative for Asthma (2020) reduce weight management difficulties.

Families also reported exercise engagement to be context-dependent on the perceived social outcomes. The anticipation of negative social stigma from breathlessness and excess weight created a reluctance for young people to engage in physical activity. These findings mirror other literature about the effects of weight-focused bullying and asthma-related stigma during exercise (Maïano et al., 2018; Winn et al., 2018). A study by Winn and colleagues (2018) found that some young people living without asthma described peers with asthma as lazy and believed that they used asthma as an excuse to not exercise. Despite these findings, one participant in

this research discussed engaging in exercise and normalising asthma symptoms as a method to overcome stigma. Social-concept may explain these differences young people's behaviour. Hughes and colleagues (2017) theorised that young people would engage in activity if it was perceived to be important for their social acceptance; if medication use was thought to be less appealing, young people may use inappropriate strategies such as exercise reduction or avoiding treating asthma symptoms during activity. This may cause suboptimal asthma control and a reduced ability to engage in exercise that can add to weight management barriers. Encouraging young people to seek peer-support may improve their confidence in using medication during activity (Suorsa et al., 2015). Exercise engagement in schools may also be improved through asthma education modules. Research suggests that asthma care programmes can improve asthma knowledge, students concern over asthma stigma and the use of asthma medication (Cicutto et al., 2014). School nurses have an opportunity to improve asthma knowledge as well as communication between HCPs, schools and families (Mickel et al., 2016).

These findings highlight the need for services to support not only the symptomatic experiences of asthma but also for HCPs to convey understanding of the 'lived' experience of asthma and overweight during consultations. As found in previous literature, HCPs are perceived to treat illness as an objective domain and not demonstrate an understanding of the subjective experience, which can leave patients feeling powerless and reliant on medication (Carel et al., 2015). HCPs ability to show empathy towards families' experiences of living with asthma may work towards improving patient-physician relationships, mitigating the discomfort of weight conversations (Peläez et al., 2015; Alexander et al., 2018) and helping families to identify barriers to weight management. Practical support, ongoing monitoring and recognition of weight management were considered vital. However, due to the lack of support received, families in this research believed that the responsibility to manage weight was placed on them. Whilst the benefit of individual responsibility has been recognised, it is not thought to be effective in isolation (WHO 'Obesity and Overweight Fact Sheet', 2020). HCPs have an opportunity to support weight management, but the best way to provide weight management support during time-limited consultations is not yet understood (Bradbury et al., 2018; Clarke et al., 2018). Development of resources to help HCPs support weight management may therefore be of use. The provision of such resources would aim to reduce HCPs concerns, such as limited understanding of obesity support and damaging patient-physician relationships (Bradbury et al., 2018).

Participants in this research believed that the management of asthma was about more than just medication, and a lack of understanding of lifestyle influences acted as barriers to weight management. Participants believed that HCPs educating them on the relationship between exercise and diet with asthma would reduce perceived weight stigma, increase confidence in asthma management and motivate behaviour change (Alexander et al., 2018). Participants believed that HCPs could empower families by using strengths-based language and by discussing the benefits of weight management for asthma control (McPherson et al., 2016). Families also wished for more guidance on illness management, such as medication and strategies to manage anxiety. A HCP providing this information or management strategies in a group with other families could be one way to enhance families' confidence in managing weight and provide the emotional support perceived to be missing from asthma consultations. Facilitating peer support may be more beneficial, as it has been reported that talking to others with comparable lived experienced can help patients to process their thoughts about living with asthma (Allen-Collinson et al., 2016) and could be located in families' preferred locations. Additionally, the provision of asthma "mentors" may help to engage young people in weight management and peer-led support could prove to be more cost-effective. Previous literature has found that parent support networks have been a useful instrument for providing emotional support, information and the sense of a community (Niela-Vilén et al., 2014). This could be one way to reduce the sense of isolation many parents feel in managing paediatric asthma. Young people may also benefit from face-to-face or virtual groups. As reported by young people in this research, recognising others living with asthma have overcome similar difficulties can provide role models and inspiration for young people. Yet, it must be acknowledged that not all young people feel comfortable discussing asthma and weight which may influence engagement with support. Future research would need to investigate the feasibility and effectiveness of an asthma weight management support group as well as engagement at different ages.

3.6 Limitations

This research employed purposive sampling to recruit participants from a mix of backgrounds. The sample size used in this research was small, yet consistent with the framework approach. As it was a sample of both healthy weight and overweight/obese, it also provided a variety of experiences and beliefs of what may or may not work to help manage weight and allowed for comparisons to be made. Furthermore, this research purposefully recruited a wide age range of participants to gain an understanding of the issues across childhood and adolescence.

Narrowing the participants' age group in future research however, would help to understand in more depth, the barriers that are specific to different ages (e.g. 8-12; 13-16). While the use of arts-based methods such as drawings or visual aids were not used to facilitate child-led data collection in this study, use of such prompts may have been effective for younger participants to enrich data collection (Bagnoli, 2009). The depth of the data provided by the youngest participant may have also been restricted due to the presence of her parent during the interview (Gardner & Randall, 2012). Nevertheless, the parent did not appear to limit the young persons' contributions as the interview was not interrupted at any point.

4 Conclusion

In conclusion, these findings highlight the complexity of managing paediatric weight alongside asthma. Overall families felt unsupported and ill-equipped to manage weight alongside increased perceptions of risk created by living with asthma and uncertainty in maintaining asthma control while engaging in health-promoting behaviours. Asthma consultations clearly need to be family-centred so that HCPs can understand each families' own experiences and beliefs around the complex interaction between asthma and weight management to aid the development of individualised plans. HCPs can collaborate with families to elicit and modify family concerns and create weight management plans they are happy to engage with. HCP provision of ongoing support may help to reduce perceptions of weight stigma and individual responsibility to manage weight. Providing patient-centred support and adopting communication strategies preferred by families, such as relating weight management to improved asthma control, may help to increase families' receptiveness to weight conversations. As ongoing emotional support will be essential, research about how HCPs can best facilitate this whilst delivering opportunistic behaviour change interventions during time-limited consultations is needed.

In the following chapter, findings are presented from a qualitative study exploring healthcare professionals' experiences of weight management in families living with asthma.

CHAPTER 4

Weight-management in children living with asthma: A qualitative study of the experiences of paediatric healthcare professionals

4.1 Introduction

The previous chapter explored the challenges of weight management faced by young people living with asthma from the perspective of young people and their parents. Findings highlighted the interdependency of the asthma-obesity relationship and how this can influence engagement in eating and exercise behaviours. This current chapter aimed to complement those findings by exploring HCPs' own experiences of weight management in children living with asthma.

As highlighted by the families in Chapter 3, doctors, nurses and other HCPs play a key role in providing weight management support. Currently, weight management is promoted by the UK National Health Service (NHS) initiative "Make Every Contact Count". This initiative encourages HCPs to provide opportunistic health behaviour change advice during every patient contact to enable individuals to make healthier choices (Health Education England, 2020). Alongside this, strategies have been developed to help HCPs to support families to manage weight, such as recommendations to learn local weight management pathways and to learn how to correctly determine children's BMI percentiles (NICE, 2015).

Despite guidelines on how to support healthy weight maintenance in clinical practice, several barriers have been identified to hinder support provision. HCPs, such as junior doctors, nurses and allied health professionals, have reported that they do not perceive it as within their job role, have limited time to do so and feel uncomfortable discussing patient weight (Elwell et al., 2014; Bradbury et al., 2018. There is also an added sensitivity to discussing child weight due to the stigma attached to overweight and obesity (Puhl et al., 2020). HCPs highlight insufficient training on how to raise the topic of weight and limited resources to help provide families with guidance on weight management (Bradbury et al., 2018). Literature suggests that doctors and nurses worry that parents will react defensively to child weight being raised in clinic which could compromise the patient-physician relationship (Dewhurst et al., 2017). Such barriers may result in HCPs missing opportunities to provide weight management support (Jones et al., 2014).

4.2 Aims and Objectives

In order to optimise the weight management support provided for paediatric asthma populations, it is crucial to understand how weight is managed currently and what changes could be made to improve support and advice. The purpose of this study was to explore the views and experiences of healthcare professionals concerning the weight management advice and support offered to families' and children living with asthma.

4.3 Method

4.3.1 Design

A qualitative methodology with individual, semi-structured interviews was used. A semi-structured interview guide provides a flexible approach to data collection and allows for a variety of topics to emerge. This approach can create the opportunity for novel information to emerge, which can be explored at depth (Pope et al., 2002).

4.3.2 Sample and Recruitment

Healthcare professionals working at a specialist children's hospital providing care to children and young people with a clinical asthma diagnosis were identified and recruited through purposive sampling. The identified healthcare professionals worked within both secondary and tertiary care, which allowed for a variety of perspectives and experiences to arise. These potential participants were provided with an invitation letter and information sheet about the study (see Appendix G and Appendix H). Interested HCPs were asked to contact the researchers to receive more information and to arrange an interview. The recruitment of participants commenced following a favourable review from a local University Research Ethics Committee (Project #995).

4.3.3 Data collection

Before interviews commenced, informed consent and demographic data were collected from the participants. Interviews were conducted face-to-face at the participants' convenience in a private, quiet room in the specialist children's hospital to reduce the risk of disruptions (McCrath et al., 2019). The interview schedules were developed from the research literature and the study objectives (see Appendix I). The interview guide outlined the questions in a tentative order so that topics can be explored as they arise. Before the interviews begin, an open and curious attitude was adopted to help build rapport (Drew et al., 2010). The use of

easy questions to break the ice aimed to increase the participants' comfort in answering questions honestly (Jason & Glenwick, 2016). Open-ended questions followed this and focused on participants' experiences of working with young people living with asthma and obesity, how to manage weight in this population and the barriers and facilitators to providing weight management support. The use of a semi-structured interview design facilitated the opportunity to pursue the independent beliefs and experiences of each participant that arose spontaneously (Rosenthal, 2016). Such freedom facilitates the ability to clarify participants' meaning and to explore topics of interest at greater depth (Doody & Noonan, 2013). On average, the duration of the interviews lasted 45 minutes. Each participant received a £10 voucher as gratitude for taking part in the project.

4.3.4 Data analysis

Interviews were audio-recorded, transcribed verbatim and anonymised. Data were then analysed using a thematic Framework method described by Gale and colleagues (2012). This approach is well suited to the management and analysis of qualitative data in applied health research and allowed for emerging commonalities in the dataset and comparison of participants views across and within cases. To increase trustworthiness and rigour within data analysis, transcripts were independently coded by two researchers and then discussed before reaching agreement on data interpretation (Press, 2005). This approach is in line with critical realist principles which accept that knowledge can be fallible and embraces the development of deeper levels of explanation and understanding (McEvoy & Richards, 2006). Researchers followed an approach of familiarising themselves with the data, highlighting key concepts, coding, creating an analytical framework, indexing and interpreting. Differences in interpretation were solved through discussion with a third researcher. Implicit connections between the codes were the basis of the formation of categories. The categories were then revised and refined before being reduced into a thematic framework matrix (for an example see Appendix J). This allowed patterns to be identified and comparisons across and within cases to be interpreted. Greater detail on the analytical approach can be found in Chapter 3. As with the previous chapter, strategies were incorporated to ensure the trustworthiness in the findings (e.g. a comprehensive audit-trail, double-coding transcripts, discussion and developing ideas with a research team, providing thick description: Shenton, 2004). Furthermore, the context in which participants have been recruited from has been detailed (Shenton, 2004).

4.3.5. Reflexive Account

As discussed in Chapter 3, the use of reflexive practice helps qualitative researchers to become aware of their role in the collection and analysis of data (Finlay, 2002). Recognising and reporting the researchers' preconceptions and beliefs can help to enhance the trustworthiness and transparency of qualitative findings (LaBlanca, 2011). Therefore, the following reflexive account of the data collection for this chapter has been included.

Interviews were conducted at the local paediatric hospital where the HCPs worked to ensure that they were convenient. I felt a nervousness from my limited interview experience, and I arrived early at the hospital before each interview to become comfortable in the private room. I sensed that some HCPs understood I was an early career researcher, and they were all friendly and easy to build rapport with before the interview started. As a result, my nerves eased quickly after the HCPs arrived, and my confidence grew after each interview. In contrast with my own experiences as a patient, the HCPs did not appear rushed as they explored the topics that arose during the interviews. The participants were enthusiastic and thorough as they demonstrated their expert knowledge of asthma and their experiences with overweight/ obesity and asthma. Råheim and colleagues (2016) describe "inferior" and "superior" knowledge positions between researcher-researched when the interviewee has greater professional knowledge. As the balance of power between the interviewer and interviewee typically favours the interviewer, it is possible this shift in power may have helped facilitate the collection of in-depth data (Anyan, 2013; Råheim et al., 2016).

4.4 Findings

4.4.1 Participants

A sample of 10 healthcare professionals participated in the research (see Table 11).

Table 11: Healthcare professional Characteristics

Characteristics	*N*
Job title	
Paediatric Respiratory Nurse Specialist	3
Consultant in Paediatric Respiratory Medicine	4
Consultant in General Paediatric Medicine	3
Gender	
Male	3
Female	7
Age	
30-39	2
40-49	5
50+	1
Unspecified	2
Frequency of contact with paediatric asthma patients	
Daily	5
Weekly	4
Unspecified	1
Ethnicity	
White British	5
Asian - Indian	4
Asian - Unspecified	1

4.4.2 Themes

Three core themes were generated from data analysis: 1) factors affecting health behaviours, 2) weight management support in current practice, and 3) developing weight management interventions. The themes are presented below:

4.4.2.1 Factors Affecting Health Behaviours

Eating Behaviours

HCPs perceived food to be more than a source of nourishment, suggesting instead that parents used food as a tool to modify child behaviour. One example was given when a parent gave their child food in clinic so that they did not interrupt the consultation: "They'll just keep opening another bag of crisps and giving it them, because they want to keep the child relatively quiet" (Respiratory consultant 3). While maintaining good asthma control appeared to be a priority, less significance was placed on the influence of nutritional intake and wellbeing. This was reinforced by the idea that parents used food as an emotional tool to compensate for the

perceived restrictions of living with asthma: “why would you deny your child that when actually they’re being denied so many other things’” (Respiratory Nurse 2).

Additionally, HCPs felt that young people themselves turned to food as a way to cope with living with asthma. Professionals described how low self-esteem as a result of the “fears of facing [*asthma*]” (Respiratory Consultant 4), may contribute to behaviours that exacerbate weight gain, as it was thought that some children living with asthma “get all sad and then some people turn to food” (Respiratory Nurse 3). Professionals felt that such eating behaviours may indicate that young people were struggling to cope. Mindless eating (or eating because children are bored) was also proposed by some as a way of coping with the perceived restrictions in physical activity.

Changes in society were also suggested to add difficulty to children maintaining a healthy weight. HCPs displayed an understanding of how the obesogenic environment made weight management more challenging due to substantial food advertisement and the availability of unhealthy food that was "full of salt and sugar” (Respiratory Consultant 4). Likewise, portion sizes were reported to be excessive as “people have extraordinarily high expectations for the children eating an adult size plate” (General Paediatrician 3). This could also be a reflection of cultural practices; HCPs reported that in some households, food was a sign of “prosperity and well-being and affluence” (General Paediatrician 1). Establishing such attitudes early in life may contribute to eating behaviours that children maintain over time. HCPs further suggested that older children had more freedom over their food choices and were able to eat during and after school away from parental supervision. It is possible that a decline in parental control as the child develops, may lead to parents feeling “helpless" (General Paediatrician 1) regarding their child’s diet:

> “There's that factor of a person's independence from either of the two people who are giving them messages and that becomes really tough as well because, you know, you're fighting against someone who wants to assert themselves.” (General Paediatrician 3)

Physical Activity

Professionals perceived families to often misinterpret exercise intolerance and asthma symptoms. Instead, HCPs attributed a lot of child breathlessness to “just their fitness level” (Respiratory Consultant 4). HCPs suggested that misinterpreting symptoms could reduce confidence in a child’s exercise parameters, leading to avoidance behaviours and a decline in engagement with physical activity:

> "Some of our young people don't do PE at school because who knows if it's going to exacerbate their asthma. That automatically puts them in the mind-set that they can't do exercise" (Respiratory Nurse 1).

It was proposed that low confidence in the child's ability to exercise may be amplified by a history of severe asthma attacks, creating fear of exacerbating asthma as the experience "tends to linger on in our young people" (Respiratory Consultant 2). This was problematic for professionals as it was thought that misinterpreting breathlessness for asthma symptoms led to the development of a vicious cycle of difficulty in exercising, weight gain and poor asthma control. It was suggested that teaching children to correctly attribute breathlessness to fitness *or* asthma could increase willingness to engage in physical activity. HCPs reported using rehabilitation programmes to help children regain strength and confidence:

> "We are working on the young people with the help of a physiotherapist to encourage them to gradually build up because they are kind of desensitised" (Respiratory Consultant 2).

Participants also described advising patients to use asthma medication before exercising to help increase their activity capability.

While recognising that asthma symptoms can limit a child's activity, HCPs felt that parental anxiety was often "the main reason why children are inactive" (General Paediatrician 3) as parents were often "frightened to let them exercise" (General Paediatrician 3). It was discussed how this anxiety could be transferred from parent to child. However, providing information alone was not thought to be sufficient to increase exercise behaviour. Instead, managing both parental and child anxiety was felt to be an important part of asthma treatment.

HCPs cited examples of parents and other HCPs preventing children from engaging in Physical Education (PE) at school: "families and … some health practitioners … have written notes … for school to say they can't do PE" (Respiratory Nurse 2). Notably this was in contrast to HCP's goals for children with severe asthma, as one Respiratory Consultant reported: "one of the management aims for these children with asthma is getting them to do more physical exercise" (Respiratory Consultant 1). HCPs suggested that some families were reluctant for children to engage in activity lessons in school because of concerns about how some teachers responded to children's breathlessness: "Some PE teachers have asked them to carry on and some PE teachers have said that they are actually making it up to get out of exercise" (Respiratory Consultant 4). It is possible that poor asthma awareness among teachers at school leads to

children and families to restrict PE participation due to perceptions of safety. Nurses described how they sometimes worked with "PE teachers educating them about asthma" (Respiratory consultant 4). Such education was seen as a positive way to increase confidence amongst teachers while reassuring families and children that they would receive appropriate support and care in school.

Inactivity was generally viewed as prevalent among patients with asthma and was described as a contributor to weight gain. HCPs believed that some children may prefer to stay inside, "watch telly and then have a more sedentary lifestyle" (Respiratory Nurse 3). It is also suggested that inactivity resulted from poor sleeping associated with asthma. A second vicious cycle then emerged, whereby increased tiredness led to a reduction in child energy levels and desire to exercise:

> "Difficulty in sleeping […] puts them into a pro-inflammatory state [*and*] makes them feel tired [*and*] not [*want*] to take part in exercise during the day" (Respiratory Consultant 3).

There was also insight in to how obesity could provoke another cycle, as for some patients "their exercise limitation is not necessarily due to asthma, that *[it]* is really because of their obesity" (Respiratory Consultant 4). However, HCPs displayed an uncertainty about the direction of the relationship between asthma and obesity as some HCPs felt it could be bidirectional and proposed that children's asthma could be getting worse because of increasing inactivity and weight. Nevertheless, this highlights the complexity of teasing out whether patients' difficulty with exercise is due to asthma control, increased weight or fitness ability in children, as one HCP described it as a "catch twenty-two situation" (Respiratory Consultant 1). Alternatively, other participants felt that an asthma diagnosis could lead to children feeling as though they have "some special get-out-of jail-free card" (General Paediatrician 3) that excused them from having to partake in exercise. In contrast to previously discussed reasons, using asthma as a reason to avoid exercise highlights that health outcomes are not always a primary consideration when making decisions.

Family

Professionals believed that a rise in obesity prevalence led to obesity now being perceived as more normative in society. One HCP described about how "being big and beautiful" (General Paediatrician 3) was seen as something to be celebrated and how it was perceived to be possible to be overweight and healthy. As a result, families were thought to be less concerned about

children being overweight which posed challenges for HCPs in terms of changing beliefs. Some families were thought to be more concerned "about how other people perceive the children because of the obesity" (General Paediatrician 3) and were less likely to recognise child overweight if they are also overweight themselves. This suggests that parents may be less likely to view being overweight as a medical concern, whereas HCPs were very aware of the medical consequences of obesity:

> "It's been judged that that's not appropriate for children to make the choice to smoke because the health consequences are very bad and, for some reason, [*weight*] is not viewed in the same way" (General Paediatrician 3).

Parents were seen as being more accepting of the idea that asthma (and not weight) was responsible for symptoms displayed by their child: "they see as two entity and they don't see the factor of what it is" (General Paediatrician 2). It could be argued that parents place more significance on asthma as it requires medical management and parents are taught the implication of asthma outcomes since diagnosis. It was thought that the consequences of obesity were not a worry for families as they were not perceived to be in the immediate future. However, participants referenced a rise in obesity related health issues emerging in paediatric patients that have previously only been seen in adults (e.g. type 2 diabetes). Thus, raising awareness about the immediate and longer terms effects of weight (both for asthma control and other co-morbidities) was deemed to be a priority. Conflicting views within families and family dynamics were seen as a challenge to this, particularly when different family members take "a different way of looking at it" (General Paediatrician 2). It was thought possible then, that exposure to mixed health messages by role models could create confusion and reluctance for children to engage in weight management.

The cost of exercising was felt to be another deterrent for families as accessing places to exercise and the cost of appropriate clothing may be too much for some: "when you're in a comfortable position, you don't think about, but for them that can be a big thing" (Respiratory Nurse 3). Increasing access to free gym memberships was one suggestion for tackling this. Two HCPs reported that young people under 16 can access free gym membership, however there was some uncertainty as to the ease of accessing this and who provided it: "Pass? I think it comes health. I'm not aware where it comes from to be honest" (Respiratory Consultant 1, R1). Such confusion suggested that these kinds of interventions may be underutilised. It was also acknowledged that patients from lower socio-economic backgrounds may "not [*have]* role models who have shown them how to cook healthy meals" (General Paediatrician 1). Costlier

healthy foods and little guidance on nutrition and cooking were therefore viewed as maintaining factors.

Relationships with Peers

Healthcare professionals discussed how living with a chronic condition can lead to young people feeling as though "there's something terribly wrong with them" (Respiratory Consultant 2, R2). Participants described how perceptions of self can be important when young people enter adolescence as they become conscious of how they are being perceived by their peers. This was thought to generate feelings of anxiety, resulting in lower "confidence and not being able to engage [*in]* peer group" activities (Respiratory consultant 1). Peer perceptions of medication were also considered influential as young people "don't want to explain what it is" (Respiratory Nurse 3), adding to physical activity barriers when around peers. Low "self-esteem" (Respiratory Consultant 4) and poor body dissatisfaction were suggested as leading to exercise avoidance. One HCP described how an increase in body satisfaction from weight loss helped motivate children to maintain weight loss. The professional discussed how perception from peers, particularly of the opposite sex, was important for "wanting to look better, presumably, to impress girls" (General Paediatrician 3).

Reduced school attendance for those with asthma could further decline peer engagement. It was perceived that when attending school, poor asthma control may restrict peer socialisation and physical activity. One professional reported the case of a patient whose poor asthma control caused her "not [*to*] be out at break times, lunch times, PE, etc" or attend social events after school (Respiratory consultant 1). Therefore, reduced engagement in activities outside of school may stem from anxieties around perceptions, difficulties maintaining friendships and poor asthma control which could be a contributing factor weight gain.

Asthma Treatment

HCPs expressed that some patients and parents had complained about certain medications (e.g. steroids) increasing appetite, causing their child to eat more. Professionals also recognised that steroids could result in weight gain and were conscious of the consequences of asthma treatment. Participants discussed monitoring treatment dosages to ensure that the correct dose was being used to avoid unnecessary steroid induced weight gain. It was explained that weight is measured routinely at every appointment so that it can be closely monitored as "managing the obesity does become a primary aim of their treatment" (Respiratory Consultant

1). Yet it is possible that as asthma is often comorbid with other conditions, managing several conditions can lead to a lower prioritisation of weight management. An example was reported by a nurse who stated that children using steroids "haven't got a choice, they're just going to be heavier" (Respiratory Nurse 3). This gave a sense that weight gain was accepted as necessary when steroids were used.

Many HCPs expressed feelings of concern that many children were trapped once again, in a vicious cycle where poor asthma control required steroids which exacerbated weight gain, but that weight gain made it more difficult to exercise and exacerbated asthma symptoms which, in turn, required more steroids:

> "We give them medications which can make them hungry. They then eat more and become more overweight and unable to exercise and then that impacts on their asthma because they're not fit as well" (Respiratory Nurse 1).

However, after discussing weight gain and the requirement to use steroids for asthma control in some patients, one Respiratory Consultant explained that "at the same time… their asthma is better, they are able to do more stuff" (Respiratory Consultant 2). This treatment approach was reinforced by a Nurse who reported telling patients that an inability to exercise indicated a need to review their medication. This suggests that medication may be a useful tool in weight management as it can facilitate participation in exercise.

In some cases, it was thought that patients were on too much medication due to their misinterpreting dyspnea for asthma symptoms. An awareness of this was shown as one participant stated that they "should not just be increasing their asthma medications" (General Paediatrician 1) without knowing the cause. However, it is possible that HCPs may also not be decreasing medication due to uncertainty around symptoms. Weight presented a challenge to correct medication dosage as it was thought that overweight patients may be prescribed too much medication. It was discussed how oral steroids "may not work as well in obese children compared to a non-obese child" (Respiratory Consultant 4) meaning that overweight patients may require higher dosages of medication to control their asthma. In cases where a patient's weight increases after taking steroids, a higher dose may be needed to continue to be effective, further increasing weight and creating another vicious cycle.

One Respiratory Consultant felt "forced to give quite a lot of our children the oral steroids" (Respiratory Consultant 2) due to children not perceiving inhalers as a medicine. Such

perceptions of medication by young people were suggested to lead to poor adherence, which in turn exacerbates asthma, thus leaving HCPs feeling as though there were limited treatment options available. Professionals believed that it was important for patients to understand the importance of adherence for their asthma control and thus, weight management. One participant believed that if patients "just tried a little bit harder for longer with what I'm suggesting that some of that medication would go" (General Paediatrician 3).

4.4.2.2 Weight Management Support in Current Practice

Weight Management Conversations

Initiating conversations about a child's weight was considered to be more difficult than addressing other health behaviours such as smoking, due to the stigma surrounding obesity: "it's the elephant in the room" (Respiratory Nurse 2). Generally, HCPs preferred it when the family raised the topic of weight, although this was rare. Instead, professionals looked for opportune moments during consultations "to shoehorn it in" (General Paediatrician 2). Whether HCPs chose to pursue the topic of weight in a consultation was dependent on how they felt that the mood was that day: "I know it's been right before and you think now perhaps isn't the time to discuss this" (Respiratory Nurse 2), implying that a patients receptiveness was an important consideration. The patient-physician relationship was recognised as having an important role in these sensitive conversations, as good rapport helped professionals to feel more comfortable and to predict how patients would respond so that they could "approach them accordingly" (Respiratory Consultant 2). The desire to maintain these relationships added further pressure to the outcome of the conversation as "to be a good service you have to have a good relationship with the family" (General Paediatrician 3). Professionals worried about whether it was worth pursuing weight management conversations if it would harm the physician-patient relationship. They acknowledged the importance of choosing their words carefully and were reluctant to use words such as "fat" or "obese". This may be due to an awareness of how sensitive the topic of weight can be or because previous conversations had led to complaints from families. One General Paediatrician described sharing experiences of weight management with his own children, as a means to appear more relatable. It was believed that families would be more receptive to this approach, though it didn't make the conversation any less uncomfortable:

> "Usually if we are able to get through to the family that we understand where this is coming from and show that little bit of understanding, it tends to work better. But, even with that, can we have these conversations comfortably?" (Respiratory Consultant 4).

Medicalising weight management conversations was an approach used by all participants. This involved plotting routinely collected height and weight data onto a growth chart and using it to talk about weight. Medical statistics were seen as easy to refer to when discussing the importance of maintaining a healthy weight. One General Paediatrician explained by doing so "the personalities are taken out of the equation" (General Paediatrician 2), as it is "sometimes necessary to give people a dignified exit" (General Paediatrician 2). Enquiring about food intake and activity were also discussed as medical ways to initiate conversations around weight.

It was felt by some professionals that they were "ill-prepared" for discussing weight management with patients which led to "difficulty in how to bring out some of these sensitive conversations" (Respiratory Consultant 4). Training on how to initiate conversations of a sensitive nature was suggested to help with this. Professionals valued families' views and believed that "training must come from our patient families" (Respiratory Consultant 4) to help determine ways in which families preferred to be spoken to about weight. One General Paediatrician acknowledged how difficult it was for those early on in their careers and discussed how a clinician's skills to address sensitive topics developed over time:

> "So I think once you devise strategies and you skill yourself with the tools that is necessary to approach these, then it becomes easier" (General Paediatrician 1).

Discussing child weight became more difficult when the parent attending with the child was also overweight. Professionals worried that families would perceive them to be "making a judgment call on family's lifestyle" (Respiratory Consultant 4). Consequently, HCPs tried to find ways to frame the conversation that didn't appear to be judgmental. Family weight was also perceived to be a barrier to promoting behaviour change, as trying to encourage an overweight family to alter their lifestyle was considered to be difficult when "they don't really see it as being a health problem" (General Paediatrician 3) and thus do not understand the medical impact of excess weight on the child's asthma. In addition to family weight, the physicians' own weight was considered to influence weight management support. Professionals reported that raising the topic of weight was more difficult when they themselves were overweight:

> "Imagine you're saying, 'You're overweight' and then you're overweight yourself, it's not a great example is it. And you just think, 'Well I've had a Big Mac for lunch' (Respiratory Nurse 3).

In cases where there was little or no progress with weight loss, professionals reiterated the importance of managing weight to patients but acknowledged that raising the topic can become

more difficult over time. Consequently, some professionals described becoming “battle weary” (General Paediatrician 3), deliberating over whether they were being unkind. This raises the question of whether the perceived discomfort and negative consequences of discussing weight with families outweighs the potential benefits of weight loss/maintenance. Professionals recognised the importance of addressing the topic, but in one case where a patient struggled with difficult-to-manage asthma, a Nurse worried about causing immediate distress: “Another stick to beat them with, but then, it’s hard because you know, we all know that we should [*because*] the outcomes have improved” (Respiratory Nurse 2). It is apparent that HCPs empathy for the patients’ struggle may interfere with providing weight management advice.

A lack of evidence to confirm that losing weight improved asthma was considered to make promoting weight loss more difficult. A General Paediatrician compared the uncertainty of the outcome to that of dieting for weight loss: “You know if somebody said you could go on a diet and you may lose weight, probably no one would ever do it, would they?” (General Paediatrician 3). It is implied that for patients the possibility of asthma improvement isn’t enough of an incentive to outweigh the difficulty of trying to lose weight. It may be that immediate results and clearer statistics help patients to see medical relationships and help HCPs to promote the benefits for weight loss. This lack of evidence combined with limited resources to help support weight meant that HCPs felt they were alone in trying to tackle the problem: “the thing is there isn't anything there [to refer to] so it is like making a diagnosis and saying, ‘Well I can't actually help you’” (Respiratory Consultant 4). One General Paediatrician reported having no other way to support weight management than to “talk about it in different ways and use different language” (General Paediatrician 3). A sense of frustration arose around professionals “banging the same drum” (Respiratory Nurse 1). One Respiratory Consultant suggested that even if weight management support was available, she didn’t have time to search for it. Short consultation times meant that while some professionals would have liked to spend more time exploring weight management, there was not enough time “to see beyond the asthma” (General Paediatricians 1). This meant that “guiltily” (Respiratory Nurse 1) weight management was not always prioritised in consultations.

When the issue of weight management was raised, HCPs perceived that very few patients gave open and honest reactions. One Respiratory Consultant discussed a time when a mother denied that her child ate unhealthy food whilst the child ate crisps during the consultation. HCPs went on to show doubt for “how much they do and what do they mean” (General Paediatrician 1),

highlighting uncertainty in whether families' perceptions of healthy lifestyles align with the professionals'. How a family viewed their child's weight was considered vital. In cases where families did not perceive their child's weight to be a problem, they were often dismissive of support stating that "everyone in our family is like this" (General Paediatrician 1). Other times, parents took offense on behalf of the child. One parent for example, was said to have claimed it was "inappropriate" for the issue of weight to be raised and her children to be upset. The participant went on to say that it was likely that the parent who complained didn't want to "get that message" (General Paediatrician 3). However, continuous support was reported to be needed, because families' receptiveness and acceptance of weight management support was reported to be dependent on "where people are at that time in their life" (Respiratory Nurse, R2). Conversations about weight were suggested to trigger awareness of the consequences of weight and motivate change in some patients. Though this was not always the case, as one nurse described, a patient who initially agreed to attend a weight management support group but didn't attend.

Referrals

Where possible, professionals referred families to other services to support them with weight management. These included dietetics, psychology and school nurses, as well as referring back to the patient's GP. Yet, professionals stated that they were "not certain that GPs are the right people to refer to" (Respiratory Consultant 1) indicating a lack of certainty about the protocol for weight management support. In some cases, referrals did not always happen. One Nurse described how the team had contacted GPs to see if there were any weight management programmes to refer to, but then went on to say that she hadn't actually referred any patients to the GP herself as "it does take a lot of time" (Respiratory Nurse 1). In contrast, a General Paediatrician spoke of one success story after referring a family to the GP to be weighed monthly. Monthly weigh-ins proved to be effective and helped the parents monitor weight more regularly than asthma consultations so that "the parents [*could*] see the weight climbing" (General Paediatrician 3)**.** Professionals desired more dialogue with other healthcare professionals after referrals had been made as they described receiving no feedback on whether families were engaging in weight management programmes. Often, it was only months later in asthma consultations that the professionals could monitor the patients' weight. It was felt that patients needed more regular support than outpatient clinics could offer "to ensure they're not getting lost somewhere in the system and that they have actually had the access that you think that they've had" (Respiratory Consultant 1). Liaison with other healthcare

professionals such as school nurses and physiotherapy was preferred to working alone as knowledge could be exchanged. This helped to cater to individual needs as a "certain degree of expertise" (Respiratory Consultant 4) was needed overcome weight management barriers caused by asthma and the increased risk of other comorbid conditions. Examples of doing this included working with schools and local gyms. By sharing knowledge and working together, professionals felt able to strengthen and reinforce weight management support.

It was clear that HCPs wanted to provide support, but that they frequently felt "powerless" (Respiratory Consultant 3). Frustrations emerged over limitations in the available resources as local weight management programmes had recently been decommissioned. One General Paediatrician spoke of how they were told to hand out leaflets. Professionals also referred families to the Change for Life and NHS websites**.** It was clear that HCPs wanted to have somewhere to refer families to for weight management support before the patient became obese:

> "So [*unless*] they've hit the bottom, they don't receive any service. Down there, there is no parachute" (General Paediatrician 1).

Since the start of data collection, responsibility for weight management at the study site had been transferred to dietetics. Some consultants worried about how effective this would be due to long waiting lists and a belief that specialised exercise support was also required for weight control in children living with asthma. However, despite exercise being seen as essential to asthma care, HCPs felt that they had limited capacity to carry out exercise challenges and lung function tests on all patients.

Responsibility

Opinion on whose responsibility it was to manage weight was varied. Some professionals felt they had "a responsibility not to ignore" (Respiratory Consultant 3) weight concerns and that they were able to provide brief, opportunistic interventions. This included specialised education on asthma management; physical activity and nutrition. However, despite having the interests of the child at heart, participants felt it was not strictly part of their job role:

> "Whereas we exist anyway, we already exist. So, you know, it's easy to refer to us to be expected to deal with it but we can't deal with it well" (General Paediatrician 3).

The scale of combatting overweight in patients was seen to be daunting, with one HCP reporting they felt that they were "swimming uphill" (General Paediatrician 3); questioning whether they

were “the right person to monitor” (Respiratory Consultant 1) weight long-term. It was suggested that weight management should be moved into the community as primary care professionals were more appropriate to be monitoring weight and providing health promotion, however one participant expressed disappointment that "the guidance is all about primary care to manage obesity but it's not really happening” (General Paediatrician 3).

By moving weight management into the community, it was perceived that more emphasis could be placed on the prevention of weight gain which would be more beneficial than trying to solve the problem. Two General Paediatricians discussed how prevention needed to start in the early years before children reach their care: “you see it's not down to one geographical health location like a hospital, it has to start early” (General Paediatrician 1). There was also a sense that weight management should be more than just the responsibility of medical professions, but that it should be integrated within public health:

> “And seeing it as a high enough priority when they keep saying the NHS is in the biggest financial crisis, well the thing is...then the solution needs to start right at the grassroots. To have a healthier nation, it's to prevent all of this” (General Paediatrician 1).

HCPs highlighted that school was an appropriate environment to oversee weight management support as there was regular contact with the child. However, one Respiratory Consultant explained that they had to “be very clear that this is their [*the families*] responsibility still” (Respiratory Consultant 1). HCPs perceived that some families did not wish to take responsibility for a child’s weight, instead preferring to place the blame on factors beyond their control, such as genetics, medication or disease. Professionals identified that any success was down to them as the “hard work is done with the family” (General Paediatrician 3).

4.4.2.3 Developing weight management interventions

Intervention content

Generic weight management support that could be tailored to the needs of an asthma population and personalised to individual patients was recommended by participants:

> “I don’t think that the intervention necessarily needs to be very different from what most um most weight interventions are, but I think it’s just the understanding of the condition and how do you facilitate and work around” (Respiratory Consultant 1).

> “There’s so many different reasons why people are overweight” (Respiratory Nurse 2).

Although professionals had previously discussed how education alone was insufficient to change behaviour, they nevertheless focused on a range of educational components that should be included in weight management interventions. Education on diet, such as calorie intake, portion size, healthy food alternatives and eating with the family were suggested. It was thought that diet education needed to accommodate different cultural backgrounds. Alongside this, specialised exercise education was suggested, such as the "recognition that asthma does come with exercise related symptoms" (General Paediatrician 1) and the benefits of "using the inhalers appropriately […] to continue with the exercise" (General Paediatrician 1). One General Paediatrician also felt that the inclusion of education on the consequences of obesity was important so that children and families could have a better understanding of the implications. The majority of HCPs felt that interventions should include a psychological component to support patients by addressing the "wider issues" of living with a chronic condition such as asthma (Respiratory Consultant 3). Psychological support was also perceived to help with adherence to both the "asthma treatment and obesity management" (General Paediatrician 1) and changing parental behaviour "that's probably entrenched from their own childhoods in terms of how they view food" (Respiratory Consultant 3).

Participants also believed that peer support would be beneficial, so that children and families felt less stigmatised and isolated. Demonstrating weight management and the ability to exercise with examples of celebrities living with asthma or friends and other families was suggested as a tool for families to see that progress is attainable. Participants felt it was important for patients to be able to see "people who have gone through [*this*] and then advanced eventually" (General Paediatricians 1).

Targeted Group

Healthcare professionals highlighted that it was important that education and support was provided for the whole family rather than the child alone. Experiences of successful family weight loss were perceived not to have worked if they just tried to change the child's lifestyle in isolation, but their success was because the family "wholeheartedly signed up" (General Paediatrician 1). It may be that the desire to apply nutrition and exercise knowledge increases with parental involvement as parents act as role models and are gatekeepers to food and physical activity. Only one participant suggested that families may not need to be the direct recipients of a weight management programme, but rather "a lot of it may well be addressed by actually educating and supporting the professionals looking after them" (Respiratory

Consultant 4). However, the consultant still recognised that some young people would require specialised support.

One General Paediatrician highlighted that it may be important to have a varied weight range included as prevention was also important and including only overweight children may reduce motivation to change: “it might normalise it even more for them because all those other children who are not overweight are not any longer in their normal frame of reference” (General Paediatrician 3). A mixed group may not only promote more motivation to apply knowledge to their life, but also reduce excuses of health restricting them. However, for some HCPs, it was necessary for there to be a weight management programme targeted just for young people living with asthma as they “probably need a specific rehabilitation program” (Respiratory Consultant 4). Yet it was acknowledged that children with asthma may have other co-morbidities and that tackling weight was important regardless of having a long-term condition: “it doesn't have to be just limited to the asthma because most of these children also have eczema, all sorts of things” (General Paediatricians 1). There was less certainty as to the appropriate age for targeting weight management programmes. Two General Paediatricians expressed that early years should be targeted, whereas other participants believed any age could be included. Intervention content was suggested to require tailoring for different ages to enhance engagement.

Engagement

For HCPs, family engagement in interventions was thought to be challenging, particularly when weight management may not be a priority for patients: “a lot of families will start off trying very hard […] it's easier for that to just, sort of, peter out after a bit” (General Paediatrician 3). It was considered difficult to encourage attendance at additional healthcare appointments when families already take time off school and work for their asthma care: “they might actually not prioritise something like their weight over their asthma appointments” (Respiratory Nurse 1). Without motivation and commitment, weight management interventions were suggested to struggle to effect change. To increase long-term engagement in weight maintenance, HCPs suggested finding a unique way to “hook” patients in; to “tease out and draw out what it is that would be the motivator” (General Paediatrician 1) as it was evident that even when provided with knowledge, families did not always apply it to their lives: “it went in one ear and came out of the other ear” (General Paediatrician 3). To make advice more applicable, a Nurse

recommended encouraging patient initiation in weight management: “you’re going to get a lot more positive uptake than if you’re forcing them to do it” (Respiratory Nurse 3).

Incorporating a variety of activities was suggested to promote engagement, including the use of technology. This could incorporate social media and mobile phone Apps to provide health information, share “family stories” (General Paediatrician 2), “keep track of calories” (Respiratory Consultant 4, R1) and provide specialised asthma support such as “peak flows before and after exercise” (Respiratory Consultant 4). The use of gaming was further suggested as a method for young people to learn about healthy weight with “motivated stories where you try to lose weight by doing these things” (General Paediatrician 2) as well as providing opportunities for young people to partake in physical activities such as “kayaking” or “cookery classes” (Respiratory Nurse 3).

Practicalities

Funding a weight management intervention, however, was described as a barrier to its development and implementation in healthcare settings. One HCP discussed how she thought there was a reluctance to invest money in this kind of programme:

> “Too much expense to manage so many children without any definite benefit…you can't show that there's going to be any financial benefit, [*therefore*] nothing ever happens” (General Paediatrician 3).

A specialised weight management group for children and young people living with asthma was thought to hold challenges in recruiting and obtaining enough participants for it to be feasible. One professional shared worries about how many overweight children living with asthma would be available at the same time to partake. This was furthered by claims that participant numbers would reduce further if groups were tailored according to age or gender.

To ensure attendance, it was felt important for any programme to be as convenient as possible for families as “people just don't have the ability to sustain attendance over several weeks if they had to go somewhere out of their way” (General Paediatrician 3). One HCP suggested that the hospital would be ideal as a “one-stop shop” (Respiratory Nurse 2) however recognised the difficulties of families getting to the hospital. There was continued emphasis that “there needs to be something better out in the communities to help these children and families” (General Paediatrician 3). Running interventions outside of school time, having information accessible out of hours and locating support closer to patient’s homes were all suggested as ways to do

this. It was thought that by incorporating activities into a family's lifestyle, the change wouldn't be "disrupting the normal life of that child and the family" (Respiratory Consultant 1), thus being more sustainable. Several HCPs suggested school would be a good environment for providing weight management support as "all children go to school" and "parents have to interact with school" (General Paediatrician 3). It was thought that weight management could be incorporated into the school curriculum so that all children received the same healthy lifestyle advice in a less threatening environment.

Finally, professionals stressed that the programme could be delivered by anyone with a good knowledge of asthma. It was believed that "having somebody that the family wanted to please" (General Paediatrician 3) was more important than their professional background. However, a multi-disciplinary approach was also suggested to create a successful weight management team. Involvement from school nurses, community nurses, dieticians, physiotherapists, psychologists and school teachers was proposed. Participants reported that the programme should happen over a period of time, facilitating patients to build trust and rapport with programme leaders. This was anticipated to help the message to initiate changes that are "integrated into their lifestyle" (Respiratory Consultant 4).

4.5 Discussion

The current study explored healthcare professionals' views and experiences of weight management and the barriers and facilitators to providing support for a paediatric asthma population. The results of this study illuminate healthcare professionals' uncertainty and differing views regarding the nature of the asthma-obesity relationship. This could have implications for how professionals approach weight management in patients with asthma and may consequently lead to different health outcomes for children. Several vicious cycles were identified throughout this study highlighting how living with asthma can create challenges to weight management, leading to increased asthma symptoms and weight gain. Physical activity, eating behaviour, family influences and asthma medication were all recognised as influencing weight management in this paediatric asthma population.

HCPs acknowledged that asthma severity could restrict physical activity levels. However, participants believed that breathlessness during exercise was often misinterpreted as a symptom of asthma by parents and children rather than an indication of fitness. Perceiving breathlessness as a symptom of asthma was thought to decrease children's confidence in their exercise parameters. The outcome of this misinterpretation may be that children restrict their

activity levels and subsequently have lower fitness ability and develop exercise avoidance behaviours (Leinaar et al., 2016; Park et al., 1996). As has been previously documented in the literature, participants in this study suggested that restricting exercise may also develop from fear of exercise-induced asthma attacks (Kornblit et al., 2018). Research has shown that parental anxiety can lead to children developing avoidance behaviours in asthma-threat scenarios (Sicouri et al., 2017). This finding was also supported by the health professionals interviewed here. It could be that both children and parents require further education to correctly attribute breathlessness to either asthma or fitness ability, thus working to prevent cycles of exercise avoidance, increased weight, lower fitness ability and worse asthma symptoms, as well as preventing the transfer of anxiety from parent to child.

Participants recognised that parents used food as a tool to influence child behaviour. The use of food as a reward and restrictive feeding practices are known to impact on child eating behaviour and can influence eating and weight gain (Farrow et al., 2015). HCPs discussed how older children used food as a way of coping with living with asthma, echoing research findings that adolescents living with asthma are more likely to have unhealthy eating behaviours (Moreau et al., 2009). However, it is possible that children living with asthma may overeat when bored or due to perceived lower exercise parameters (Pianosi et al., 2004; Leinaar et al., 2016). For example, research has found that salty-snack consumption and television watching are associated with increased asthma symptoms (Arvanti et al., 2011). Diets high in salt and fat have been linked to increased airway inflammation and wheezing (Arvanti et al., 2011; Wood et al., 2017). Such symptoms are likely to decrease exercise tolerance and make weight management engagement more challenging, reflecting HCPs suggestions of vicious cycles furthering weight gain and reduced asthma control.

Healthcare Professionals reported parental concern around the use of steroids for asthma treatment leading to increased appetite and weight gain. It is possible that this worry could result in poor medication adherence linking to previous research which has found that parental medication concerns are associated with low medication adherence in children living with asthma (Conn et al., 2005). Likewise, research indicates that concerns about medication-induced weight gain can create a desire to avoid steroid use in adolescent asthma patients (De Simoni et al., 2017). In their Necessity and Concerns Framework, Horne and Weinman (Horne & Weinman, 2002), suggest that concerns around medication can often outweigh the perceived need to take medication. HCPs described reviewing patient weight and medication regularly to

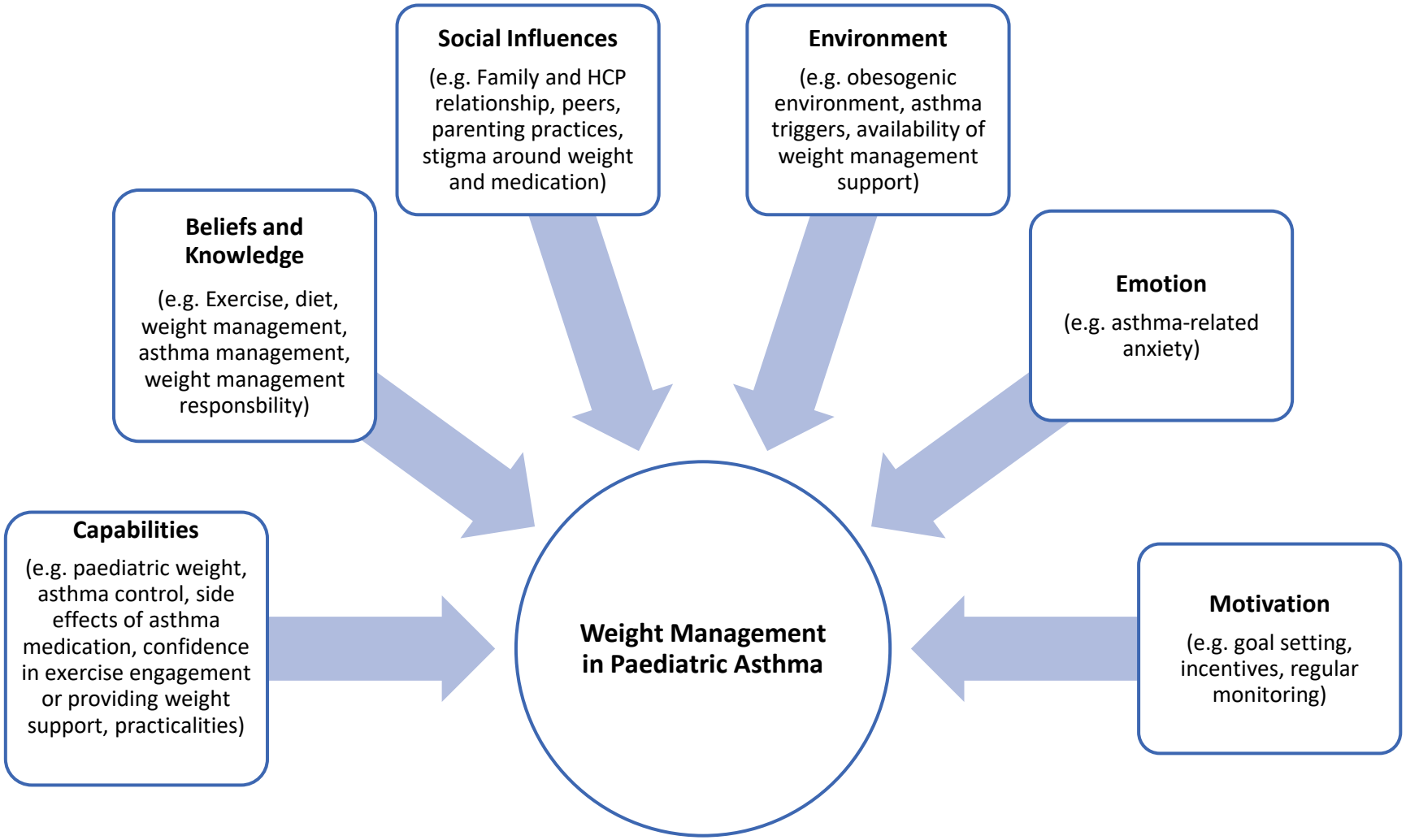
avoid unnecessary weight gain, yet, some HCPs felt that the use of steroids was necessary for asthma control. As overweight and obese children have a reduced response to steroid treatment, continued emphasis should be placed on weight management to improve both asthma control and treatment adherence in families and children living with asthma (Forno et al., 2011).

Additional paediatric asthma weight management obstacles were identified at the HCP level. Consistent with previous research, the stigma associated with discussing child weight was recognised, with communication around weight perceived as uncomfortable for professionals, even when referring to medical statistics or having a good rapport with patients (Elwell et al., 2014; Clarke et al., 2018). It was thought that a strong therapeutic relationship helped to aid conversations, though as previously reported, HCPs expressed concern that addressing weight with a child and their family may jeopardise this relationship and that parents would react negatively (Dewhurst et al., 2017; Clarke et al., 2018). Contrary to this fear, however, previous studies indicate that parents and adolescents are often supportive of HCPs addressing, discussing and monitoring adolescent weight (Shrewbury et al., 2010). Other barriers to providing support included limited resources and poor awareness (or existence) of referral pathways. Frustration with this lack of support services mirrored an adolescent sample who were overweight who expressed unhappiness at weight concerns being raised in consultations without HCPs being able to provide further intervention (Alexander et al., 2018). In addition, the hospital-based HCPs in this study felt that delivery of behaviour change support was better placed within community care settings, as found previously in other specialised HCPs (Nelson et al., 2014). Clearer guidelines on weight management support and improved local referral pathways could help bridge the gap across different healthcare sectors.

Finally, professionals in this study discussed how any new weight management programme would need to be tailored to the needs of an asthma population and incorporate education on nutrition, exercise and obesity. It was recognised that psychological support was required to help young people manage living with asthma and adhere to both asthma and weight management. It is important that weight management advice used in practice is acceptable to patients and families to enhance engagement. Complementing the views of parents and adolescents (Schwalkwijk et al., 2015; Brown et al., 2006), HCPs believed that involving the child's family, enhancing motivation and ongoing support in the community would help to sustain engagement with weight management.

The HCP findings from Chapter 4 complement those from the family reports in Chapter 3. Together, the findings highlight how families and HCPs beliefs and understanding of asthma control and weight management can influence their engagement, or provision of support, with maintaining a healthy weight. Understanding families' perceptions of the interdependency, and their lived experience of asthma, may be essential to support asthma-related anxiety or other concerns that can impact on weight management behaviours. Further interpersonal and environmental factors, and families and HCPs capabilities, need to be considered when creating a weight management intervention. An illustrative diagram of the findings from Chapter 3 and Chapter 4 can be found in Figure 3.

Figure 3: An illustrative diagram of the qualitative findings from Chapter 3 and Chapter 4



4.6 Limitations

Although the purposive sample recruited a variety of job roles to capture different views and experiences, the participants for this study came from a specialist Children's Hospital. As a result, the views and experiences may only reflect that of the local area and those of HCPs working with a severe paediatric asthma population. Recruiting a larger sample from a range of hospitals may be useful in future research, as different training and different local weight management programmes may influence the weight management support offered. Nevertheless, findings from this study are likely to be transferable to other paediatric overweight populations in the UK.

4.7 Conclusion

In conclusion, the results of this study highlight the complexity and variety of influences on managing weight in a paediatric asthma population. Tailoring family-centred weight management to the needs of a paediatric asthma population and locating support into the community were thought to be key to the effectiveness and uptake of an intervention. Providing training on sensitive conversation initiation and guidance on referral pathways may reduce the uncertainty and discomfort of providing weight management support in clinical practice, as well as encouraging more dialogue between multi-disciplinary healthcare professionals to promote ongoing support. Providing education to families alone is not enough to support weight behaviour (NICE, 2014). Future interventions would benefit from further research exploring how to enhance HCP elicitation and modification of beliefs that influence paediatric weight management in asthma.

In the following two chapters, findings will be presented from quantitative studies that examined parental and child attitudes towards feeding, eating and physical activity that were identified within the qualitative studies.

CHAPTER 5

Parental Practices around Feeding and Exercise in Children with and without Asthma

5.1 Introduction

The previous two chapters used a qualitative design to explore families' and HCPs' experiences of weight management in paediatric asthma. Findings highlighted a lack of weight management support and the interaction between asthma and families' behaviours, such as eating and exercise. The next two chapters will present findings from quantitative studies that examined parenting around feeding and exercise, and child eating and exercise, in children living with and without asthma.

A growing number of studies have found a correlation between asthma and an increased obesity risk (Azizpour et al., 2018; Chen et al., 2017). As childhood obesity can track into adulthood, it is important to understand the modifiable determinants of obesity in children living with asthma to help contribute to the development of weight-management interventions (Sahoo et al., 2015). Yet as the mechanisms underlying the asthma-obesity relationship remain unclear and are likely to be multifaceted, the role of the family environment should be considered (Baffi et al., 2015). Chapter 5 adopts a quantitative approach to objectively examine the relationships between families' practices around physical activity and eating behaviour.

Lifestyle habits are often established in early childhood, with evidence suggesting that parental feeding practices influence a child's own development of eating behaviours (Rollins, Loken, Savage & Birch, 2014; Farrow, Haycraft & Blisset, 2015; Blissett, Haycraft & Farrow, 2010; Vereecken, Rovner & Maes, 2010). Parents of children living with chronic illness may have different approaches to feeding. Previous research has found that parents of children living with chronic illnesses feel as though they are depriving their children if they restrict unhealthy foods as living with an illness already places additional limits on the child (Miniham et al., 2007). There is mixed research about parental behaviours around feeding and eating, with some studies describing parents of children living with asthma as being very vigilant of their child, including monitoring of all child food intake (Borhani et al., 2012), whilst others suggest that parents feel that they have less time to focus on a child's diet and weight when frequent medical appointments are required (Pocock et al., 2010). One population-based cohort study by Moreau et al (2009) found higher levels of skipping meals, eating for pleasure and eating when sad in adolescent girls living with asthma compared to healthy peers, suggesting an increased risk of

disordered and emotional eating in this group, but research is lacking about how or why feeding and eating behaviours differ in families where paediatrics have asthma.

Living with asthma may also result in increased difficulties engaging in physical activity as up to 90% of young people who have asthma report exercise inducing asthma symptoms (Tsai et al., 2012). Exercise-induced bronchoconstriction (EIB) can result in wheezing, shortness of breath and coughing during or after physical activity. Difficulty from EIB whilst engaging in exercise may explain why children living with asthma report reduced physical activity levels and an increased prevalence of overweight compared to peers without asthma (Vahlkvist et al., 2010; Holderness et al., 2017). Pianosi & Davis (2004) have also proposed that perceived exercise limitations, rather than actual exercise limitations, can lead to lower activity levels. It could be that the perception of breathlessness during activity is misconstrued by some families as an asthma exacerbation and is an influential factor when deciding on how much exercise to partake in (Park, Sawyer and Glaun, 1996). Parental fears around exercise and asthma exacerbation can create barriers to physical activity (Kornblit, 2018). Parents of children living with asthma may perceive their children's physical ability to be restricted and in turn limit or deter their children from engaging in exercise (Glazebrook et al., 2006; Williams et al., 2010) despite the importance of exercise for asthma control (Gomes et al., 2015).

The perception of how well controlled and managed asthma is may also influence parental behaviours around child feeding and activity. Garbutt and collagues (2017) found that parents adjusted or discontinued asthma medication based on their child's asthma symptom prevalence. Parents also incorporated non-pharmacological approaches and management strategies to avoid triggers. Threat avoidance or prevention behaviours, such as adjusting physical activity levels may be an attempt to avoid asthma symptoms (Sicouri et al., 2017; Bruzzese et al., 2016). Managing asthma symptoms may be perceived to be of greater necessity in children with inadequate asthma control, whilst children with well controlled asthma have been found to engage with more exercise (Vahlkvist et al., 2010). As increased weight has been found in children with inadequate asthma control (Forno et al., 2017), parental attitudes towards exercise may help to explain this. Correlations have also been established between dietary intake and asthma symptoms (Guilleminault et al., 2017; Arvanti et al., 2011), however there has not yet been any research examining the relationship between parental feeding practices and asthma control.

5.2 Aims and Hypothesises

This study aims to explore parental attitudes towards feeding, eating and exercise in children living with asthma compared to healthy controls to better understand how differences may contribute to the higher prevalence of childhood obesity reported in paediatric asthma. Three objectives were formulated based on the reviewed empirical evidence:

1. To establish whether there are differences between parental feeding practices, parental attitudes towards physical activity, child eating behaviours and child activity levels in children living with and without asthma.
2. To explore whether the relationships between parental attitudes towards feeding, eating, exercise and weight differ in children living with asthma compared to healthy controls.
3. To explore whether asthma control moderates any relationships between parental feeding and child weight or between parental attitudes towards exercise and child weight.

5.3 Methods

5.3.1 Participants and procedure

Following a favourable ethical opinion by a local University ethics committee (project #1330), parents of children living both with asthma (n= 319) and living without asthma (n= 316) aged between 10 to 16 years of age completed a set of standardised questionnaires. Participants were recruited and sent the questionnaire via Qualtrics, an online survey company that advertises surveys to a pool of participants who have expressed an interest in taking part in research. Qualtrics sent the study advertisement details to a cohort who had stated that they have children (some of whom were living with asthma) aged between 10 – 16 years of age. Exclusion criteria included participants living outside of the UK and child comorbidities that could influence eating or exercise behaviours (e.g. diabetes, irritable bowel syndrome, eating disorders). Participants were provided with an information sheet about the study and were given the opportunity to contact the researchers before proceeding if they had any questions to ask (see Appendix K). Before commencing the survey, participants completed a consent form and indicated that they were happy to progress.

The questionnaire included attention checks to ensure that participants who were not paying sufficient attention could be detected. Specifically, any participants who failed an attention check question, completed the survey in under 6 minutes and/ or had incompatible patterns in

answers were removed. Fourteen participants (asthma n= 9; no asthma n= 5) were removed from the study due to the child having comorbidities that could influence eating or exercise behaviours. Families were only included in the study if they were able to provide accurate child height and weight data, which was defined as having measures from within the past 6 months (n = 434). Child and parental weight data was converted in to BMI ($kg/m^{2)}$. A total of 52 children were removed from analysis as they were underweight.

5.3.2 Measures

Participants provided information about their age, their child's age, their ethnicity, marital status, education level, employment status and household income. Parents also provided height and weight data for themselves and their children. Child weight data was converted into a standardised BMIz score using LMS age- and sex- specific data for the UK (Freeman et al., 1995). Children were classified as underweight, healthy weight, overweight or obese based on international sex- and age-specific BMI percentiles defined by the International Obesity Task Force growth curves (Cole et al., 2012). Participants also completed the following questionnaire measures:

Parental feeding practices

Participants completed 8 subscales from the Comprehensive Feeding Practices Questionnaire (CFPQ: Musher-Eizenman et al., 2007), including the following: 1) child control, 2) emotion regulation, 3) encourage balance and variety, 4) environment, 5) food as reward, 6) restriction for health, 7) restriction for weight control, 8) teaching for nutrition to explore their child feeding practices. Questions included those such as "I offer sweets (candy, ice cream, cake, pastries) to my child as reward for good behaviour" and "I restrict the food my child eats that might make him/her fat". Answers were measured on a Likert scale of 1 – 5 of "never, rarely, sometimes, mostly, always" and "disagree, slightly disagree, neutral, slightly agree, agree". Higher scores indicated a greater amount of the particular child feeding practice. The Cronbach's alpha scores for child control, emotion regulation, encourage balance and variety, environment, food as reward, restriction for health, restriction for weight control were .69, .79, .70, .70, .74, .80 and .74 respectively, indicating that all subscales had good internal consistency. The CFPQ has been widely used and has good psychometric properties (Mais et al., 2015; Melbye et al., 2012).

Perceptions of child weight

For the purpose of exploring participants' concerns about child overweight and perceived child weight, two subscales of relevance were used from the Child Feeding Questionnaire (CFQ: Birch et al., 2001). The concerns about child overweight contained 3 items, such as "how concerned are you about your child becoming overweight?" Response options ranged from 1 (unconcerned) to 5 (concerned). Higher scores indicate greater concern about child overweight. One question was adapted from the perceived child overweight subscale "how would you classify your child's weight?" Response options ranged from 1 (markedly underweight) to 5 (markedly overweight). Higher scored indicate higher perceived overweight. The Cronbach's alpha for the concerns about child overweight subscale was .90 indicating that the subscale had good internal consistency. The concerns about child overweight and perceived child weight subscales have been previously used when examining child weight status and parental feeding practices (Nowicka et al., 2014).

Child eating

Parents reported child eating behaviour for their child using the Children's Eating Behaviour Questionnaire (CEBQ: Wardle et al., 2007). 4 subscales for food responsiveness (e.g. "if allowed to, my child would eat too much"), emotional over-eating (e.g. "my child eats more when worried"), enjoyment of food ("my child loves food") and desire to drink (e.g. "my child is always asking for a drink") were used to examine children's obesogenic eating behaviours. Responses were measures on Likert scale from Never to Always. Higher scores indicated a greater amount of the particular eating behaviour. The Cronbach's alpha scores for food responsiveness, emotional over-eating, enjoyment of food and desire to drink subscales were; .90, .88, .88 and .89 indicating that all subscales had good internal consistency. The CEBQ is a well-used questionnaire which has been used with families of children who are both healthy weight and overweight (Mallan et al., 2017; dos Passos et al., 2015).

Child activity

Children's physical activity levels during a typical week were explored using the Godin Leisure-Time Exercise Questionnaire (GLTEQ: Godin & Shepard, 1985). Participants were asked to answer the following on behalf of their child: "how many times on the average week do you do the following kinds of exercise for more than 15 minutes during your free time. A) strenuous exercise (heart beats rapidly) (e.g. running, jogging, jockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling)

b) moderate exercise (not exhausting) (e.g. fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing) c) Mild/ light exercise (minimal effort) (e.g.) yoga, archery, fishing from river bank, bowling, horseshoes, golf, snow-mobiling, easy walking)."

To create Metabolic Equivalent of Task (MET) values, the frequencies were weighted by intensity and summed as follows to create a total leisure activity score = (3 x mild) + (5 x moderate) + (9 x strenuous). Another question separate to this calculation asks, on a typical 7-day week, how often their child engages in an activity long enough to work up a sweat (answered on a 3 point Linkert scale from often to never/ rarely). The Cronbach's alpha for the activity score was .73 indicating that the scale had good internal consistency. The GLTEQ has been widely used, including in a sample of adolescents with asthma (Suorsa et al., 2016).

Parents' practices around child activity

To explore parenting behaviours around children's physical activity, participants completed 4 subscales from the Parenting Related to Activity Measure (PRAM: Haycraft et al., 2015). They were 1) responsibility and monitoring (e.g. "how often are you responsible for deciding how much time your child spends engaged in physical activities"), 2) pressure to exercise (e.g. "my child should always engage in physical activities"), 3) control of active behaviour (e.g. "I have to be sure that my child does not engage in too much physical activity"), and 4) overweight concern (e.g. "how concerned are you about your child needing to take part in exercise to maintain a desirable weight"). A 5-point Likert scale was used to record answers of never to always, disagree to agree and unconcerned to concerned. Higher scores indicate a greater degree of a particular behaviour or attitude. The Cronbach's alpha scores for the responsibility/ monitoring subscale, pressure to exercise subscale, control of active behaviours subscale and overweight concern subscales were .85, .67 .83 and .86 respectively indicating that all subscales had good internal consistency.

Asthma Control

To measure asthma control, parents completed the Asthma Control Questionnaire (ACQ: Juniper, 1999) which measures asthma control over the last week. It is comprised of 6 items, including "in general, during the past week how limited were you in your activities because of your asthma?" and "in general, during the past week how much of the time did you wheeze?" Participants used a 7-point Likert scale to record their child's asthma control. Higher scores

indicate poorer asthma control. Juniper et al (2006) states that not well controlled asthma is close to an ACQ total score of over 1.00. However, to be confident that asthma is inadequately controlled a cut-off point of 1.50 should be used. Therefore, all participants with an ACQ total score over 1.50 were categorised as having inadequately controlled asthma. An ACQ total score under 1.50 can be used to define controlled or partially controlled asthma (Olaguibel et al., 2012), and this cut off is therefore used in this study. The ACQ has been widely used and validated in a population aged 6-17 years (Juniper et al., 2010; Nguyen et al., 2014).

5.3.3 Statistical analysis

SPSS Statistics 23 was used to analyse the data. Kolmogorov-Smirnov tests indicated that the data was not normally distributed, therefore non-parametric tests were used where possible to analyse the data. For all tests, a criterion alpha of $p < 0.05$ was set for establishing significance. First, Mann-Whitney U and Chi square tests were used to explore whether parent age, ethnicity, marital status, education level, employment status, household income, parent BMI or child age were significant covariates which needed to be controlled for. Second, Mann-Whitney U tests were used to compare whether parental feeding practices, child eating behaviours and physical activity variables were significantly different between the groups of children with and without asthma.

The sample was then split to compare groups of children with and without asthma and Spearman's Rho correlations were used, controlling for significant covariates, to explore whether child BMIz score was significantly related to parental feeding and activity behaviours or child eating and activity behaviours. Finally, as asthma control was found to correlate with child BMI, moderation analyses were also used to explore the moderating effect of asthma control on the significant relationships identified between parental feeding, child eating and exercise with child weight scores. Specifically, whether controlled or inadequately controlled asthma moderated the effect of parental feeding, child eating or exercise in predicting child BMIz and strengthened or weakened the direction of the relationship.

5.4 Results

5.4.1 Demographic information

The mean (SD) age of the parents of children living with and without asthma was 41.24 (8.11) and 42.21 (8.21) respectively. The majority of parents were female (66.1%; 75.6%), married (61.3%; 54.7%) and educated to AS-Level/ A-Level/ other equivalent (30.6%; 32.6%). Most

parents were in full time employment (52.6%; 40.2%), White British (87.4%; 85.5%) and earning an annual household income of £20,000 - £30,000. Parents of children living with asthma had an average BMI of 27.44 (8.58) and parents of children living without asthma had a lower average BMI of 26.18 (7.03) indicating that in both groups parents were overweight on average. The mean child age in the asthma group was 12.89 (1.94) years and in the no-asthma group was 12.52 (1.94) years. 25.5% of the children in the asthma group were living with comorbidities compared to 14.1% in the no asthma group. Children in the asthma group had an average BMIz score of 1.21 (1.25), which was higher than the mean score of .89 (1.18) in the group without asthma. Of the children living with asthma, 35.5% were classified as having a healthy weight and 35.5% as overweight or obese. For children without asthma, 37.9% were classed as a healthy weight and 30.9% as overweight or obese.

5.4.2 Differences between children living with and without asthma on parental attitudes towards feeding and exercise, and child eating and exercise behaviours, and child weight

Mann Whitney U tests were used to explore the difference in parental attitudes towards feeding and exercise and child eating and exercise between the parents of children living with and without asthma. The results, as shown in Table 12, indicate that parents of children living with asthma were significantly more likely to use food to regulate emotions, restrict diet for weight control and be concerned about child overweight. Results around activity indicated that parents of children living with asthma were significantly more likely to monitor child activity, pressure children to exercise and to control active behaviours. For the child eating behaviour variables, child emotional over-eating and desire to drink were reported to be significantly higher in children living with asthma sample. No significant differences were found between other aspects of parents feeding, child eating or exercise behaviours.

Table 12: Descriptive statistics and comparisons between groups of parentings of children living with and without asthma on parental feeding, child eating and exercise variables and child weight.

	Children with asthma– Mean (SD)	Children without asthma – Mean (SD)	Mann Whitney U test
Parental Feeding			
Child Control	2.8 (.71)	2.79 (.68)	47968
Emotion Regulation	2.21 (.87)	2.02 (.7)	43273*
Encourage balance and variety	4.42 (.57)	4.42 (.55)	48150
Environment	2.59 (.77)	3.65 (.73)	45599
Restriction for weight control	3.08 (.79)	2.88 (.79)	41602**
Food as a reward	2.63 (1.1)	2.54 (1.09)	45766
Restriction for health	3.55 (1.02)	3.52 (.72)	47876
Teaching about nutrition	4.53 (.72)	4.43 (.81)	45242
Parenting Practices of Child Activity			
Responsibility/monitoring	3.52 (.82)	3.34 (.83)	42521*
Pressure to exercise	3.73 (.85)	3.53 (.91)	42131**
Control of active behaviours	2.35 (1.09)	2.05 (1.03)	40002**
Perceptions of Child Weight			
Concerns about child overweight	2.76 (1.3)	2.45 (1.33)	41697**
Perceived child overweight	3.1 (.58)	3.05 (.48)	47020
Child Eating			
Enjoyment of food	3.84 (.77)	3.89 (8)	46243
Emotional over-eating	2.47 (1.04)	2.17 (.82)	40491**
Desire to drink	2.84 (1.08)	2.63 (1.04)	42855**
Food responsiveness	2.81 (1.08)	2.66 (1)	44701
Child Activity			
Activity Score	65.36 (61.21)	65.78 (59.25)	47785
Activity frequency	1.75 (.66)	1.81 (.69)	45909
Child weight			
Child BMIz score	1.21 (1.25)	.89 (1.18)	16352**

* $p < .05$, ** $p < .01$

5.4.3 Relationships between parental attitudes towards feeding and exercise, and child eating and exercise behaviours

The sample were split to compare children with and without asthma and Spearman's Rho partial correlations were used to explore the relationships between parental attitudes towards feeding and exercise and child eating and exercise behaviours and child BMIz scores in the two groups

(see Table 13). As Mann-Whitney U tests indicated that parents of children living with asthma were significantly more likely to have a higher BMI (U = 4826, p = .014) and have a higher household income (U = 4894, p = .044), these variables were controlled for in these analyses. In both groups, child BMIz score was significantly correlated with greater parental restriction of food for weight control, higher concerns about the child being overweight and greater perceived child overweight. In both groups of children, child BMIz score was significantly correlated with greater child emotional overeating, greater child food responsiveness and a lower child activity score.

Additionally, within the group of children with asthma, child BMIz score negatively correlated with parental teaching about nutrition. Within the group without asthma child BMIz score was significantly correlated with greater parental use of food for emotion regulation, lower encourage balance and variety with feeding, more parental use of food as a reward, more restriction of food for health, more pressure to exercise, greater child desire to drink and higher child activity frequency.

Table 13: Spearman's Rho partial correlations, controlling for parental BMI and income, correlating child BMIz score with parental feeding practices, parental concerns around child weight, child eating, child activity levels and parental attitudes towards exercise.

	Child BMIz score	
	Children with asthma (n=194) – R	Children without asthma (n=188) – R
Parental Feeding		
Child Control	-.03	.12
Emotion Regulation	.12	.14*
Encourage balance and variety	-.06	-.16*
Environment	-.03	-.10
Restriction for weight control	.16**	.31**
Food as a reward	.08	.16**
Restriction for health	.08	.24**
Teaching about nutrition	-.13*	-.02
Parenting Practices of Child Activity		
Responsibility/monitoring	.01	.09
Pressure to exercise	.03	.21**
Control of active behaviours	.06	.05
Perceptions of child weight		
Concerns about child overweight	.24**	.37**
Perceived child overweight	.28**	.35**
Child Eating		
Enjoyment of food	.08	.05
Emotional over-eating	.19**	.29**
Desire to drink	.10	.19**
Food responsiveness	.13*	.30**
Child Activity		
Activity Score	-.16**	-.14*
Activity frequency	.09	.21**

* $p < .05$, ** $p < .01$

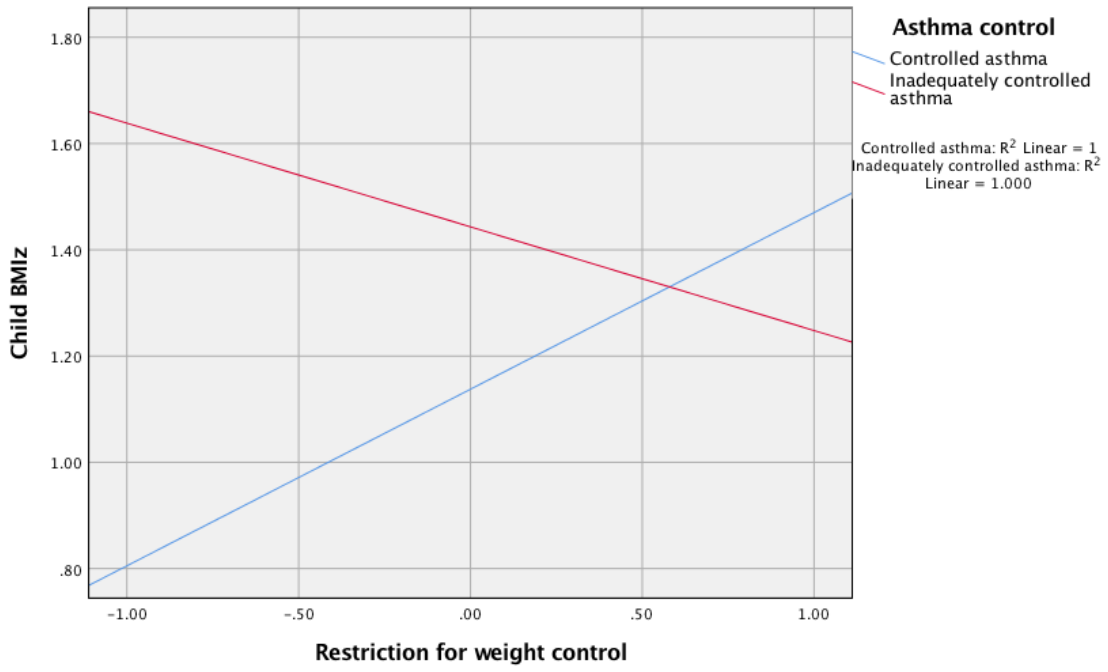
5.4.4 Asthma control as a moderator to the relationship between restriction for weight control, child activity level and child BMI

Children living with controlled asthma had a mean BMIz score of 1.04 (1.23) compared to a mean BMIz score of 1.39 (1.23) in children with inadequately controlled asthma. Mann-Whitney U tests indicate that these differences are significant; (U = 3874, $p = .041$).

As there were significant differences in BMIz scores between the children who have controlled and uncontrolled asthma, moderation analyses were used to explore whether asthma control moderates the relationships between parental feeding practices, child eating and physical

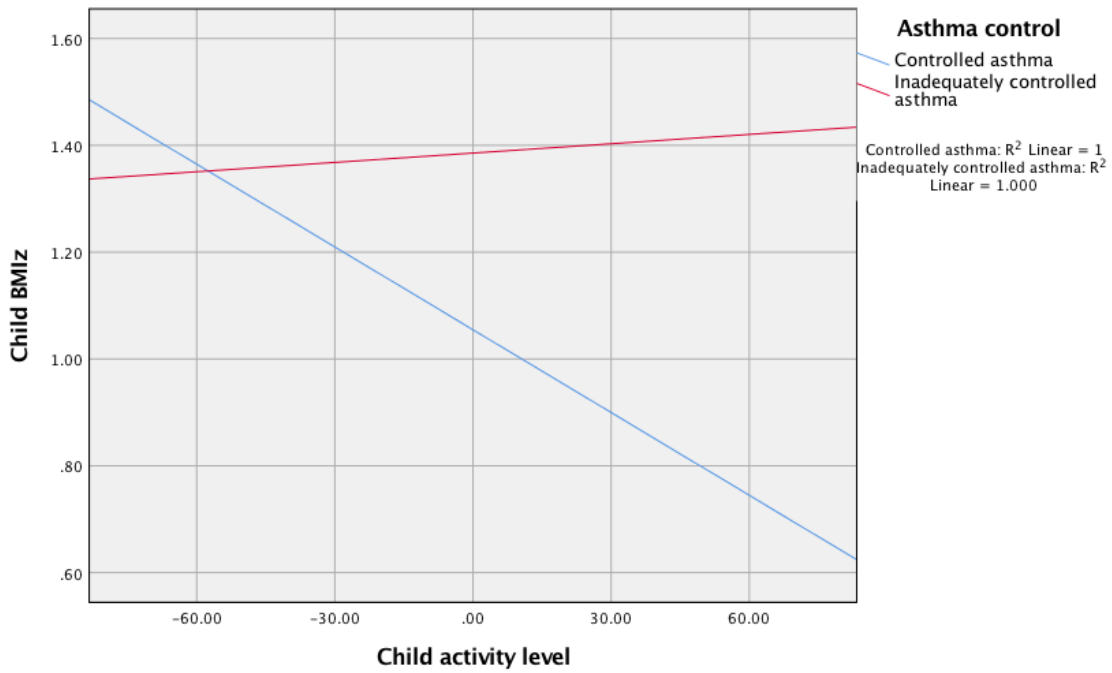
activity with child BMIz scores in the group of children with asthma. Moderation analysis indicate that asthma control moderated the relationship between restriction for weight control and BMIz; *b* = -.53, 95% [CI -0.99, -0.6], *t* = -2.23, *p* = .03. When children had adequately controlled asthma, there was a significant positive relationship between restriction for weight control and BMIz, *b* = .33, 95% [CI .05, .61], *t* = 2.36, *p* = .02. However, when asthma was not well controlled, the relationship between restriction for weight control and BMIz was not significant, *b* = -.19, 95% [CI -.57, .18], *t* = -1.02, *p* =.31 (see Figure 4).

Figure 4: The relationship between parental restriction for weight control and child BMIz score is moderated by how controlled asthma is.



Moderation analyses also showed that asthma control moderated the relationship between activity score and BMIz; *b* = .006, 95% [CI .00, 01], *t* = 2.13, *p* = .035. When asthma was adequately controlled, there was a significant negative relationship between the activity score and BMIz, *b* = -.002, 95% [CI -.0094, -.009], *t* = -2.42, *p* = .02. When asthma was not well controlled, the relationship between activity score and BMIz score was not significant, *b* = -.0006, 95% [CI -.0027, .0038], *t* = .35, *p* =.73 (see Figure 5).

Figure 5: The relationship between child activity and child BMIz score is moderated by asthma control.



Additional moderation analyses showed that asthma control did not moderate the relationships between child BMIz score and teaching about nutrition (*b* = .15, 95% [CI -.47, .78], *t* = .48, *p* = .63), child emotional over-eating (*b* = -.28, 95% [CI -.64, .07], *t* = -1.54, *p* = .13) or child food responsiveness (*b* = -.22, 95% [CI -.56, .12], *t* = -1.3, *p* = .19).

5.6 Discussion

The current study explored differences in parental feeding and exercise practices and child eating and exercise behaviours in families where children live with asthma compared to those who do not. It also explored how those practices and attitudes correlate with child weight, as indicated by child BMIz scores. The results suggest that children living with asthma had significantly higher weight to height scores compared to their peers without asthma and, related to this, that their parents reported that their children engaged in more unhealthy eating behaviours such as emotional-overeating and greater desire to drink. Parents of children with asthma reported greater concern about their child's overweight, higher levels of pressure to exercise and greater monitoring and control of active behaviours. The parents of children living with asthma also reported greater use of modifiable unhealthy feeding practices, such as the use of food to regulate emotions and restriction of food for weight control. The findings suggest

that, when compared to their peers, there are different parental influences relating to child weight and eating in families where children have asthma.

Findings that child BMIz scores are significantly higher in the asthma group supports previous research indicating that children living with asthma have an increased obesity risk (Azizpour et al., 2018; Chen et al., 2017). The significant differences found in parental feeding practices may help to explain, in part, why children living with asthma have higher BMIz scores. In response to the perceived limitations or stress caused by living with a chronic condition, parents may be more likely to use food to regulate emotions (Miniham et al., 2007). Or, children who are living with asthma may be more driven to emotionally eat and parents may learn to use food in response to emotion as a consequence of this. Child emotional over eating was related to BMI in both groups. However, a significantly greater prevalence of this practice was reported in the asthma group and may help to explain why BMIz scores are higher in this sample. As found previously in a general child population, the current study found that restrictive feeding practices in both samples were associated with a higher child BMIz score (Rollins, Loken, Savage & Birch, 2014). Significantly greater restriction for weight control by parents of children living with asthma may explain an increased obesity risk in this group. It is also possible that the restriction of certain foods could lead to children's own inability to regulate food intake and predict the development of eating in response to negative emotions (Farrow, Haycraft & Blisset, 2015). Nevertheless, the cross-sectional nature of this study means that the directionality of these relationships cannot be determined.

Interestingly, this research found parental use of food to regulate emotions to be associated with increased child weight, and parental encouragement of balance and variety of food to correlate with decreased child weight in only the sample of children living without asthma. These findings are in line with previous research in a general child population (Haszard et al., 2019; Watterworth et al., 2017). It is possible that additional barriers to managing paediatric weight in asthma moderated this typical relationship. Possible explanations include the adjustment of diet and exercise for asthma control (Farnesi et al., 2019), the use of asthma medication causing increased appetite and weight gain (de Simoni et al., 2017; Han et al., 2019), and young people preferring to limit diet variety due to food allergies (Sommer et al., 2014). While these findings support the need for a holistic and bespoke approach to weight management in paediatric asthma, further research on parental feeding and child eating in asthma is necessary to understand these relationships.

Teaching about nutrition also correlated with a lower child BMIz score in the asthma group. This provides another idea for intervention with paediatrics living with asthma. Teaching about nutrition in relation to asthma may help increase family understanding of the importance of a healthy diet, not only for weight management, but also as a means to improve asthma control. Research has found that diets high in sodium for example, can increase bronchial hyper-responsiveness, airway contraction and increase wheezing symptoms (Burney, 1987; Knox et al., 1997). Diets high in fat have also been found to increase airway inflammation (Rosenkranz et al., 2010). In comparison, Mediterranean diets high in fruits and vegetables have been linked inversely to asthma symptoms (Nagel, 2010).

Significantly higher reports of monitoring of exercise and control of active behaviours in the asthma sample supports research that indicates that parents of children living with asthma worry about their child's exercise limitations (Kornblit, 2018; Glazebrook et al., 2006). Nevertheless, no significant differences were found between the child activity score or frequency in the children living with asthma and their healthy peers. In addition, no association was found between parental attitudes towards exercise and child BMIz in asthma. It may be that parents' attitudes towards exercise in children living with asthma does not influence child activity levels. Instead, participation may still be encouraged in safe, controlled environments (Shaw et al., 2017).

Activity levels were found to correlate with child BMIz in the asthma group, whereas exercise frequency did not. This suggests that, for children with asthma, taking part in physical activity may be more important for weight management than intensive participation. This contrasts with research findings that suggest activity intensity is more important than activity type and weight management recommendations to increase activity intensity to address obesity in children living with asthma (Wanrooijet et al., 2014; Moonie et al., 2018). As no objective measures of activity intensity were taken, the reported results by parents in this study may not be reflective of the children's activity intensity.

This study supports previous research which suggests that inadequate asthma control is associated with a higher child BMIz score (Forno et al., 2017; Quinto et al., 2011). Moderation analyses indicate that asthma control moderates the relationships between both restricting diet for weight control and child activity levels with child BMIz. Specifically, when asthma is

controlled parental restriction of food for weight control predicts greater child BMIz, and child activity levels predict lower child BMIz, but these relationships were not significant if asthma is inadequately controlled. Instead, it may be that for inadequately controlled asthma there are other influential factors towards obesity. One explanation may be that the use of some types of asthma medication, such as steroids, could be a responsible for increased weight in this sample (De Simoni et al., 2017; Han et al., 2017). High-dose steroid therapy is often used in difficult to control or therapy resistant asthma (Heaney & Robinson, 2005; Hedlin et al., 2010). Han and colleagues (2019) found a positive association between steroid dose and weight gain. Another possibility is that inadequately controlled asthma is a result of poor medication adherence (Desai et al., 2011), and research has found an association between non-adherence and excess weight in children with asthma (Longo et al., 2019).

The results from the moderation analysis suggest that restriction of food for weight control may be similar between parents of children with controlled asthma and parents of children living without asthma as no significance was found in the inadequately controlled asthma sample. This supports the idea that parents may be less restrictive of unhealthy foods when illness is perceived to be more uncontrolled (Miniham et al., 2007). It may also be that parents use food as a method of emotion-orientated coping (Raspopow et al., 2013). Parents may perceive their child to be more anxious from inadequately controlled asthma and be less restrictive of foods as a tool to regulate their emotions (Dudeney et al., 2017). It may also be that food is used as a method for parents coping with their own distress of their child's illness or as a method of offering social support (Hamburg et al., 2014). Davis (1994) suggests that empathetic concern can be diminished through the use of supportive behaviour, such as the provision of food.

5.7 Limitations

To our knowledge, this is the first study to explore the relationships between parenting practices around feeding and exercise in a sample of children with asthma. An important consideration for this research is the nature of reliability in self-reported data. Research suggests that self-reported height and weight data tends to be underestimated with greater inaccuracy (Burton, Brown & Dobson, 2010), we therefore only included participants who said that they had child weight data recorded from the last 6 months but there is always a risk of unreliability in the data. Assessing the child's diet, activity level and asthma control through parental report is also another limitation to this study and should be interpreted with caution. However, using parental report is a suitable measure to counteract research that suggests that

children and adolescents can be prone to reporting errors when disclosing dietary intake and physical activity levels (Koning et al., 2018). In future research, greater consideration should be given to the accuracy of the measurements used for height and weight data alongside the informant of the data to reduce measurement error in data collection. Families should also be recruited from more diverse ethnic backgrounds to increase our understanding of how ethnic factors may influence family environments and allow for greater generalisation to other populations.

5.8 Conclusion

In conclusion, children living with asthma are more likely to be heavier and overweight compared to their peers without asthma. Differences in the parental attitudes towards feeding and exercise, and child eating and exercise behaviours between the living with and without asthma sample may help to explain this difference. A greater understanding of parental feeding practices and attitudes towards exercise, child eating and exercise and asthma control within an asthma sample is needed to help inform the development of a weight management intervention for this population.

The following chapter will present findings from further quantitative analysis examining beliefs about medicines and asthma-related anxiety, and their associations with parental feeding practices and attitudes towards exercise, in the sample of parents of children living with asthma.

CHAPTER 6

Beliefs about medicines, anxiety and typical parenting practices in families of children living with controlled and inadequately controlled asthma

6.1 Introduction

The previous chapter highlighted an increased child weight in the asthma sample, specifically in young people living with inadequately controlled asthma, and how parenting practices can differ between parents of children living with and without asthma. This current chapter aimed to extend those findings by examining the asthma sample further and exploring differences between the parents living with controlled and inadequately controlled asthma.

The goals of asthma management are to control symptoms and prevent future adverse outcomes (GINA, 2019). To achieve this, ongoing management of the child's asthma is essential. Parents play an integral role in monitoring and managing asthma symptoms throughout childhood and adolescence, typically holding responsibility for assessing the breathing condition of their child, obtaining/administering medicines and supporting the child to adhere to a treatment plan. As the child moves towards adolescence, parents are also responsible for teaching self-management skills and assisting young people to become independent self-carers (Chen et al., 2015). The differences in approaches to asthma management as well as parenting practices need to be considered to understand what factors may be associated with an increased weight.

Adherence to asthma medication is crucial to control asthma symptoms (GINA, 2020). Families with asthma are also recommended to use asthma medication where necessary before exercise to reduce the risk of exercise-induced asthma symptoms during or after activity (Corbridge & Nyenhuis et al., 2017). Nevertheless, parental illness perceptions and beliefs about their child's medication can have a significant impact on how they support their child's illness management. Previous research has found that parental illness perceptions and beliefs about the necessity of asthma medication correlate with adherence behaviour (Klok et al., 2011; Sonney et al., 2017. Meanwhile, frequently reported medication concerns (e.g. addiction, immunity, weight gain) (Zaraket et al., 2011; Garbutt et al., 2017; De Simoni et al., 2017) have been associated with non-adherence to asthma treatment plans and worse asthma control (Mammen et al., 2017). Parental perceptions of poor asthma control and concern that asthma medication has harmful consequences can result in limitations to physical activity and preference of non-pharmacologic approaches to asthma management (Hayduck et al., 2015; Peláez et al., 2015). Instead, parents

may prevent physical activity opportunities to reduce the risk of exercise-induced bronchoconstriction (EIB) (Williams et al., 2010; Winn et al, 2018).

A greater parental perception of physical activity limitations have been found in children living with inadequately controlled paediatric asthma (Eisenberg et al., 2020). However, it is possible that parents' perceptions of exercise limitations may not always be accurate. Previous research suggests that parental interpretation of exercise-induced asthma symptoms is poor (Kornblit et al., 2018; Jago et al., 2016; Eisenberg et al., 2020). In many cases, parents report incorrectly interpreting breathlessness as an asthma exacerbation when it is in fact a result of lower exercise tolerance (Panditi & Silverman, 2003). Further concerns that school teachers do not know how to respond to asthma exacerbation has been associated with parents feeling uncomfortable with their child engaging in exercise when they are not present (Kornblit et al., 2018). This is problematic as evidence suggests regular exercise engagement can lead to improvements in both exercise capacity and asthma control (Gomes et al., 2015).

Parenting a child who is living with a chronic illness, such as asthma, may also have implications for parental well-being. Higher levels of parental stress have been reported in parents of children who are living with asthma compared to the parents of peers without asthma (Ghaffari et al., 2018; Avcil et al., 2019). Increased stress may result from the challenges of balancing family life and work demands alongside the management of a chronic and unstable condition such as asthma (Kish et al., 2018; Fawcett et al., 2019). The unpredictability associated with asthma exacerbations is thought to lead to parental worry, fear and helplessness (Chen et al., 2015). This may, in part, explain the positive relationship found between greater parental anxiety and poorer clinical outcomes for children with asthma (Avcil et al., 2019). It is possible that parental asthma-related anxiety may interfere with a parent's ability to assist with their child's asthma management or that anxiety may be a response to the emotional distress experienced by children living with more severe asthma (Staudenmayer, 1981; Selby et al., 2018).

Theories of parenting have suggested that parental exposure to chronic stress will impact directly on feeding practices (El-Bebadli et al., 2015). It is possible that the ongoing stressors found in parents of a child living with chronic illness may result in less responsive feeding (Borhani et al., 2012; Hughes et al., 2015). When parents experience greater stress and anxiety they have been found to use more controlling and unhealthy feeding practices, such as using

food as a reward, overtly restricting food from their child and providing snacks when meals are skipped (Gouveia et al., 2019; Mitchell et al., 2009; Alm & Olsen, 2017). Emotional feeding is another strategy that many caregivers use to target and improve the negative mind states of others (Hamburg et al., 2014). Parents who are busy struggling to cope with daily stressors are thought to regulate emotion through the provision of food as a time-efficient means of caring and showing support (Hamburg et al., 2014). Hamburg et al (2014) also proposed empathetic emotion regulation, the idea that offering food through concern for another helps to ease distress in both the provider and the receiver. Therefore, the repeated use of food to boost positive emotion can be reinforced in both parent and child.

The body of literature examining the relationship between parental stressors and feeding has, thus far, been conducted in a general population. The relationship between asthma-specific parental anxiety and feeding practices has not yet been investigated. A greater understanding of the factors that influence parental behaviours around food in children with asthma is needed, given the importance of diet and weight maintenance for asthma outcomes (Guilleminault et al, 2017). As research has found higher stress levels in parents of children living with worse asthma exacerbations and greater unhealthy feeding practices (Ghaffari et al., 2018; Hughes et al., 2015), we propose that more unhealthy feeding practices will be found in parents of children living with inadequately controlled asthma. In addition, given that children with inadequately controlled asthma are more likely to experience greater emotional distress (Selby et al., 2018) and that parents are more likely to emotionally feed children who display more negative emotion (Steinsbekk et al., 2017), we propose that a child's asthma control will moderate the relationship between parental anxiety and the use of food to regulate emotions.

6.2 Aims and hypothesises

The aim of this study is to establish any differences in beliefs about medicines, levels of asthma-related anxiety and parental behaviours between parents of children with controlled asthma and those with inadequately controlled asthma. Two objectives were formulated based on the reviewed empirical evidence:

1. To establish whether there are differences between parents of children with controlled and uncontrolled asthma in relation to: beliefs about medicines, levels of asthma-related anxiety, illness perceptions, approaches to physical activity and feeding practices.

2. To explore whether asthma control moderates the relationship between:
    a. Parental asthma medication beliefs and parental control of child activity.
    b. Parental asthma-related anxiety and the use of food to regulate emotions.

6.3 Methods

6.3.1 Participants and procedure

Parents of children living with controlled asthma (n=181) and with inadequately controlled asthma (n=129) aged between 10 to 16 years of age participated in this study. Participants were recruited from Qualtrics, an online survey company that advertises surveys to a pool of people who have expressed an interest in partaking in research. Qualtrics sent advertisement details to parents of children aged between 10 to 16 years of age living within the UK. Participants who had children living with asthma were used for this project. More details on the procedure can be found in Chapter 5.

6.3.2 Measures

Data were collected from the participants on their age, their child's age, their ethnicity, marital status, education level, household income, height and weight and their child's height and weight. Parental weight and height information was converted into BMI (kg/m^2). Child weight and height was converted using a standardised BMIz score from LMS age- and sex- specific data for the UK (Freeman et al., 1995). Participants also completed several standardised measures, as detailed below (further detail about the measures is provided in Chapter 5).

Parental feeding practices

The Comprehensive Feeding Practices Questionnaire (CFPQ: Musher-Eizenman et al., 2007) was used to measure participants parental feeding practices. The Child Control, Use of Food for Emotion Regulation, Restriction of food for Weight Control, Use of Food as a Reward and Restriction of food for Health reasons subscales were used. A higher score indicated a greater amount of the particular feeding practice. The Cronbach's alpha scores for these subscales were as follows; .71, .82, .69, .72, .74, .79, suggesting that the scales have strong internal consistency.

Parenting practices around child activity

To explore parenting of child activity, the Parenting Related to Activity Measure (PRAM: Haycraft et al., 2015) was used. This measured parents Responsibility/ Monitoring, Pressure to Exercise and Control of Active Behaviours. A higher score indicated a higher degree of the

particular behaviour or attitude. Cronbach's alpha scores were .87, .67, .82 respectively, showing good internal consistency.

Beliefs about medicines

The Beliefs about Medicines Questionnaire (BMQ: Horne., 1999) was used to measure parents' perceptions of asthma medication, including inhalers. The instrument contains two subscales measuring beliefs about medicines in general; a general harm subscale which collects responses to statements such as such as "medicines do more harm than good" and a general overuse subscale which collects responses to statements such as "doctors place too much trust in medicines". It also contains two subscales measuring specific beliefs; one assessing perceived necessity of specific medications and one examining concerns about side-effects of those medicines. The questionnaire can be adapted to a particular condition and for this study, was adapted for asthma. The specific concerns subscale collects responses to statements such as "my child having to take asthma medication worries me", and the specific necessity subscale collects responses to statements such as "my child's life would be impossible without their asthma medication". The inclusion of both subscales allows for the assessment of whether differences between groups occur both in general and asthma medicines or only in asthma medicines. Responses are measured on a scale ranging from "strongly agree" to "strongly disagree". Higher scores indicate stronger concerns and beliefs. Cronbach's alpha scores for the general harm, general overuse, specific concerns and specific necessity subscales were; .82, .83, .81, .85 indicating that the subscales had a good internal consistency. The BMQ has been widely used to assess parents' beliefs about medicines in children living with asthma (Sonney et al., 2017; Klok et al., 2015; Ménard et al., 2018).

Parent Asthma-Related Anxiety

To measure participants' anxiety about their child's asthma, the Parental Asthma-Related Anxiety Scale (PAAS) was used (Bruzzese et al., 2011). The PAAS is currently the only illness anxiety scale to measure specific concerns parents have about their child's asthma. The instrument contains two subscales to assess how nervous or worried participants feel about their child's asthma over the last 2 weeks. Participants respond from "never" to "always" to questions assessing their worry. Questions from the severity and treatment subscale include "in the last two weeks, how often did you become nervous or worried about your child having an asthma attack and not having his/ her asthma medicine" and "in the last two weeks, how often did you become nervous or worried about your child dying because of asthma". Questions from

the disease related restrictions subscale included “in the last two weeks, how often did you become nervous or worried about your child missing school because of asthma” and “in the last two weeks, how often did you become nervous or worried about your child having an asthma attack when doing physical activity like sports, dancing or exercise”. A higher score indicates greater asthma-related anxiety. Cronbach’s alpha scores for the severity and treatment subscale and the disease related restrictions subscale were .91 and .90 respectively indicating that the subscales had good internal consistency. The PAAS has been used in previous research as a measure of parental asthma-related anxiety (Gardner, 2015; Bruzzese et al., 2016).

Brief Illness Perceptions Questionnaire

Parents perceptions of their child’s illness were measured using the Brief Illness Perception Questionnaire (Brief IPQ) (Broadbent et al., 2006). The brief IPQ is a more concise measure of the 80-item revised Illness Perception Questionnaire (IPQ-r) (Moss-Morris et al., 2002). The Brief IPQ comprises of nine questions that assess different cognitive (consequences, timeline, personal control, treatment control, identity, coherence) and emotional domains (concern, emotional representation). Responses were measured on a Likert scale from 0 to 10 (eg. no affect at all; severely affects their life). Higher scores indicate a more negative perception of the illness. The generalised illness questionnaire has been adapted for use in asthma and for parental response, for example “how much does your child’s asthma affect their life?”. The Cronbach’s alpha for the Brief IPQ was .68, indicating acceptable internal consistency. The Brief IPQ has been used widely as an alternative measured to the (IPQ-r) to allow for quicker assessment of illness perceptions (Broadbent et al., 2015). It has previously been used by parents of child living with asthma to assess their illness perceptions (Koppen et al., 2018; Sonney et al., 2017).

Asthma control

To measure children’s asthma control, parents completed the Asthma Control Questionnaire (ACQ: Juniper, 1999). Higher scores on this measure indicate worse asthma control. A total ACQ score of 0 – 1.49 was used to categorise children as having controlled or partially controlled asthma. A total score of 1.5 and above was used to categorise children’s asthma as inadequately controlled (Juniper et al., 2006). Scores under 1.49 have previously been used to define controlled or partially controlled asthma (Olaguibel et al., 2012).

6.3.3 Statistical Analysis

SPSS Statistics 23 was used to analyse the data. Kolmogorov-Smirnov tests indicated that data from the Brief IPQ data was normally distributed. Thus, parametric tests were used for analysis of the Brief IPQ, whilst non-parametric tests were used for other data. For all tests, $p < 0.05$ was set as the criterion alpha for establishing significance. First, Mann-Whitney U and Chi square tests were used to compare parent age, ethnicity, marital status, education level, household income, parent BMI, child age and child BMIz scores between the groups (children with well controlled or inadequately controlled asthma) to establish whether there were any significant covariates that needed to be controlled for. Next, Mann-Whitney U tests were used to compare parental beliefs about medicines, parental asthma-related anxiety, parenting of child activity and parental feeding practices between the controlled asthma and inadequately controlled asthma groups. *T* tests were used to compare parental illness perception beliefs between the controlled asthma and inadequately controlled asthma groups.

Finally, moderation analyses were used to examine whether the relationship between parents' beliefs about medicines and parenting of child activity was moderated by asthma control, such that parental beliefs predicted less support for activity when asthma was inadequately controlled. Moderation was further used to explore whether the relationship between parental asthma-related anxiety and the use of food to regulate emotions was moderated by asthma control, such that the relationship was stronger when asthma was inadequately controlled. Parental BMI and child BMIz scores were found to be significant covariates and were therefore controlled for during moderation analysis, which was conducted using PROCESS for SPSS (Hayes et al., 2013).

6.4 Results

6.4.1 Demographic information

The mean (SD) age of the parents of children living with and without asthma was 41.58 (8.1) and 40.75 (8.13) respectively. The majority of participants were female (66.9%; 65.1%), married (60.8%, 62%) and educated to AS-Level/ A-Level/ Other equivalent (29.8%; 31.8%). Most parents earned a yearly household income of £20,000 - £30,000 (23.2%; 22.5%) and described themselves as White British (89%; 85.3%).

Children living with controlled asthma had a mean age of 12.88 (1.95) and children living with inadequately controlled asthma had a mean age of 12.89 (1.95). 40.9% of the controlled asthma

children were female compared to the 42.6% female sample in the inadequately controlled asthma group. The majority of children had no comorbidities (73.5%; 76%). The controlled asthma group had a lower mean ACQ total score of .68 (.42) compared to the inadequately controlled asthma group at 2.33 (.67).

Mann Whitney U tests indicated that there was a significant difference between parent BMI in the 2 groups of children (U = 9935, p = .031) such that those with controlled asthma had a significantly lower mean BMI of 26.77 (9.18) than the parents of children with inadequately controlled asthma, who had a mean BMI of 28.39 (7.59). In addition to this, Mann Whitney U tests indicated that there was a significant difference between child BMIz score and asthma control (U = 3874, p = .041). Children living with controlled asthma had a lower mean BMIz score of 1.09 (1.28) compared to the mean BMIz score of 1.39 (1.19) in inadequately controlled asthma.

6.4.2 Differences between parental beliefs about medicines, asthma-related anxiety, parenting of child activity, parental feeding practices and illness perceptions between children with controlled and inadequately controlled asthma

Mann Whitney U tests were used to examine the difference in parental beliefs about medicines, asthma-related anxiety, parenting of child activity and parental feeding practices. The results from the Beliefs about Medicines Questionnaire, as shown in Table 14, indicate that parents of children with inadequately controlled asthma reported significantly higher specific concern and specific necessity beliefs about asthma medication than parents of children with controlled asthma. Significantly higher scores for anxiety around severity and treatment and disease related restriction were found in parents of children living with inadequately controlled asthma. For the parenting practices regarding child activity, significantly higher levels of pressure to exercise and control of active behaviours were reported in the group of children with inadequately controlled asthma. For parental feeding practices; child control, emotion regulation, restriction for weight control, food as a reward and restriction for health were all significantly higher in the parents of children living with inadequately controlled asthma. No significant differences were found between other measures for beliefs about medicines or parenting practices.

Table 14: Descriptive statistics and results from Mann Whitney U tests comparing the parental beliefs about medicines, asthma-related anxiety, parenting of child activity and parental feeding practices.

	Controlled asthma – Mean (SD)	Inadequately controlled asthma – Mean (SD)	Mann Whitney U tests
Beliefs about medicines			
Necessity of asthma medication	15.25 (4.05)	19.41 (3.28)	4774**
Concerns about asthma medication	12.76 (3.97)	16.7 (3.83)	5301**
Concerns around general medicine overuse	11.58 (3.73)	11.98 (3.84)	10929
Concerns about general medicine harm	9.88 (3.37)	10.65 (3.85)	10380
Parent asthma-related anxiety about:			
Severity and treatment	.89 (.87)	2.05 (1.14)	4506**
Disease related restrictions	.99 (.89)	2.16 (1.11)	4543**
Parenting practices around child activity			
Responsibility/monitoring	3.45 (.87)	3.61 (.73)	10543
Pressure to exercise	3.59 (.87)	3.93 (.78)	8803**
Control of active behaviours	2.09 (.94)	2.71 (1.19)	8131**
Parental feeding practices			
Child Control of Feeding	2.7 (.68)	2.94 (.74)	9394*
Use of food for emotion regulation	2.03 (.78)	2.46 (.94)	8513**
Use of food as a reward	2.36 (.96)	3.03 (1.16)	7618**
Restriction of food for weight control	2.9 (.78)	3.31 (.74)	8212**
Restriction of food for health	3.37 (1.03)	3.8 (.65)	8685**

* $p < .05$, ** $p < .01$

T tests were used to explore the differences in parental illness perceptions between the parents of children living with controlled and inadequately controlled asthma (see Table 15). Parents of children living with inadequately controlled asthma reported significantly higher beliefs about the serious consequences of asthma, higher perception of the continuation of asthma and greater attribution of symptoms to asthma. Significantly greater concern for their child's asthma and greater emotional responses to asthma were also reported by the parents of children living with inadequately controlled asthma. No other significant differences were found between other illness perception beliefs.

Table 15: Descriptive statistics and results from *t* tests comparing the parental illness perceptions between parents of children living with controlled and inadequately controlled asthma

	Controlled asthma – Mean (SD)	Inadequately controlled asthma – Mean (SD)	*t* test
Brief Illness Perception Questionnaire			
Consequences	2.68 (1.95)	5.37 (1.96)	-11.918**
Timeline	5.33 (2.84)	7.10 (2.09)	-6.012**
Personal control	5.43 (3.21)	5.26 (2.32)	0.540
Treatment control	5.47 (3.21)	5.46 (3.01)	0.034
Identity	3.44 (1.91)	6.05 (1.63)	-12.627**
Concern	4.68 (2.55)	7.36 (2.11)	-9.747**
Coherence	5.67 (3.37)	5.83 (3.28)	-0.405
Emotional representation	3.95 (2.72)	6.47 (2.58)	-8.199**
Total score	37.02 (10.54)	49.53 (10.02)	-10.524**

* $p < .05$, ** $p < .01$

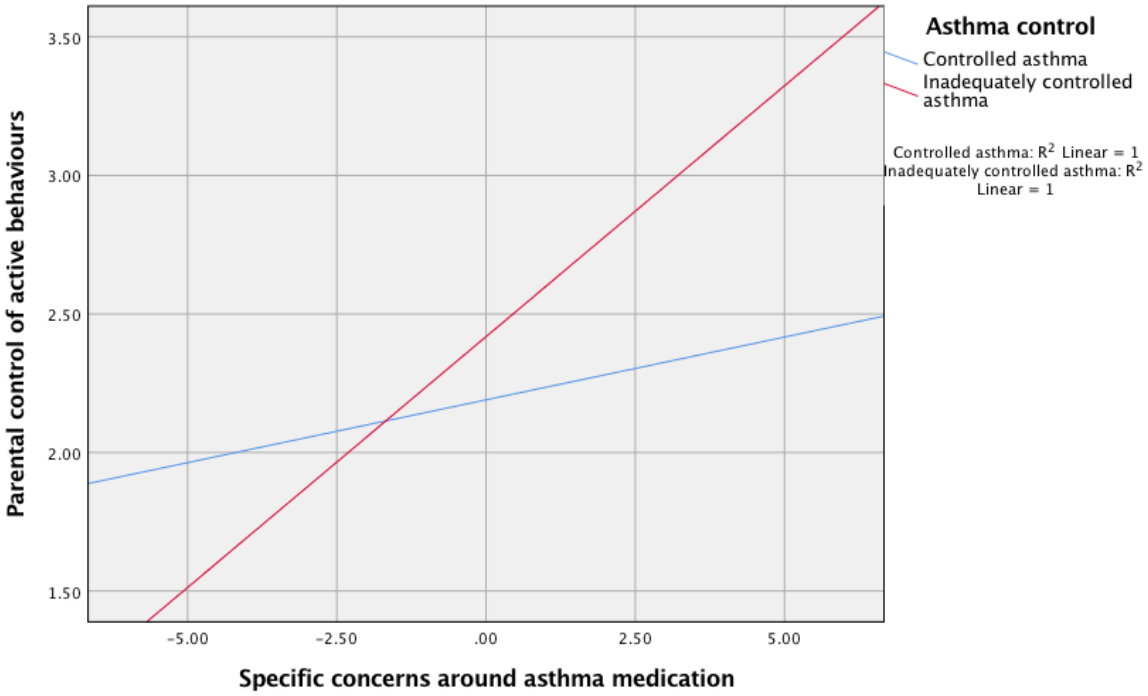
6.4.3 Asthma control as a moderator of the relationship between parental beliefs about medicines and parenting around child activity

Children living with inadequately controlled asthma had a mean ACQ total score of 2.33 (.67) compared to the mean ACQ total score of .68 (.42) in the controlled asthma group. Mann-Whitney U tests indicates that this difference was significant; (U= 16290, $p = .000$).

It was hypothesised that asthma control would moderate the relationship between beliefs about asthma medicines with a) parental control of active behaviours. The PRAM control of active behaviour subscale was used for this analysis.

Moderation analysis indicated that asthma control moderated the relationship between concerns about asthma medication and parental control of active behaviours; $b = .14$, 95% [Cl .07, .20], $t = 3.96$, $p = .0001$. The relationship was found to be significant when asthma was controlled; $b = .05$, 95% [Cl .01, .09], $t = 2.13$, $p = .03$. However, the relationship was found to be stronger when asthma was inadequately controlled; $b = .18$, 95% [Cl .13, .23], $t = 6.67$, $p = .0000$ (see Figure 6).

Figure 6: The relationship between BMQ specific concerns and PRAM control of active behaviours moderated by asthma control



Asthma control was not found to moderate the relationship between parental control of active behaviours and the necessity of asthma medication (*b* = -.46, 95% [CI -1.26, .34], *t* = -1.13, *p* = .26).

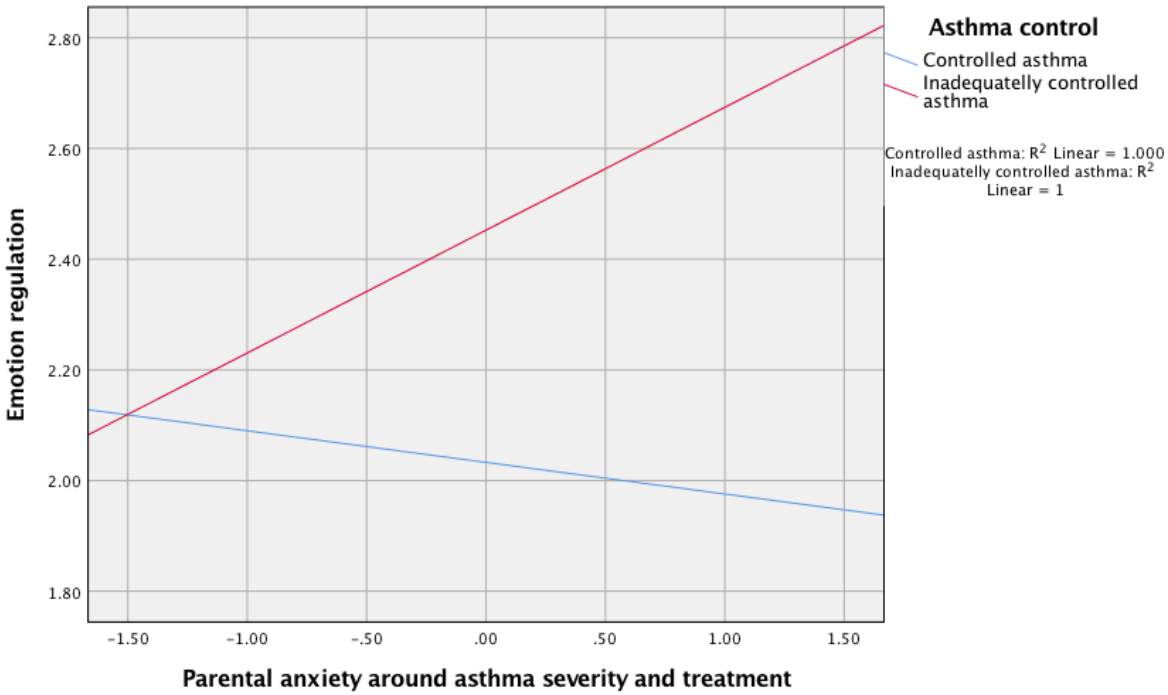
6.4.4 Asthma control as a moderator between parental asthma-related anxiety and using food to regulate emotions

It was hypothesised that asthma control would also moderate the relationship between parental asthma-related anxiety and emotion regulation through the use of food. Specifically, it was hypothesised that the relationship between asthma anxiety and parental use of food to regulate emotions would be moderated by asthma control.

Moderation analysis indicated that asthma control moderated the relationship between parental anxiety about asthma severity and treatment and use of food for emotion regulation; *b* = .23, 95% [CI .03, .53], *t* = 2.24, *p* = .03. When asthma was controlled, the relationship was not significant; *b* = -.06, 95% [CI -.25, .14], *t* = -.59, *p* = .56. However, when asthma was inadequately controlled, a significant relationship was found between parental anxiety about

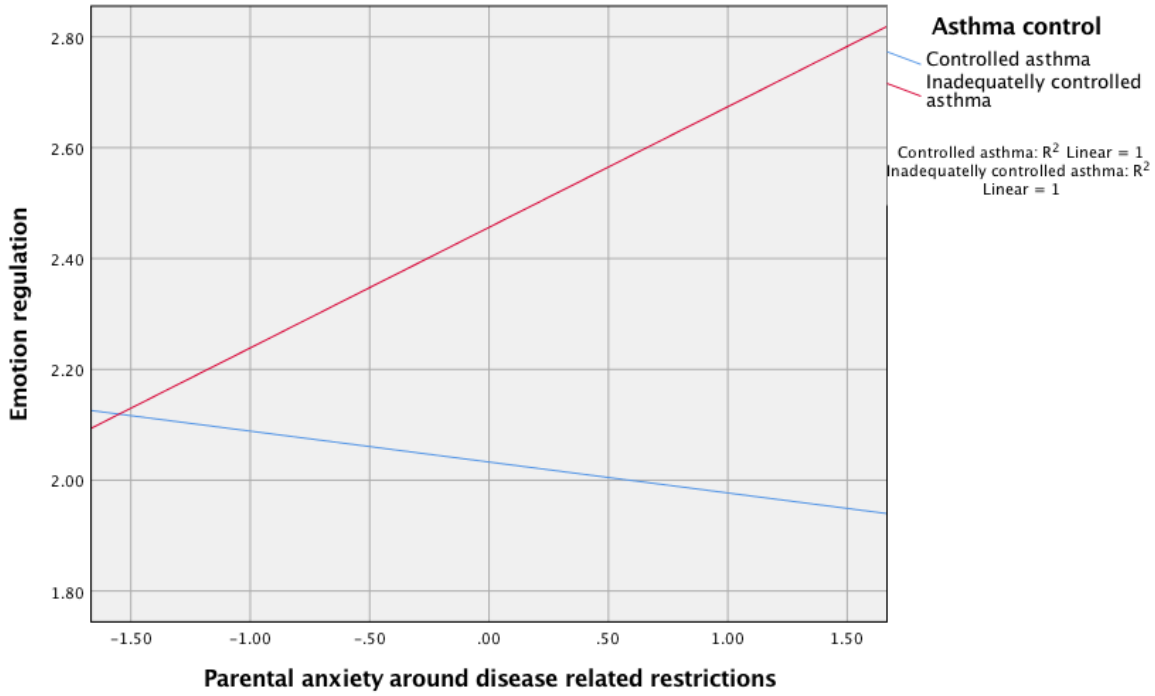
asthma severity/ treatment and emotion regulation; *b* = .22, 95% [CI .07, .38], *t* = 2.86, *p* = .0047 (see Figure 7).

Figure 7: The relationship between PAAS severity and treatment and CFPQ emotion regulation moderated by asthma control.



Moderation analysis also indicated that asthma control moderated the relationship between parental anxiety about asthma-related restriction and use of food for emotion regulation; *b* = .27, 95% [CI .02, .52], *t* = 2.16, *p* = .03. When asthma was controlled, the relationship between parental asthma-related anxiety of disease-related restrictions and use of food for emotion regulation was not significant; *b* = -.06, 95% [CI -.24, .13], *t* = -.6, *p* = .55. However, when asthma was inadequately controlled parental asthma-related anxiety of PAAS disease-related restrictions significantly predicted parental use of food for emotion regulation; *b* = .22, 95% [CI .05, .39], *t* = 2.5, *p* = .01 (see Figure 8).

Figure 8: The relationship between parental asthma-related anxiety of disease related restrictions and parental use of food for emotion regulation is moderated by asthma control



6.5 Discussion

The current study explored the relationships between beliefs about medicines, parental illness perceptions, parental anxiety and parental practices regarding child activity and feeding, in a sample of parents of children living with asthma. Parents of children living with inadequately controlled asthma had higher negative perceptions of illness duration, expected illness outcomes, child's identity, illness concern and emotional response to the illness. Greater concerns about treatment side-effects and perceptions of the necessity for asthma medicines and higher parental asthma-related anxiety were also found in the inadequately controlled asthma sample. Furthermore, there were greater amounts of control of active behaviours and pressure to exercise, and greater unhealthy parental feeding practices in the uncontrolled asthma sample. Alongside these findings, children with inadequately controlled asthma had a significantly higher child BMIz score and their parents had significantly higher BMI scores. The relationship between specific concerns about asthma medicines and parental control of child active behaviours was stronger in children with inadequately controlled asthma. Additionally, the relationship between parental asthma-related anxiety and the use of food to regulate child emotion was only found to be significant when asthma was inadequately controlled.

Parents who had children living with inadequately controlled asthma were found to have greater negative illness perceptions than those living with controlled asthma. Parents in the inadequately controlled asthma sample reported perceptions of greater asthma consequences, longer duration of the illness, worse asthma symptoms, greater concern about asthma and a greater emotional response to asthma. This supports previous literature that suggests greater negative illness perceptions about asthma correlate with worse asthma control (Kosse et al., 2019). It is possible that more negative illness perceptions develop as a result of worse asthma outcomes. Alternatively, the common-sense model of self-regulation suggests that an individuals' cognitive and emotional representation of an illness can act as a guide to their illness management and, in turn, influence health outcomes (Leventhal et al., 2003; Hagger & Orbell, 2003). There is literature to suggest that negative illness representations can influence families' coping strategies and management of asthma (Sonney et al., 2014; Kaptein et al., 2010). Exploring parents' illness perceptions may offer a possibility to understand families' asthma self-management, modify illness perceptions and change health behaviours and outcomes.

This study found that there were no significant differences between parents of children with controlled and inadequately controlled asthma in terms of their beliefs about general medicines. Yet, parents of children living with inadequately controlled asthma reported significantly greater necessity and concern beliefs about asthma medicines. This supports research that has found that uncontrolled asthma correlates with greater parental asthma medicine necessity beliefs and reported medicines concerns (Koster et al., 2011; Kornblit et al., 2018). It may be that parental beliefs about the need for treatment and concerns about the potential for adverse effects of taking asthma medicines interfere with adherence behaviours (Horne & Weinman, 2002). The Necessity-Concerns Framework (Horne et al 1999) suggests that when high necessity and high concern beliefs coincide, people will be ambivalent about adhering to medication. This may explain why high medication necessity and high medication concern beliefs are found in the parents of children living with inadequately controlled asthma. This has previously been reported by Koster and colleagues (2011) who found that high necessity and concern beliefs were associated with poorer asthma control.

No significant difference was found in the levels of parental responsibility and monitoring of child exercise between the groups. It may be that regardless of asthma control, an increased perception of vulnerability in children with asthma results in parents feeling responsible for monitoring how much exercise their child engages in (Shaw et al., 2020). Interestingly, both

significantly higher levels of control of active behaviours and pressure to exercise were found in the inadequately controlled asthma group. Research has found that parents perceive asthma to be a barrier to exercise and that engaging in exercise may make their child become more ill (Glazebrook et al., 2006; Williams et al., 2008). It is also possible that as asthma control becomes poorer, the barriers to exercise are perceived to be bigger (Westergren et al., 2017). This may result in hypervigilant parenting around physical activity and parents wishing to have more control over how much exercise their child engages in (Kornblit et al., 2018). However, greater levels of reported pressure to exercise in parents of children with inadequately controlled asthma suggests that they also realise the importance of their child engaging in exercise. As increased exercise has been associated with improvements in asthma control (Gomes et al., 2015), methods to reduce barriers to activity are needed. Greater reassurance and provision of safe, controlled environments in which to exercise may help to reduce concerns, and improve risk management and enjoyment of exercise (Shaw et al., 2017; Westergren et al., 2017).

Asthma control moderated the positive relationship between specific concerns around asthma medication and parental control of active behaviours. This relationship was significant in both controlled and inadequately controlled asthma groups but was stronger in families where children have inadequately controlled asthma. This finding may help to explain previous findings of lower activity levels in children with worse asthma control (Westergren et al., 2017). As reduced physical activity levels are associated with worse asthma outcomes (Lang et al., 2014), parents need to be better informed around asthma treatment to address concerns (Kornblit et al., 2018). Additionally, parent education is needed to improve identification of EIB and physiologic symptoms (Cordova-Rivera et al., 2018; Jago et al., 2016). It is possible that exercise intolerance is incorrectly attributed to EIB and reinforces parental concern about medicines. Consequently, parents may control how much exercise their child engages in as a non-pharmacologic method to prevent EIB in their child. As exercise is promoted as a means to assist asthma control (GINA, 2019), physicians need to be better informed of parental beliefs about asthma medicines as they may interfere with the inclusion of exercise as part of a treatment plan or the use of medication before exercising. However, this could be problematic as research suggests that physicians are unaware of such concerns as parents do not share them in consultations, and identifying and addressing adherence ambivalence can be challenging for clinicians during short consultation times (Kornblit et al., 2018; Unni & Shiyanbola, 2016). The use of consultation tools, such as the Medicine Related Consultation Framework (MRCF), which have been developed to support the delivery of person-centred healthcare may be useful. The

MRCF provides structured consultation skills training to help clinicians improve their ability to elicit patient illness and medicine beliefs and create individualised management plans that incorporates the individual's perspective (Abdel Tawab et al., 2011). Literature supports this idea, suggesting that involving parents in treatment planning increases trust in the physician (Garbutt et al., 2016).

It may also be useful for physicians to explore the emotional toll of being a caregiver for a child who is living with asthma. The results of the study support previous research that suggests there is a positive correlation between parental anxiety and worse clinical asthma outcomes (Avcil et al., 2019. The direction of the relationship is unknown due to the cross-sectional nature of the data. However, there is literature to suggest that parents of children living with chronic illness have the highest levels of parenting stress which varies by illness severity (Pinquart, 2017). Parental anxiety may increase in this sample in response to worse asthma outcomes, such as more medical appointments and hospitalisation, increased parenting demands and having to take time off work (Ghaffari et al., 2018; Nunes et al., 2017; Lakhanpaul et al., 2017). It is possible that parental anxiety and increased demands to parents' time may reduce the ability to support the needs of paediatric asthma who greatly rely on parent support to manage the illness (Staudenmayer, 1981; Koster et al., 2015). Alternatively, parental anxiety may arise due to an increased emotional distress displayed in young people with inadequately controlled asthma (Selby et al., 2018). Jang and colleagues (2019) found that social support had an inverse relationship with parental stress. Future research into a family-centred asthma programme with a support group component may provide benefits to family psychological wellbeing and asthma outcomes.

Increased child control of diet, use of food to regulate emotions, food as a reward and restriction of diet for weight management and health were found to be associated with inadequately controlled asthma. Greater levels of anxiety in the parents of children living with inadequately controlled asthma may explain the increased unhealthy feeding practices in this population (Gouveia et al., 2019; Mitchell et al., 2019. It is also possible that using food as a reward or to regulate emotions increases the difficulty in adolescents understanding how to regulate their appetite and can lead to later emotional feeding and increased child BMIz scores (Aparicio et al., 2016). The restriction of food for weight management and health reasons were also found to be higher in the inadequately controlled asthma sample. This may be in response to the significantly higher mean BMIz scores in children with inadequately controlled asthma or

from increased asthma exacerbations alongside the knowledge that weight management and a healthy diet can help improve asthma symptoms (GINA, 2019).

This study extends results that have previously established increased parental anxiety in inadequately controlled asthma (Avcil et al., 2019). It was found inadequately controlled asthma moderated the relationship between parental asthma-related anxiety around severity and treatment, and anxiety around disease related restrictions, with the use of food to regulate emotions. The causality of this relationship cannot be established. It is possible that parents perceive higher levels of distress in children with worse clinical manifestations of asthma and use food as a means to alleviate their child's distress and their own empathetic response (Selby et al., 2018; Hamburg et al., 2014). Previous research has indicated increased binge eating in adolescents has been associated with increased health dissatisfaction (Olguin et al., 2017) suggesting that the feeding practices may be responsive to child demands. It is also possible that a diet of daily high energy dense snacks, as described in previous literature as being used by parents to regulate emotion, are a contributor to worse asthma control (Wang et al., 2017; Raaijmakers et al., 2014). The use of such foods can lead to increased child preference for high sugar and high fat foods (Vollmer et al., 2017). Western diets high in sugar and fat are thought to have a negative impact on asthma control (Guilleminault et al, 2017). The association between poor diet and worse asthma control emphasises the need to address factors that may influence poor dietary intake. Addressing parental asthma-related anxiety alongside education around diet may be an important addition to family-centred interventions.

6.6 Implications

Understanding the practices parents use in response to their medication beliefs, anxiety and asthma control is of importance as they are likely to indirectly influence poorer asthma outcomes through reduced exercise, poor diet quality and increased child weight (Lang et al., 2014). Increasing our knowledge of such modifiable constructs can inform the development of personalised family interventions for both asthma and weight management. Strong patient-physician dyads need to be developed alongside the use of consultation tools so that beliefs about medicines and parental anxiety can be elicited during a short consultation time (Tilly-Gratton et al., 2018; Unni & Shiyanbola, 2015). If clinicians have an awareness of families' perceptions, techniques such as motivational interviewing (MI) can be used to improve the motivation and commitment of the whole family towards treatment adherence within consultations (Borrelli et al., 2007). MI encourages patients to adopt behavioural change, such as treatment adherence, in a way that aligns with their own values and goals whilst exploring

and resolving patient ambivalence (Borrelli et al., 2007). Improving families' interpretation of breathlessness during exercise, engagement in pulmonary rehabilitation and providing family illness management programmes are other important components to help improve asthma outcomes through reducing barriers to exercise and helping parents to effectively manage anxiety (Jago et al., 2016; McDonald & Ram, 2016; van Mechelen et al., 2018). Parents are in an important position to promote and normalise physical activity and healthy eating alongside the correct asthma therapeutic management. Engaging parents of young people with asthma in psycho-education programmes and behaviour change interventions may lead to positive outcomes for their child's asthma control.

6.7 Limitations

The results of this research should be interpreted in light of its limitations. As the data is cross-sectional, we can determine significant relationships but we cannot determine the direction of those relationships. It is likely that relationships between parental beliefs about medicines, asthma-related anxiety, parenting practices and asthma control are bi-directional. Future research using longitudinal designs are needed to measure changes over time and to establish the order of effect. The use of a parental report questionnaire to measure asthma control as opposed to objective testing is another limitation. However, this approach is in line with the Global Initiative for Asthma recommendations which state that parents have a "longer recall period" than children and should be involved in such discussions to understand child's asthma symptoms with greater accuracy (GINA, 2016). In future studies, child involvement or the use of physiological assessment would provide a more robust measure of asthma control. Research also suggests that there are significantly different racial disparities in asthma outcomes (Mitchell et al., 2016). As 89% of participants were White British, greater recruitment of other ethnic groups is needed to increase understanding the multitude of factors which may influence greater asthma control in different populations.

6.8 Conclusion

This study suggests that unhealthy parenting practices, such as using food for emotion regulation and control of active behaviours, can be influenced by parental asthma-related anxiety and beliefs about medicines. Asthma control has been found to moderate the relationships between parental asthma-related anxiety and using food to regulate emotions, and concerns around asthma medication and control of child physical activity. These results highlight the importance of eliciting and understanding parents' beliefs about medicines and

parental asthma-related anxiety. Parenting practices are modifiable and understanding what may drive them provides a target for intervention to improve child asthma outcomes.

The next chapter presents the development of an asthma-specific weight management intervention to help support a healthy weight in young people living with asthma.

CHAPTER 7

Developing an Intervention for a Paediatric NHS Service to Support Healthy Weight Management Behaviours in Children Living with Asthma

7.1 Introduction

In the previous chapters, formative research was undertaken to explore factors relating to weight management in paediatric asthma. Following best practice guidelines (MRC, 2020), this chapter describes how the findings of these primary and secondary research studies were synthesised and mapped to psychological theory to develop an evidence-based and theory-driven behaviour change intervention to support healthy weight in paediatric asthma.

Behaviour change interventions can be implemented to modify health behaviours or adapt healthcare professional (HCP) practice (MRC, 2020) to improve patient outcomes. Interventions to change health behaviours are typically complex and contain several interacting components designed to change a specified behaviour (Connor & Norman, 2017). A theoretical approach to intervention design can help to conceptualise the determinants of behaviours, illustrate the relationships between the determinants and provide a framework of factors that an intervention needs to address (ICEBeRG, 2006). Theory can also be tested and evaluated, consequently developing a greater understanding of effective theory in different settings, populations and behaviours (Michie et al., 2008).

Currently, there are numerous theories and frameworks for behaviour change. This creates a challenge for researchers when deciding which theories to apply during intervention development (Michie et al., 2005). The Theoretical Domains Framework (TDF) was developed to address this problem and create a 'best fit' framework (Booth and Carroll, 2015). Michie and colleagues synthesised and simplified multiple health psychology theories into 14 theoretical (originally 12) domains and 84 constructs using a consensus approach (Michie et al., 2005; Cane et al., 2012). Therefore, the TDF provides the opportunity to bring together insights from several theories when guiding intervention development which can enhance understanding of behaviour change processes (Shaw et al., 2016; Michie et al., 2005). The TDF was initially developed to understand the processes involved in changing HCPs behaviour (Michie et al., 2005). Following this it has been extensively applied across a range of groups, settings and behaviours, including, for example, smoking cessation, nurses eating and physical activity behaviour, and asthma medication adherence (Campbell et al., 2018; Power et al., 2017; Yamada et al., 2017).

Further to the identification of appropriate theory, there is also a need to provide a thorough description of the techniques used to change behaviour. Historically, the 'active ingredients' of interventions have been poorly reported, and as a result, the content of interventions can be interpreted and delivered differently to that intended (Michie et al., 2009). To develop a good understanding of what has been delivered in an intervention, the UK Medical Research Council advises that "a full description" of interventions are reported (MRC, 2020). Behaviour change technique (BCT) taxonomies have been developed to support the characterisation of intervention content and have been widely used to report interventions (Michie et al., 2013). Using an international consensus approach, Michie and colleagues have developed a behaviour change technique taxonomy v1 that specifies intervention components into 93 BCTs, clustered into 16 groups. It has been recommended that researchers report and specify the BCTs delivered in interventions using this taxonomy as well as mapping theoretically derived behaviour change mechanisms to the BCTs selected during development (Michie et al., 2013; Michie et al., 2008). Michie and colleagues have created a matrix which has linked BCTs to different theoretical constructs from the TDF and can be used as guidance for researchers when developing interventions to enhance the effectiveness of an intervention (Michie et al., 2008).

Several frameworks have been developed to guide intervention design (e.g. Behavior change wheel). Intervention Mapping (Bartholomew et al., 2016) is a 'problem-driven' approach that is widely used to understand health problems and develop interventions in healthcare settings (Fernandez et al., 2019). It provides a systematic process for intervention development, implementation and evaluation that provides support on how to integrate empirical evidence and theory into intervention design. The six key steps of intervention mapping are:

1. Conducting a needs assessment of the identified population;
2. Identifying the behavioural determinants of the health problem and creating intervention behaviour change objectives;
3. Identifying theory- and evidence-based methods of behaviour change and selecting practical applications for intervention delivery;
4. Preparing intervention programme materials;
5. Planning implementation strategies;
6. Designing a process and outcome evaluation.

Following these guidelines for intervention design, this chapter outlines the development of a theory- and evidence-informed behaviour change intervention to support healthy weight management behaviours in young people aged 12 to 16 years of age living with asthma.

7.2 Step 1: Conducting a needs assessment of the identified population

A thorough understanding of the health problem (weight management in children living with asthma), including a needs assessment of the target population (young people living with asthma) was undertaken and is reported in the following chapters of the thesis:

- Chapter 2: Weight Management Interventions for Paediatric Asthma: A Systematic Review;
- Chapter 3: The Views and Experiences of Weight Management in Families living with Paediatric Asthma;
- Chapter 4: Weight-Management in Children Living with Asthma: A Qualitative Study of the Experiences of Paediatric Healthcare Professionals;
- Chapter 5: Parental Practices around Feeding and Exercise in Children living with and without Asthma;
- Chapter 6: Beliefs about medicines, anxiety and typical parenting practices in families of children living with controlled and inadequately controlled asthma.

Findings identified the following key barriers to weight management in children living with asthma:

- Exercise-induced asthma symptoms, beliefs about capability to exercise with asthma and restriction of activity;
- An obesogenic environment and limited community weight management support.
- Sensitivity of discussing weight and limited time to do so in consultations;
- The use of food to regulate child emotions and restriction of food to manage child weight in inadequately controlled asthma;
- (Non-)Adherence to asthma medication, beliefs about medication, and the side effects of asthma medication;
- Asthma-related anxiety.

7.3 Step 2: Identifying the behavioural determinants of the health problem and creating intervention behaviour change objectives

Primary research from this PhD (see Chapters 3-6) was reviewed to identify the determinants of weight management behaviours in families living with paediatric asthma and the weight management support provided to them by healthcare professionals. The key barriers and facilitators to weight management and weight management support found in this research were highlighted and reduced into a list of 28 key factors. The TDF was then used to translate the 28 empirical behavioural determinants into seven theoretical constructs (Michie et al., 2005; Cane et al., 2012). Concepts from each domain in the TDF were used to increase accuracy in mapping determinants to seven theoretical constructs. These findings suggested that the following factors influence weight management behaviours: capability in families living with paediatric asthma; capability beliefs; knowledge and skills; social influences; environmental context and resources; emotion; motivation, goals and behavioural regulation (see Table 16). Alongside this, the following factors were found to determine HCP's provision of weight management support to families' living with asthma: capability; beliefs; knowledge and skills; social influences; environmental context and resources (see Table 17). These behavioural determinants were supported by the literature review on weight management in families living with paediatric asthma and the weight management reported in Chapter 1.

Table 16: Determinants of weight management behaviours in families living with paediatric asthma

1. Capability
    - Practicalities (e.g. financial, organisation, scheduling)
    - Asthma control (e.g. severity, adherence, health seeking behaviours, transferring asthma management to young people)
    - Paediatric weight
    - Exercise self-efficacy
    - Consequences of asthma medication (e.g. increased appetite)
2. Beliefs
    - Beliefs about asthma medicines (e.g. beliefs about weight gain and ability to manage weight whilst on medication)
    - Beliefs about asthma management (e.g. families' control, control during school time)
    - Beliefs about diet-outcomes (e.g. asthma outcomes, emotion regulation, restriction for weight control)
    - Beliefs about weight management responsibility
3. Knowledge and skills
    - Knowledge about nutrition
    - Knowledge about exercise
    - Knowledge about asthma
    - Interpretation of breathlessness
4. Social Influences
    - Peer group influences (e.g. embarrassment from using medicines/ breathlessness, asthma and weight-focused bullying/ stigma, feeling different, perceived support, self-identity)
    - Parenting of child activity (e.g. restriction, encouragement, monitoring)
    - Family and HCP relationship (e.g. ease of discussing paediatric weight/ worry about damaging relationship)
5. Environmental context and resources
    - Obesogenic environment (e.g. food availability, perception of weight)
    - Availability of weight management programmes/ support
    - Environmental asthma triggers
6. Emotion
    - Fear of asthma exacerbations (e.g. exercise-induced bronchoconstriction)
    - Asthma-related anxiety
7. Motivation, Goals and Behavioural Regulation
    - Motivation to monitor weight
    - Regular monitoring of weight
    - Incentivising weight management
    - Realistic goal setting

Table 17: Determinants of HCPs providing weight management support to families living with asthma.

1. Capability
    - HCP confidence in weight management support
    - HCP ability to provide weight management support (e.g. short consultation times, irregular appointments, competing priorities)
2. Beliefs
    - Beliefs about weight management responsibility
3. Knowledge and skills
    - HCP knowledge of weight management support (e.g. obesity treatment, communication skills, knowledge of referral pathways)
4. Social Influences
    - Family and HCP relationship (e.g. ease of discussing paediatric weight/ worry about damaging relationship)
    - HCPs perception of families' receptiveness and readiness to engage in weight management
5. Environmental context and resources
    - Availability of weight management programmes/ support

7.4 Step 3: Identifying theory- and evidence-based methods of behaviour change and selecting practical applications for intervention delivery

A logic model outlining the mechanisms of behaviour change was created for weight management behaviours in families living with asthma (Figure 9). This model can be used to explain the activation and maintenance of weight management behaviours, such as exercise engagement and healthy eating that can lead to improved weight and asthma outcomes. A separate model (Figure 10) was developed to explain the mechanisms of action that can increase the provision of weight management support given by HCPs and, in turn, reduce paediatric weight and improve asthma outcomes. Due to the complexities of the mechanisms feeding into the asthma-obesity relationship, the logic models are subject to revision and will be reviewed following the evaluation of the intervention.

Using the present logic models, behaviour change objectives were created for an intervention with two strands; one that targets the behavioural determinants of weight management in families living with paediatric asthma (Table 18), and one targeting HCP weight management support (Table 19). As recommended by the UK Medical Research Council (MRC, 2020), multiple components were selected to increase opportunities for behaviour change.

Selection of behaviour change techniques

Following the identification of behaviour change objectives, techniques to change behavioural determinants were selected from the BCT taxonomy v1 (Michie et al., 2013, see Table 18 and

Table 19). The selection of BCTs was guided by a matrix created by Michie and colleagues that maps theoretical domains to BCTs (Michie et al., 2008). As this intervention was being designed for an NHS setting, consideration was given to the appropriateness of BCTs in this context. The APEASE criteria (Acceptability, Practicability, Effectiveness, Affordability, Side-effects, Equity) was applied to help select the most suitable BCTs (Michie et al., 2014).

Figure 9: Logic model of the mechanisms of change for weight management engagement in families with paediatric asthma

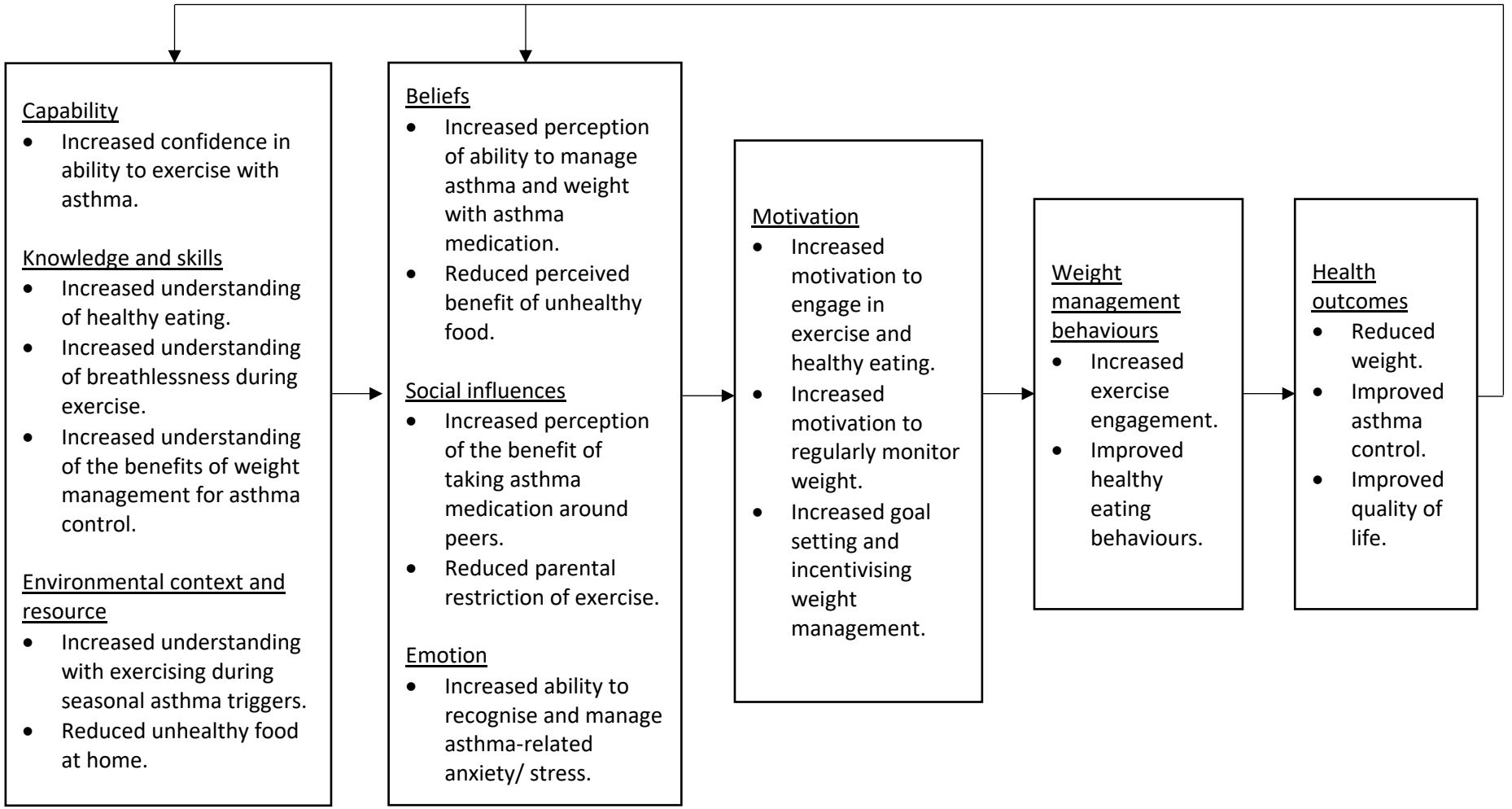


Figure 10: Logic model of the mechanisms of change for HCP weight management support

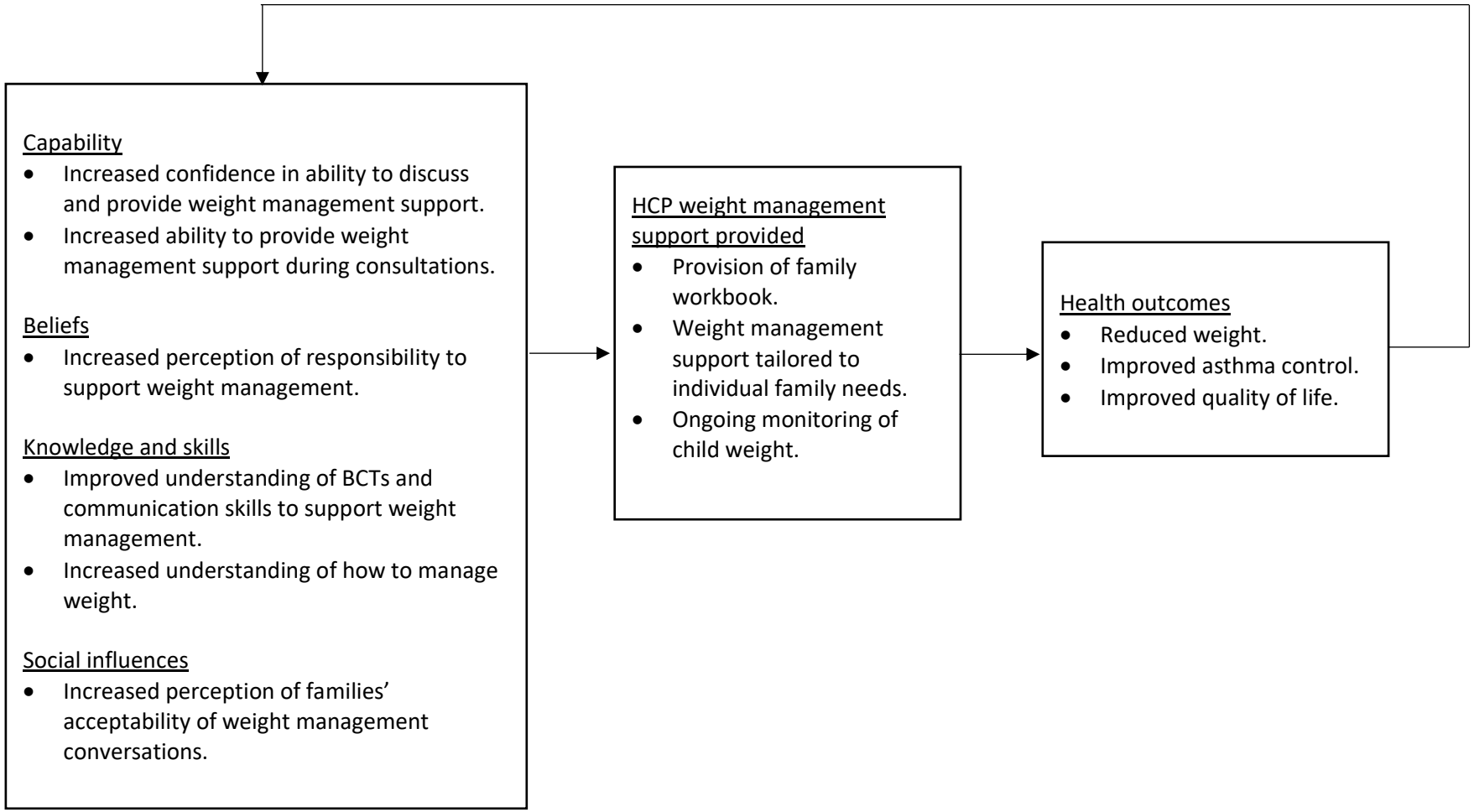


Table 18: A table of intervention behaviour change objectives and techniques identified to facilitate change in families

Theoretical domains	Change objectives	Behaviour change techniques
Capability	• To increase families' confidence in ability to exercise with asthma (self-efficacy)	6.2 Social comparison 15.1 Verbal persuasion about capability 15.2 Focus on past success 15.4 Self-talk 11.1 Pharmacological support
Beliefs	• To increase families' perceived necessity of asthma medication to facilitate asthma control and exercise • To address families concerns about medication outcomes • To decrease perceived benefit of unhealthy food and increase knowledge of asthma-diet relationship	5.1 Information about health consequences 9.2 Pros and cons 15.1 Verbal persuasion about capability 13.2 Framing/reframing 1.2 Problem solving
Knowledge and skills	• To increase families' knowledge of healthy eating behaviours • To increase families' knowledge of exercise in the context of asthma and the causes of breathlessness during exercise • To increase families' understanding of the underlying causes of asthma symptoms and the benefit of weight management for asthma control	5.1 Information about health consequences 4.1 Instruction on how to perform behaviour
Social Influences	• To increase young people's confidence in ability to explain asthma outcomes to peers • To increase young people's confidence in ability to take asthma medicines around peers • To increase parents' confidence in facilitating physical activity for young people	15.1 Verbal persuasion about capability 15.4 Self-talk 9.2 Pros and cons 1.2 Problem solving 8.1 Behavioural practice and rehearsal 3.2 Social support (practical)

Environmental context and resources	• To reduce availability of unhealthy food at home • To increase families understanding of exercising during seasonal asthma triggers	5.1 Information about health consequences 12.1 Restructuring physical environment
Emotion	• To increase families' ability to recognise asthma-related anxiety/ worry and manage stress constructively	11.2 Reduce negative emotions 1.4 Action planning 3.2 Social support (practical)
Motivation, goals and behavioural regulation	• To increase families' motivation to engage in weight management behaviours • To maintain families' motivation to engage in weight management behaviours over time	1.1 Goal setting (behaviour) 1.3 Goal setting (outcome) 1.2 Problem solving 1.4 Action planning 10.6 Non-specific incentive 10.3 Non-specific reward 1.5 Review behaviour goal(s) 1.7 Review outcome goal(s) 2.4 Self-monitoring of outcome(s) of behaviour

Table 19: A table of intervention behaviour change objectives and techniques identified to facilitate change in HCPs

Theoretical domains	Change objectives	Behaviour change techniques
Capability	• To increase HCPs confidence in ability to discuss overweight/ obesity, management plans and ongoing support with families • To increase HCPs ability to elicit and address barriers and facilitators to weight management during consultation time	4.1 Instruction on how to perform the behaviour 8.1 Behavioural practice and rehearsal
Beliefs **Knowledge and skills**	• To increase HCPs perception of responsibility to support families weight management • To improve HCP's understanding of BCTs, communication skills and approach to discussing weight with families (e.g. motivational interviewing, use of language) • To increase HCP's understanding of obesity management	15.1 Persuasive communication 5.1 Information about health consequences 4.1 Instruction on how to perform behaviour 8.1 Behavioural practice and rehearsal
Social Influences	• To change HCPs perceptions of family readiness for weight management support	6.3 Information about others' approval

Table 20: Ideas for practical application of BCTs for weight management engagement in families living with asthma

Change Objectives	Behaviour change techniques	Ideas for practical application
Capability	6.2 Social comparison	• Draw attention to other young people living with asthma and their exercise ability
	15.1 Verbal persuasion about capability	• Convince families that a goal of asthma management for the child is to be able to exercise, argue against self-doubts and assert that they can and will
	15.3 Focus on past success	• Advise family to describe or list previous experiences of successfully engaging in exercise
	15.4 Self-talk	• Encourage positive self-talk or self-encouragement before or during exercise
	11.1 Pharmacological support	• Encourage the use of asthma medication before or during exercise to facilitate exercise
Beliefs	5.1 Information about health consequences	• Provide information on the benefits of asthma medication and outcomes of treatment • Provide information on the relationship between asthma and diet
	9.2 Pros and cons	• List advantages and disadvantages for adhering to medication • List advantages and disadvantages for unhealthy diet choices
	15.1 Verbal persuasion about capability	• Tell family that they can successfully manage asthma and manage weight whilst living with asthma
	13.2 Framing/ reframing	• Suggest that families view exercise as improving asthma control as opposed to risking it • Suggest that families view breathlessness as a normal outcome of exercise as opposed to asthma symptoms

		• Suggest that families view unhealthy eating behaviours as worsening asthma control as opposed to improving emotions
	1.2 Problem solving	• Identify barriers to weight management and develop strategies to engage in weight management
Knowledge and skills	5.1 Information about health consequences	• Provide information on healthy eating • Provide information on the relationship between asthma, excess weight and weight management. • Provide information on the relationship between asthma and diet • Provide information on exercise and accommodating asthma
	1.1 Instruction on how to perform behaviour	• Advise how to interpret breathlessness as exercise intolerance or an asthma symptom
Social Influences	15.1 Verbal persuasion about capability	• Tell family that young people can successfully exercise whilst living with asthma, argue against self-doubts and assert that they can and will
	15.4 Self-talk	• Encourage parent and young person to use positive self-talk and self-encouragement for engaging in activity
	1.2 Problem solving	• Identify barriers to discussing asthma outcomes with peers/ using medication around peers and identify ways to overcome barriers
	9.2 Pros and cons	• List advantages and disadvantages of discussing asthma and using medication around peers
	8.1 Behavioural practice and rehearsal	• Practice how to tell friends about asthma and asthma outcomes during exercise
	3.2 Social support (practical)	• Advise young person to consider the benefits of supportive peer relationships and support • Advise young person to identify supportive peers

Environmental context and resources	5.1 Information about health consequences	• Provide information on environmental asthma triggers and how to reduce the risk whilst still engaging in exercise
	12.1 Restructuring physical environment	• Advise families to remove unhealthy food from the house to reduce availability • Advise families to exercise indoors during months perceived to carry seasonal threat to asthma control
Emotion	11.2 Reduce negative emotions	• Advise on stress management techniques to reduce asthma-related anxiety and fear of exercise-induced bronchoconstriction
	1.4 Action planning	• Identify unhelpful thoughts and emotions and recognise when stress management techniques are needed
	3.2 Social support (practical)	• Advise families to identify sources of social support for management
Motivation, goals and behavioural regulation	1.5 Goal setting (outcome)	• Families to collaborate with HCP and set weight loss goal to enable ongoing support
	1.1 Goal setting (behaviour)	• Families to collaborate with HCP and set realistic exercise/ diet goals for young person and record in family resource to enable ongoing support
	1.2 Problem solving	• Families to collaborate with HCP and identify families' barriers to weight management and discuss ways in which they could overcome them. Log in resource document to enable ongoing support
	1.4 Action planning	• Prompt planning of weight management engagement
	10.6 Non-specific incentive	• Advise families to identify a reward for young person if goals are achieved
	10.3 Non-specific reward	• Recommend young person receives reward for achieving goals

1.5 Review behaviour goal(s)	• Review families' healthy weight management behaviour engagement and consider modifying future goals accordingly
1.7 Review outcome goal(s)	• Review how much weight has been lost and consider modifying future goals accordingly
2.4 Self-monitoring of outcome(s) of behaviour	• Advise families to monitor weight at home and record in family resource

Table 21: Ideas for practical application of BCTs for weight management support in HCPs

Change Objectives	Behaviour change techniques	Ideas for practical application
Capability	4.1 Instruction on how to perform the behaviour	• Advise HCPs on how to elicit and address barriers and facilitators to weight management during consultations
	8.1 Behavioural practice and rehearsal	• Refer to e-modules so HCPs can role play providing weight management support using motivational interviewing
Beliefs	15.1 Persuasive communication	• Highlight the role of delivering healthy lifestyle messages as a core responsibility of job role
Knowledge and skills	5.1 Information about health consequences	• Provide information on the relationship between asthma, excess weight and weight management • Refer to e-modules on managing obesity
	4.1 Instruction on how to perform behaviour	• Advise HCPs on how to use families' preferred communication and provide motivational interviewing guidance • Advise HCPs on how to use BCTs in consultations
	8.1 Behavioural practice and rehearsal	• Refer to e-modules to role play providing weight management support using motivational interviewing
Social Influences	6.3 Information about others approval	• Inform HCPs that a lot of families' think favourably of HCPs raising the topic of weight management

7.5 Step 4: Preparing intervention programme materials

A practical plan was developed to deliver the selected BCTs (see Table 20 and Table 21). The APEASE criterion was again applied so that content and delivery considered the limited consultation time and resources available in NHS healthcare settings (Michie et al., 2014).

Intervention content

Two weight management resources were developed; one to support weight management in families of children living with asthma and another to support HCPs providing weight management support (see Appendix L and Appendix M). The resources contain psycho-educational and cognitive-behavioural strategies with motivational elements to improve the weight management engagement of families and the provision of weight management support by HCPs.

The family workbook provides education and behaviour change strategies on: asthma and weight; asthma and exercise; asthma and medication; asthma and diet; asthma and stress. The workbook contains activities to help families to identify their barriers to weight management; develop and practise strategies to overcome these barriers; challenge beliefs about exercise, asthma medication and diet; improve exercise self-efficacy; identify sources of social support and set goals and self-monitor weight (see Figure 11, 12, 13).

Figure 11: Setting SMART weight management goals in the family workbook.

Figure 12: An activity for families to list the advantages and disadvantages of asthma medication to challenge their beliefs about asthma medicines.

Benefits of taking my asthma medication	Bad parts of taking my asthma medication

Figure 13: An activity to increase families' exercise self-efficacy.

Examples of times asthma has not limited my physical activity:

1.

2.

3.

Remind yourself of these achievements before taking part in physical activity.

The HCP resource provides information on the asthma-obese phenotype; asthma outcomes from weight management; a step-by-step guide to weight management conversations; a guide to motivational interviewing; how to address specific asthma barriers to weight management (see Figure 14) and links to further useful resources, such as e-modules on understanding and managing obesity and a role-play simulation to learn and practise motivational interviewing.

Figure 14: Guidance for HCPs on how asthma concerns can interfere with weight management and how HCPs can help families to understand barriers in consultations.

Physical activity concerns

Family concern	Behaviour	How to support concerns
Asthma limits young person's ability to engage in exercise	Reduced or restricted exercise to decrease the risk to asthma control	• Reassure families that a goal of asthma management is for young people to be able to engage in exercise and address self-doubts • Ask families to recall times young person has successfully engaged in exercise and suggest they view exercise as a method to improve asthma control • *Suggest families look at p9-14 of the family resource*
Cold weather or high levels of pollen increase risk to asthma control when exercising	Reduced or restricted exercise on days perceived to be a risk	• Recommend families find indoor physical activity opportunities during days perceived to be a risk • Recommend young people cover their chest, throat and keep a scarf over their mouth if exercising in cold weather • *Suggest families look at p11-14 of the family resource*
Breathlessness during physical activity is a symptom of asthma	Reduced or restricted exercise to decrease the risk to asthma control	• Suggest that families view breathlessness as a normal outcome of exercise. • Provide guidance on how to identify differences in asthma symptoms and exercise outcomes • *Suggest families look at p9-14 of the family resource*

Mode of delivery

It is anticipated that HCPs would access and review the HCP resource online. Utilising the weight management conversation guidance and BCTs recommended in the resource, such as discussing the positive and negative consequences of asthma medication adherence, HCPs would support families' concerns. Subject to family preference, HCPs would then provide families with a paper- or web-based version of the family workbook. The family workbook offers interactive activities that HCPs and families could do together in consultations, such as: set goals, develop strategies to overcome barriers, record weight, and review progress and provide ongoing feedback in future consultations. To address the limited time available for opportunistic behaviour change interventions in consultations, HCPs could also ask families to complete workbook modules at home in between consultations. If feasible, it may be useful for families to receive motivational calls, texts or emails in between consultations to encourage and sustain behaviour change in families and review workbook modules. Completing homework tasks in between consultations,

practicing behavioural skills learned in modules and text-based communication has been found to have good acceptability and health outcomes in previous CBT and health interventions (Webb et al., 2017; Pramana et al., 2018; Harari et al., 2018).

7.6 Step 5: Planning implementation strategies

Effective implementation of an intervention relies on how acceptable it is to the recipients (Sekhon, Cartwright & Francis, 2017). As stated by the Medical Research Council framework (MRC, 2020), stakeholders and users should be included in intervention development. Qualitative methods can be useful to gain insight on content components and application strategies, and the ease of use and satisfaction with resources. Gaining this feedback through a series of focus groups with families and with HCPs "may be required to progressively refine the design" (MRC, 2020, p10). Therefore, before piloting the intervention, focus groups should be conducted with a small number of families and HCPs who have used the intervention to examine acceptability to users and identify areas for improvement.

7.7 Step 6: Designing a process and outcome evaluation

Process Evaluation

To assess the understanding of the potential barriers and facilitators to using the intervention resources and to identify areas for improvement, a process evaluation would be carried out (see Figure 15). The Reach Effectiveness Adoption Implementation Maintenance (RE-AIM) framework (Glasgow et al., 1999) was designed to evaluate the impact of interventions at multiple levels (e.g. individual, organisation) and assess the external validity of interventions in real-world settings. This framework could be used to conduct a process evaluation in the following way:

Reach: The number of participating families and their characteristics would be collected through a survey. The characteristics would include data on age, gender, ethnicity, parents' employment status, weight, and asthma control.

Effectiveness: Following the intervention delivery, focus groups would be conducted to explore families' perceptions of the effectiveness of the intervention workbooks at changing their weight management behaviours (e.g. diet, exercise), adherence to asthma medication, emotional wellbeing and their understanding of the asthma-obesity relationship. Furthermore,

a reflective tool guided by the Health Behaviour Competency Framework (Dixon & Johnston, 2010) would be developed and implemented at baseline and post-intervention to assess changes to the determinants of HCP weight management support. The reflective tool would measure HCPs confidence in their competence to: communicate with and engage families in conversations about weight; adapt weight management support to individual families; manage families' expectations of the intervention; deliver weight management information; structure and pace interventions appropriately; and recognise barriers and facilitators to weight management.

Adoption: Separate focus groups with families and HCPs post-intervention will review their acceptance of the intervention content and delivery, it's relevance for changing weight management behaviours, their perceived barriers to using the intervention material and how they could be overcome.

Implementation: Focus groups will be used to identify HCPs fidelity to the weight management conversation guidance and recommended strategies to address families' asthma-related concerns. How frequently they used the guidance and strategies and reviewed families progress will also be explored. Barriers and facilitators to using the HCP resource and family workbook will also be investigated during focus groups.

Maintenance: HCPs would record the completion of family workbook modules and the dates of child weight being recorded in the workbook at follow-up asthma consultations. Within the focus groups, HCPs and families would be asked whether they maintained following guidance from the intervention resources and the challenges on continuing to do so.

Effect Evaluation

To assess intervention effectiveness, data would be collected at baseline, post-intervention and three months' post-intervention. This would involve a triangulation of health measures to determine effectiveness on changing the determinants of weight management in children with asthma, including: objective measures for child weight (measured in clinic) and lung function (clinical pulmonary function test in clinic); and self-reported measures of asthma symptoms (Asthma Control Questionnaire: Jupiter et al., 1999), parent and young person's asthma-related anxiety (Parent Asthma-Related Anxiety Scale, Youth Asthma-Related Anxiety Scale: Bruzzese et al., 2011), child activity (Godin Leisure-Time Exercise Questionnaire: Godin & Shepard, 1985),

parenting of child activity (Parenting Related to Activity Measures: Haycraft et al., 2015), parental feeding practices (Comprehensive Feeding Practices Questionnaire: Musher-Eizenman et al., 2007), child eating behaviours (Children's Eating Behaviour Questionnaire: Wardle et al., 2001), medication beliefs (Beliefs about Medicines: Horne et al., 1999).

Figure 15: Evaluation model for the intervention

Process Evaluation

Dimension	Measure
Reach: Number and characteristics of participating families.	Survey at baseline and post-intervention.
Effectiveness: Perceived effectiveness at changing families weight management behaviours, adherence to asthma medication, emotional wellbeing and understanding of asthma-obesity relationship, and HCPs confidence in providing support.	Focus groups post-intervention. Survey at baseline and post-intervention.
Adoption: Family and HCPs acceptance and satisfaction with intervention delivery and content.	Focus groups post-intervention.
Implementation: HCP and families use of intervention resources.	Focus groups post-intervention.
Maintenance: Completion of family workbooks and ongoing use of HCP and family guidance.	Focus groups post-intervention. HCP records of families' workbook use.

Effect Evaluation

Outcomes	Measure
Behavioural outcomes 1. Child activity 2. Parenting of child activity 3. Parental feeding practices 4. Child eating behaviours 5. Medication beliefs	*Baseline, post-intervention and 3 months after delivery* 1. Godin Leisure-Time Exercise Questionnaire (Godin & Shepard, 1985) 2. Parenting Related to Activity Measures (Haycraft et al., 2015) 3. Comprehensive Feeding Practices Questionnaire: Musher-Eizenman et al., 2007 4. Children's Eating Behaviour Questionnaire: Wardle et al., 2001 5. Beliefs about Medicines: Horne et al., 1999
Health outcomes 1. BMI z-score 2. Asthma control 3. Asthma-related anxiety	*Baseline, post-intervention and 3 months after delivery* 1. Objective weight measures in clinic 2. Asthma Control Questionnaire (Jupiter et al., 1999); lung function tests in clinic 3. Parent Asthma-Related Anxiety Scale and Youth Asthma-Related Anxiety Scale (Bruzzese et al., 2011)

7.8 Discussion

Following the step-by-step protocol of Intervention Mapping (Bartholomew et al., 2016), this chapter outlines the development of an evidence-based and theory-informed intervention to support paediatric asthma weight management in an NHS setting. As the use of Intervention Mapping has provided a systematic process to intervention development, it has allowed the steps and choices of this intervention to be thoroughly described. The transparent reporting follows guidance by the UK Medical Research Council and TiDIER (MRC, 2020; Hoffman et al., 2014) and allows for future implementation of the intervention as well as evaluation to increase understanding of the intervention components. The intervention aimed to support weight management by addressing health behaviours in families as well as the provision of weight management support by their HCPs. Theoretically underpinned behaviour change techniques were embedded into resources that intended to change families and HCPs confidence, beliefs, and knowledge and skills in weight management.

Resources containing psycho-educational and cognitive-behavioural strategies were developed for both families and HCPs to address barriers to weight management. The family workbook includes a broad range of topics, such as dietary and physical activity education that have previously been used in effective asthma weight management interventions (Jensen et al., 2013; Martin et al., 2016). The family workbook also contains activities, such as goal setting and cognitive reframing that allow families to tailor the intervention to their own needs. Interventions that can be tailored have previously been found to be more effective at supporting weight management (Ryan et al., 2019). Furthermore, previous research suggests intervention resources used alongside email- and/or telephone-mediated support have shown enhanced engagement and significant weight loss (van Weir et al., 2009; Alkhaldi et al., 2016). While it is not possible to observe families' engagement in this intervention, steps will be undertaken to assess user views and experiences of using the intervention resources within the process evaluation.

The HCP resource aimed to enhance the weight management support that HCPs provided to families' living with asthma during consultations. This intervention is consistent with Public Health England's 'Make Every Contact Count' scheme, which encourages HCPs to provide brief opportunistic interventions at every contact (MECC, 2020). HCPs are ideally placed therefore, to provide short, cost-effective interventions as they have regular contact with families in asthma review consultations (Vijay et al., 2015). While HCP behaviour change interventions can

increase patients' intention to change behaviour, additional interventions outside of healthcare settings may be needed to achieve improvements in health outcomes (Butler et al., 2013). The World Health Organisation obesity and overweight factsheet (WHO, 2020) supports this, reporting that change to individual behaviour can "only have its full effect where people have access to a healthy lifestyle". Therefore, alongside recommendations for HCPs to refer families to other specialist support when necessary, family weight management workbooks were developed.

A strength of this intervention is its consideration of the time constraints under which HCPs are working and the availability of existing resources. Despite HCPs' understanding of the importance of implementing opportunistic behaviour change interventions, limited time to do so and viewing the health behaviour as unrelated to the clinical appointment are often described as a barrier by HCPs (Bradbury et al., 2018). Additionally, young people living with asthma report a lack of understanding regarding the relation of weight and asthma control; this can also be a barrier to behaviour change (Alexander et al., 2018). The intervention resources developed here provide BCTs that HCPs can use within consultations with limited training and allow for further educational and cognitive-behavioural activities to be completed outside of a consultation. The resource also highlights the importance of weight management for both HCPs and families by emphasising the relationship between weight and asthma outcomes. As paediatric weight management interventions do not typically include advice tailored to the needs of asthma, including asthma-specific guidance in these resources may increase acceptability (Alexander et al., 2018).

While guidance was followed for how to map theoretical constructs to appropriate BCTs (Michie et al., 2005; 2014), there is no precise guidance on how to deliver intervention content in different populations. Therefore, it is essential to use a "person-based" approach and involve target intervention users and other stakeholders to co-design intervention delivery (Yardley et al., 2015). Involving the stakeholder and users can be labour and time-intensive. Nevertheless, it can provide useful insight to the relevance of the intervention as well as whether the intervention content is delivered in a way that is feasible and engaging to its users (Majid et al., 2018; Sin et al., 2019). Such methods of stakeholder and user involvement are becoming more widely recognised and can generate novel ideas for interventions that may not have been identified through academic development alone (O'Brien et al., 2016). It can facilitate a multidisciplinary team, allowing skills to be drawn from a variety of experts (O'Brien et al., 2016)

and is linked to increasing the success of intervention outcomes (Langley et al., 2018). While the intervention resources were developed with input from target families and HCPs, having given their views on intervention components within the qualitative studies, more input on intervention content, design and delivery would provide value in terms of maximising user acceptability and engagement. Ideas on how this could be done are discussed in step 5 and 6.

7.9 Conclusion

This intervention was designed to increase weight management engagement in families of children living with asthma and the support provided by their HCPs. Intervention development was informed by psychological theory and research evidence and includes psycho-educational and cognitive-behavioural strategies to support weight management in children and young people with paediatric asthma. Further input and review from target users and other stakeholders to revise the resources are recommended before the piloting of this intervention. Implementing a pilot intervention and its evaluation may offer further insight into how to best incorporate effective weight management alongside clinical guidelines to asthma management.

The next and final chapter provides a discussion of all studies presented in this thesis within the context of what is already known and what this thesis contributes to the evidence-base regarding weight management in paediatric asthma.

CHAPTER 8

General Discussion

8.1 Introduction

This chapter begins with a summary of the background literature relating to asthma and obesity, before re-stating the aims of the thesis, outlining where and how the aims have been met. Against this backdrop, key findings from the systematic review and empirical studies are synthesised and discussed with reference to the development of a weight management intervention specifically for families of children living with asthma. Following this, methodological issues arising from the research are discussed, alongside directions for future research and implications for practice.

8.2 Summary of background and aims

Asthma is one of the most common chronic illnesses in children (WHO, 2019). Young people living with asthma have a 51% increased risk of becoming obese compared to their peers (Chen et al., 2017). Living with comorbid asthma and obesity is understood to modify the clinical characteristics of asthma, increasing the prevalence and severity of symptoms experienced (Peters et al., 2018). Currently, there is no clear guidance on how to support a healthy weight in this population. Moreover, the number of potential mechanisms underlying the asthma-obesity relationship (Peters et al., 2018) makes understanding how to optimise asthma-specific weight management difficult. So far, physical activity, diet, asthma medication and anxiety have all been associated with the aetiology and/ or management of both asthma symptoms and obesity. Nevertheless, research on living with comorbid asthma and obesity, how these factors interact and how the interaction influences weight management, remains limited.

Thus, the overarching aim of this thesis was to explore the relationship between paediatric asthma and overweight/ obesity in order to develop an asthma-specific weight management intervention.

The objectives of this thesis were:

1. To evaluate the effectiveness of existing paediatric weight management interventions for asthma and describe their use of theory, mode of delivery and behaviour change techniques (Chapter 2).

2. To explore the experiences, views and behaviours of families of children living with asthma, and the healthcare professionals (HCPs) working with children who have asthma, concerning weight management (Chapters 3 and 4).
3. To examine parental and child attitudes towards feeding, eating and physical activity in families living with and without asthma (Chapters 5 and 6).
4. To synthesise the formative research to develop a weight management intervention tailored to the needs of families with paediatric asthma, and the HCPs working with children living with asthma (Chapter 7).

8.3 Principal Findings

A synthesis of the findings from the systematic review, qualitative and quantitative empirical studies, and the development of an asthma-specific weight management intervention generated four key themes: child weight, physical activity, dietary influences, and asthma-specific weight management. These themes will be explored in the context of existing research. The influence of asthma medication and anxiety run throughout the themes and will not be discussed separately.

8.3.1 Child Weight

An increased child weight in young people living with asthma was reported. Findings from Chapter 5 found that parents of children living with asthma reported their children to have a higher weight compared with those living without asthma. This supports previous research which has identified an increased obesity risk in children living with asthma (Chen et al., 2017; Contreras et al., 2018). In particular, the findings in Chapter 5 support previous findings that suggest there to be an association between increased child weight and worse asthma control (Forno et al., 2017), as parents of children living with inadequately controlled asthma in this programme of work reported a higher child weight than parents of children living with controlled asthma. These findings may offer some explanation as to why, in the present research, parents of children living with asthma reported a greater concern about child weight.

8.3.2 Physical activity

Families' engagement in physical activity appeared to be dependent on their beliefs about the outcomes of exercise on asthma control. Some families expressed fear of asthma exacerbation during exercise or uncertainty regarding their child's exercise parameters which invoked a perceived need to take preventative steps, such as reducing or limiting exercise opportunities.

Adjustment of exercise was thus reported as a method for managing asthma symptoms in the qualitative studies (Chapters 3 and 4), highlighting the significance of self-efficacy in families when engaging in exercise. Qualitative reports of parental hypervigilance around child activity where children have asthma were corroborated by quantitative findings in Chapter 5, as parents of children living with asthma reported higher monitoring of child exercise and increased control of active behaviours. Moreover, control of active behaviours was reported to be higher in the inadequately controlled asthma sample compared to the controlled asthma sample in Chapter 6, suggesting that parents' perception of asthma control may influence their restriction of child activity. Inactivity due to fear of exercise-induced bronchoconstriction was also reported by HCPs in Chapter 4, to contribute to child overweight/ obesity; leading to a vicious cycle of weight gain, worse asthma control, difficulty partaking in exercise and further weight gain.

Families reported uncertainty of the types of exercise that were considered safe to take part in with asthma, expressing a sense of doubt about whether asthma medication controlled asthma symptoms in Chapter 3. Alongside this, HCPs in Chapter 4 reported that families often misinterpret the usual symptoms of breathlessness during exercise as a symptom of asthma. It is possible that incorrect identification of breathlessness creates a positive feedback loop reinforcing asthma exercise parameters, uncertainty in medication and the need to control exercise. Families reports of concern about asthma medication in Chapter 3 were extended in Chapter 6, as parents of children living with inadequately controlled asthma reported greater necessity and concern about asthma medication than the parents of children living with adequately controlled asthma. Furthermore, moderation analysis indicated that asthma control moderated the positive relationship between specific concerns about asthma medication and parental control of active behaviours. This relationship was found to be significant in the inadequately controlled asthma sample. It may, in part, explain previous findings of greater parental control of active behaviours and increased sedentary behaviours in children living with worse asthma control (Westergren et al., 2017; Lu et al., 2016).

Qualitative findings (Chapters 3 and 4) also highlight how young people's exercise context was appraised for risks to asthma control before engaging in physical activity. During months perceived to carry environmental risks to asthma control, such as winter and summer months, families and HCPs reported more challenges to exercise engagement and increased sedentary activity behaviours. The safety of exercise environments may help to explain why there were

no differences in parental monitoring of child activity between the controlled and inadequately controlled asthma groups. Parents of children living with asthma may perceive their children as more vulnerable to environmental threats due to the nature of asthma regardless of asthma control (Shaw et al., 2010). In contrast, findings from Chapter 5 show a higher level of pressure to exercise in parents of children living with asthma than without asthma. It is possible that ambivalence between understanding the need to exercise for health and uncertainty of how to do so safely interferes with exercise behaviours and increases obesity risks in asthma.

Social contexts were also found to be of importance. Young people in Chapter 3 for example, discussed how the anticipation of negative social stigma from excess weight, using asthma medication and breathlessness during activity created a reluctance to engage in physical activity. These findings reflect those found in Chapter 4, whereby HCPs reported low body satisfaction and having to explain asthma medication to be a barrier to young people exercising around their peers. Limiting exercise and talking to friends about asthma was thought to increase confidence in exercise participation. In contrast, one young person in Chapter 3 believed normalising symptoms and non-adherence to medication during activity overcame stigma as exercise engagement was necessary for peer acceptance. Differences in how social-concept and social acceptance are evaluated may explain why some young people living with asthma use inappropriate strategies such as exercise avoidance or medication non-adherence (Hughes et al., 2017). Exercise avoidance and medication non-adherence may feed into cycles of poor asthma control, increased difficulty exercising and increased weight. Moderation analysis in Chapter 5 highlighted the importance of asthma control for weight management; only when asthma was controlled did child activity predict lower child weight.

8.3.3 Dietary influences

Challenges to maintaining a healthy weight were reported to emerge from the environment. Families and HCPs in Chapters 3 and 4 described an obesogenic environment in which children have easy access to unhealthy food and where large portion sizes have become the norm. The influence of this environment, and family and peer food choices, were reported to influence parental feeding practices and child eating behaviours. Nevertheless, analyses in Chapter 5 did not find the environment to correlate with child BMI in the asthma or no asthma sample. However, it is possible a better understanding of nutrition might help to support and reduce ~~these~~ unhealthy parental feeding and child eating behaviours, as increased teaching about nutrition was associated with a lower child weight in the asthma sample in Chapter 5.

Further findings from this thesis suggest that parents of children living with asthma may be more likely to use different parental feeding practices to parents of children living without asthma. While HCPs perceived parents to use food as a tool to alter child behaviour in Chapter 4, parents reported a responsibility to monitor and restrict foods that they believed made symptoms worse (Chapter 3). This responsibility emerged through families' own experiences, as the connection between diet and food was not discussed in consultations. These reports mirror previous findings of dietary adjustment to reduce the risk of asthma exacerbation (Farnesi et al., 2019; Garbutt et al., 2016). Parents associating food with asthma control and modifying food choices may explain the findings in Chapter 6 of increased restriction of food for health in young people living with inadequately controlled asthma.

HCPs in Chapter 4 also perceived parents to use food as a tool to compensate for restrictions imposed from living with asthma. Findings from Chapter 5 (the first research to quantify the parental feeding practices of parents of children living with asthma), offers support for this. Here, parents of children living with asthma reported a greater use of unhealthy feeding practices**,** such as the use of food to regulate emotions and restriction for weight control, than the parents of children without asthma. These findings sit within a body of literature that suggest increased use of food to regulate emotions and restrictive feeding practices are associated with a higher child BMI in a healthy population (Stifter & Moding, 2018; Rollins, Loken, Savage & Birch, 2014). A moderation analysis in Chapter 5 indicated that the relationship between parental restriction of food for weight control and child weight was only significant in the sample with controlled asthma. It could be speculated that parents of children living with inadequately controlled asthma may be less restrictive with food or use food as a method of emotion-orientated coping (Pagnani et al., 2007; Raspopow et al., 2013). Alternatively, weight gain from steroids often used as asthma medication in inadequately controlled asthma may increase weight regardless of parental restriction of food (Han et al., 2019).

Further examination of the influence of asthma control on parental feeding practices in Chapter 6 indicates that parents of children living with inadequately controlled asthma report increased child control of feeding, use of food for emotion regulation, use of food as a reward, restriction of food for weight control and restriction of food for health compared to parents of children who have controlled asthma. The parents of children living with inadequately controlled asthma also reported higher levels of asthma-specific anxiety, consistent with previous findings (Avcil

et al., 2019). This was the first study to explore the influence of parental asthma-related anxiety on parental feeding practices. Moderation analysis indicated that the relationship between parental asthma-related anxiety around severity and treatment/ disease-related restrictions, and the use of food to regulate emotions, was moderated in only the inadequately controlled asthma sample. These finding support other literature suggesting that ongoing stress in parents of children living with a chronic illness can alter feeding practices (Hughes et al., 2015). The increased child weight in the inadequately controlled asthma sample found in Chapter 6 may be, in part, explained by higher levels of parents using food to regulate their child's distress and their own empathetic response (Selby et al., 2018; Hamburg et al., 2014). Feeding practices, such as increased use of food as a reward or to regulate emotions, may also increase adolescents own difficulty to regulate their appetite and further increase child weight (Aparico et al., 2016).

As well as parental feeding practices, findings from this thesis support previous findings that the eating behaviours of young people living with asthma are different to that of their peers without asthma (Hatton et al., 2014; Moreau et al., 2009; Olguin et al., 2016). HCPs and families also reported an increase in young people's appetite as a side effect of asthma medication which was thought to lead to weight gain. Both HCPs and families reported a sense of hopelessness at managing weight whilst taking steroid medication, which at times influenced medication non-adherence as a strategy to manage weight. It is important to note that one parent reported how negative emotions created by the expectation of weight gain from steroid use led to inconsistent eating behaviours, such as binge eating and food restriction. Such eating behaviours and non-adherence as a strategy to manage weight may increase weight through several pathways; inconsistent eating behaviours, suboptimal asthma control and increased exercise limitations. Further findings in this thesis quantify a relationship between asthma and emotional eating, as parents reported that children living with asthma were more likely to emotionally overeat and desire to drink than their peers without asthma.

8.3.4 Asthma specific weight management

In Chapter 2, a systematic review of asthma-specific weight management interventions highlighted weight management as having the potential not only for weight reduction, but also for improving asthma control in young people living with asthma. The asthma-specific weight management interventions included in this review consisted of a variety of components, including; physical activity sessions, diet alteration, education on physical activity, diet, asthma,

and obesity, and cognitive behavioural strategies. This systematic review was the first to identify the theory, mode of delivery and use of BCTs within asthma-specific paediatric weight management interventions. In line with previous research (Prestwich et al., 2014), the review found a limited description of theory used, with only two interventions reporting a theoretical rationale behind an intervention development and the application of theory. In the interventions with a significant group allocation effect, individual family sessions were the most frequently used format of intervention delivery and the most frequently observed BCTs were; instruction on how to perform behaviour, self-monitoring of behaviour, social support (unspecified), demonstration of the behaviour, and behavioural practice/ rehearsal. However, results should be interpreted with caution due to the limited description of interventions. Due to only three of the eight included interventions providing accessible protocols online, it is possible that additional theory, modes of delivery and BCTs that have not been reported within the text were used. As a result, it is challenging to infer what intervention characteristics are effective at modifying weight management behaviours in children with asthma and reproducing these results.

Limited weight management support appeared to be available for the families of young people living with asthma and obesity in this thesis. Families in Chapter 3 for example, reported that consultations focused on asthma medication and guidance around weight management behaviours, such as exercise or diet, were limited or not provided. As discussed in Chapter 4, several barriers to HCP provision of weight management support included insufficient training, restricted time in consultations and uncertainty of the weight management referral protocol. These reports collaborated with the families in Chapter 3 who experienced limited referrals or family weight management programmes within the community, and despite feeling ill-equipped, families felt a responsibility to manage weight alone. When weight management or exercise groups were available, families considered the practicalities, cost of accessing and young people's motivation to be barriers to accessing them.

Developing families' understanding of the asthma-obesity relationship was considered vital in providing weight management support. HCPs and families in Chapter 3 and Chapter 4 discussed how a greater understanding of the relationship between exercise and diet with asthma would help increase families' receptiveness to weight conversations and motivate their engagement in weight management behaviours. Alongside this, HCPs and families also considered asthma medication and strategies to manage anxiety to be essential parts of a weight management

programme. As demonstrated in Chapter 6, families' beliefs about medication and their asthma-related anxiety can influence weight management behaviours. Therefore, their elicitation and modification would be necessary to manage young people's weight successfully.

An evidence-based and theory-informed weight management intervention tailored to the needs of asthma was developed using the formative research discussed. Intervention development followed the steps of Intervention Mapping (Bartholomew et al., 2016) and TiDier reporting guidelines (Hoffman et al., 2014) to provide transparency for future implementation and evaluation. The intervention resources developed for families and HCPs offer a cost-effective and practical approach to weight management that requires limited weight management or behaviour change training for healthcare organisations. The use of the intervention resources is also developed in line with Make Every Contact Count recommendations and takes into consideration HCPs' time restraints. By associating weight management with asthma management, it may work towards motivating family weight management engagement and ease the discomfort of discussing weight in consultations (Alexander et al., 2018). Furthermore, the inclusion of psycho-educational and cognitive-behavioural strategies allows families to tailor weight management to their own needs which may enhance intervention effectiveness (Ryan et al., 2019). At present, the intervention resources include modules on the asthma-obesity relationship, exercise, medication, diet, stress, and setting SMART goals. However, before the intervention can be piloted and evaluated, the resources require review and refinement by service-users and stakeholders to ensure they are acceptable and engaging for the target audience. This is in line with MRC intervention development guidelines and can help to increase intervention acceptiveness and engagement, and improve recruitment, retention and feasibility of intervention delivery (MRC, 2020; Majid et al., 2018; Sin et al., 2019).

8.4 Methodological considerations

A mixed-methods design was used in this thesis to offer a problem-driven approach to explore the asthma-obesity relationship. In line with the critical realist perspective, which accepts alternative accounts of any phenomenon (Maxwell & Mittapalli, 2010), mixed-methods research (MMR) provided an opportunity to gain a rich understanding of families' and HCPs' experiences while also corroborating and expanding on the underlying relationships identified. The successful triangulation of findings to develop an asthma-specific weight management intervention indicates trustworthiness in the qualitative and quantitative studies (Zohrabi,

2013). While there is little consensus on how to ensure creditability in MMR, the Good Reporting of a Mixed Methods Study guideline (O'Cathain, Murphy & Nicholl, 2008) has been followed. Furthermore, the thesis scores highly on the Pluye and colleagues (2009) critical appraisal checklist for MMR (see Table 22).

Table 22: A table based on Pluye and colleagues (2008) MMR critical appraisal checklist.

Types of mixed methods study components	Methodological quality criteria	Presence (1) /absence (0)
Qualitative	Qualitative objective or question	1
	Appropriate qualitative approach or design or method	1
	Description of the context	1
	Description of participants and justification of sampling	1
	Description of qualitative data collection and analysis	1
	Discussion of researchers' reflexivity	1
Quantitative	Appropriate sampling and sample	1
	Justification of measurements (validity and standards)	1
	Control of confounding variables	1
Mixed Methods	Justification of the mixed methods design	1
	Combination of qualitative and quantitative data collection-analysis techniques or procedures	1
	Integration of qualitative and quantitative data or results	1
Total		12/12

Another methodological consideration relates to the use of a cross-sectional sample in the quantitative studies. As a result, the causality of relationships identified cannot be inferred and require further examination to gain an understanding of their nature. Future research should use longitudinal designs to help identify the direction of the relationships reported in this thesis. Furthermore, the quantitative data was self-reported, and the child eating, exercise frequency and asthma control data was obtained by parental report. Although the reliability of self-reported data should be considered; efforts were made to remove data from participants that failed an attention check question, completed the survey in under 6 minutes and/ or had incompatible patterns in the dataset. Weight and height data measured over six months prior to the study were also removed. While future research should consider the informants of data as well as the accuracy of measures, findings from child interviews do corroborate quantitative associations of emotional over-eating in the asthma sample.

Furthermore, despite efforts to recruit from a range of places, the representativeness of the participants was limited. In particular, a large majority of participants in the quantitative studies were White British. Although exploring how different ethnic factors influence weight

management behaviours in asthma was not within the scope of this thesis, findings from Chapters 3 and 4 highlighted the importance of the cultural context for the provision of food. Furthermore, only one father participated in the qualitative studies, suggesting that the views and experiences of fathers may be underrepresented. Low male recruitment may reflect the fact that mothers adopt the primary caregiver role within many families or experience a more significant burden from caregiving (Sharma et al., 2016; Swinkels et al., 2019). Nevertheless, future research must recruit from more diverse backgrounds and a higher proportion of fathers to obtain a greater understanding of the role of family structure and dynamics in child weight management.

The sensitivity of the topic of weight should also be acknowledged. Due to the stigma attached to weight (Puhl et al., 2020); discussing weight during the interviews may have presented a challenge for young people (Alexander et al., 2018). To minimise potential distress, the doctoral researcher consciously refrained from using stigmatising language such as “overweight” or “obesity” throughout interviews. Further efforts were taken to try and reduce the power imbalance between interviewer and participant by giving young people the freedom of choice over where and when to have the interview as well as trying to build rapport and appear informal beforehand. However, it is possible that the sensitive nature of weight restricted the depth at which some young people shared their views or experiences as one young person, in particular, appeared to be unsettled. The use of other qualitative approaches, such as arts-based methods or open-ended questionnaires may help to decrease discomfort and unequal power relations in future research as well as making interviews more inclusive for younger participants (Kutrovátz, 2017).

Consideration should also be given to the models and frameworks used in the process of developing the intervention in Chapter 7. It should be recognised that the models and frameworks used originate from the recent field of behavioural science and that the understanding of behaviour and behaviour change is evolving (Davis et al., 2015). Nevertheless, the systematic approach used in Intervention Mapping provides a transparent framework. Thus, all steps and choices made in the development of the asthma-specific weight-management intervention can easily be evaluated and refined as the knowledge base develops. Furthermore, Intervention Mapping acknowledges the variability in contexts, populations and settings and allows relevant theories to be incorporated in intervention design unlike other frameworks such as the Behaviour Change Wheel (Michie et al., 2014). The TDF provides insight

from 33 theories and allows for a broader consideration of potential intervention barriers and facilitators to weight management than the use of a more narrowly focused theory (Cane et al., 2012). However, the challenges of mapping BCTs to theoretical constructs should be acknowledged. While some guidance is provided by Michie and colleagues (Michie et al., 2008; 2014), it does not provide explicit direction with regards to the selection of effective BCTs and some may not apply to specific contexts or populations. As a result, the selection of some BCTs was based on knowledge of health psychology theories and practices and discussion, drawing upon expertise within the research team.

8.5 Future Research

To continue building on contributions made by this thesis, future research should address the limitations outlined above and consider the following issues:

- Obtain feedback on the asthma-specific weight management resources developed in Chapter 7 through focus groups and individual consultation, and conduct a pilot intervention and evaluation following the steps outlined.
- Explore weight management experiences in different child age ranges to help understand weight management barriers specific to different age groups (e.g. 8-12 years; 13-16 years).
- Following the publication of more paediatric asthma-specific weight management interventions, continue to build a knowledge base of what theory and BCTs are associated with behaviour change in this population.
- Consider the feasibility of a family-centred asthma weight management group that enables peer support.
- Explore adolescents' experiences and perceptions of asthma medication on weight management and its influence on eating behaviours.
- Examine how young people living with and without asthma perceive exercising with excess weight, breathlessness and medication use to influence their social acceptance.
- Investigate what influences the prioritisation of weight management or asthma control when engaging in exercise or adhering to medication.

8.6 Implications for Research

The thesis highlights a limited reporting of the characteristics of paediatric asthma-specific weight management interventions. This created challenges when assessing and evaluating the

effectiveness of weight management interventions designed for young people living with asthma. In order to develop an understanding of the causal pathways that may lead to behaviour change in paediatric asthma, greater clarity is needed in future reporting. Paediatric weight management interventions must adhere to reporting guidelines, such as the CONSORT (Schulz et al., 2011) and TIDieR (Hoffmann et al., 2014) to enhance their transparency. Furthermore, the use of standardised terminology throughout reports will aid the identification of intervention characteristics, and support intervention evaluation and replication in other settings and populations. Researchers should consider using a context reporting checklist or taxonomy (Pfadenhauer et al., 2017; Hoffman et al., 2014) to help inform other researchers of the transferability of the intervention to their context. The theoretical rationale behind interventions and how theory has been applied should also be reported. An understanding of the theoretical underpinnings will help to develop a knowledge base of which underlying mechanisms of interventions may or may not facilitate behaviour change, and optimise future intervention development. Finally, a protocol of the intervention development should be published in an open-access format. Unless information about intervention development is accessible, future researchers cannot reliably replicate interventions in appropriate contexts and learn from them.

8.7 Implications for Practice

The overall findings of this thesis highlight the need for HCPs to integrate weight management into asthma management. Currently, HCPs focus on medicalised care during healthcare appointments, yet research highlights the importance of young people's weight and lifestyle choices, such as exercise and diet, for asthma control (Peters et al., 2018). Such evidence proposes that weight management and holistic care should therefore become part of providing asthma support, as opposed to being perceived as taking time away from the consultation. To address paediatric obesity in children with asthma, HCPs must support families' understanding of the role of weight management in asthma and normalise discussing topics such as attitudes towards exercise, parental feeding and child eating, and beliefs about medication in consultations. If the relationship between asthma and weight is brought to families' attention upon diagnosis, it may increase awareness of the importance of weight management earlier and work as a preventative measure. Furthermore, establishing weight management, exercise and diet as components of controlling asthma will work towards making conversations around weight more acceptable to families (Alexander et al., 2018).

This thesis has outlined how an evidence-based and theory-informed asthma-specific weight management resource could be used to help support a healthy weight in families living with asthma. Limited weight management resources and insufficient weight management training have been highlighted as barriers to supporting families with weight management. Asthma-specific weight management resources, such as the ones developed in Chapter 7, should be used to enable cost-effective support that requires little HCP training on weight management and behaviour change. Alongside this, the use of motivational interviewing techniques within consultations should be promoted to facilitate the elicitation of factors that may influence weight and asthma outcomes. Motivational interviewing has been found to enable a patient-centred approach to co-designing bespoke weight management plans that can help support individuals' unique challenges (Reims & Ernst, 2016).

HCPs should also find strategies to expand on the ways in which care is provided to families. This thesis demonstrates that families perceive HCPs to focus on treating asthma as an objective domain. As a result, families felt isolated when managing asthma and solely responsible for supporting a healthy weight. It is vital that HCPs show an understanding of the difficulty of balancing asthma management with other demands faced by families and incorporate empathy into consultations. HCPs should consider and elicit asthma-related concerns or anxiety as they may not only interfere with asthma and weight management but the psychological well-being of the whole family. At present, this is difficult due to short consultation times. Where possible, the benefits of facilitating support outside of consultations should be considered, such as developing or referring to an asthma peer support group.

8.8 Conclusion

Using a mixed-methods approach to explore the relationship between paediatric asthma and obesity, findings from the studies reported within this thesis provide new evidence on the interdependent nature of the asthma-obesity relationship. Thus, the thesis enhances understanding of the necessity in tailoring weight management support to address the challenges created by asthma. The findings highlight how fundamental it is to elicit and modify families' beliefs about physical activity, eating behaviours, asthma medication and management and their psychological well-being to promote healthy weight behaviours. The number of recommendations for practice and research demonstrates the real-world application of these findings. It is vital that future research further explores the established associations

found and evaluates the effectiveness of the asthma-specific weight management resources developed.

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Appendix A: Parent invitation letter

Aston University

NHS
Birmingham Women's and Children's
NHS Foundation Trust

Weight-management in children living with asthma: A qualitative study of families' experiences

Dear Parent/Carer and Young Person,

The asthma team at Birmingham Children's Hospital and researchers at Aston University are conducting a study to explore how families feel about the weight management advice given to families of children/young people with asthma.

We would like to find out how parents/carers and children/young people feel about existing support services designed to help children with asthma to manage their weight, and how services could be improved.

As a parent of/young person with asthma, we invite you to take part in our study.

This would involve you being interviewed by a researcher. Interviews can be carried out via telephone, skype, at your home or Aston University. Interviews usually take around 60 minutes. They will be audio-recorded, but made anonymous and confidential.

Study findings will be made into a report to share with local healthcare teams and may be used to improve services in the future. If you are able to take part, you will receive a £10 voucher as a thank you.

If you would like to take part or would like more information, please contact the research supervisor, Dr Claire Farrow via email or telephone:

Email c.farrow@aston.ac.uk Tel: 0121 204 5384

Please be reassured that participation is voluntary and will in no way affect the care you receive.

We look forward to hearing from you.

Yours sincerely,

Dr Claire Farrow
School of Life & Health Sciences
Aston University
Aston Triangle
Birmingham
B4 7ET

Appendix B: Parent participant information sheet

Aston University
Birmingham

NHS
Birmingham Women's and Children's
NHS Foundation Trust

Weight-management in children living with asthma: A qualitative study of families' experiences

Participant Information Sheet

You are being invited to take part in a study exploring how families feel about the weight management advice and support provided for children who have asthma. This study is being carried out by researchers from Aston University, in collaboration with health professionals at Birmingham Children's Hospital.

Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read this information and discuss it with others if you wish. If you would like more information, please contact Dr Claire Farrow the research supervisor, whose contact details can be found overleaf.

Who is doing the research?

This study is being conducted by Rebecca Clarke as part of her PhD being undertaken at Aston University.

What is the purpose of the study?

For children and young people with asthma, difficulty with exercise and asthma medication can make weight management challenging. As a result, asthma symptoms can be more difficult to control. So far, little is known about how weight management support can accommodate these challenges in the services offered. The purpose of this study is to explore how parents/ carers and children/ young people feel about current services to support weight management in children who have asthma, and how they believe services could be improved.

Why have has your child been invited?

You are being invited to take part in this study because you are a parent or a carer of a child/ young person who has asthma.

Do I have to take part?

No, it is your choice. If you decide to take part, you are free to change your mind at any time without giving a reason. There will be no consequences for your child if you decide not to participate.

What will happen to me if I take part?

You will be invited to an interview with a researcher who will ask you some questions about the support and services currently offered to help children and young people with asthma manage their weight and how these services could be improved in the future. The interview will be conducted by a researcher; either Rebecca Clarke, Gemma Heath or Claire Farrow. The interview will be audio recorded and last around 60 minutes depending on how much you have to say. Interviews can be conducted via telephone or skype, in a private room at Aston University or at your home, whichever is easiest for you. The cost of travel or parking can be reimbursed. You can choose to skip questions

you find difficult. At any point during the interview you can choose to stop and withdraw from the study. After the interview, demographic information will be collected (e.g. your age, ethnicity, gender). This information will be used to explore the range of participants that have taken part. The interview and your demographic information will not be passed on to anyone outside of the research team.

What are the possible risks or benefits of taking part?

We will provide you with a £10 *Love to Shop* voucher as a small token of thanks for taking time to do the interview. There are no other material benefits to you in taking part in this study; however, the findings will help us to understand how parents and young people believe that the current services could be improved to support weight management in children who have asthma. Ultimately, this information may be used to improve services in the future.

We do not expect there to be any risks to you in taking part in this study. However, in the unlikely event that you become upset during the interview, the research team will be able to provide you with the support and contact numbers you need.

Will my taking part in the study be kept confidential?

Yes. Only the research team will know that you have taken part. All your study data will be anonymised, which means that your name and any other identifying information will be removed and replaced with an identifier number, so that you cannot be identified by what you have said. Confidentiality will only be broken if information regarding risk of harm to a child is disclosed.

An external company who have a confidentially disclosure will write up the interview. After this, the research team will ensure that all data is kept securely at Aston University. Paper documents will be stored in a locked cabinet and digital files will be stored on a secure server will password protection. Once the audio recordings are transcribed, they will be destroyed. Only the research team will be able to access these files.

Who is organising this study and acting as data controller for this study?

In order to comply with the General Data Protection Regulation, Aston University is required to provide information about who is responsible for organising our research and how research data will be managed. This sheet provides that information and should be read in conjunction with the Participant Information Sheet for this study.

Aston University is the sponsor for this study based in the United Kingdom. We will be using information from you in order to undertake this study and will act as the data controller for this study. This means that we are responsible for looking after your information and using it properly. Aston University will keep identifiable information about you for 6 years after the study has finished.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways in order for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally-identifiable information possible.

You can find out more about how we use your information at www.aston.ac.uk/dataprotection or by contacting our Data Protection Officer at dp_officer@aston.ac.uk.

If you wish to raise a complaint on how we have handled your personal data, you can contact our Data Protection Officer who will investigate the matter. If you are not satisfied with our response or believe we are processing your personal data in a way that is not lawful you can complain to the Information Commissioner's Office (ICO).

Our Data Protection Officer is Victoria Mee and you can contact them at: dp_officer@aston.ac.uk.

Individuals from Aston University and regulatory organisations may look at your research records to check the accuracy of the research study. The only people in Aston University who will have access to information that identifies you will be people who need to contact you to arrange and undertake research visits or audit the data collection process. The people who analyse the information will not be able to identify you and will not be able to find out your name, or contact details.

When you agree to take part in a research study, the information about you may be provided to researchers running other research studies in this organisation and in other organisations. These organisations may be universities, NHS organisations or companies involved in health and care research in this country or abroad.

This information will not identify you and will not be combined with other information in a way that could identify you. The information will only be used for the purpose of research, and cannot be used to contact you

What will happen to the results of the study?

A final report of the findings will be produced and sent to you if you choose. Please email Claire Farrow if you would like this (c.farrow@aston.ac.uk). Anonymised results will also be shared with the Respiratory/General Paediatric teams at Birmingham Children's Hospital so that improvements to services can be made. Additionally, the results of the study may be presented at scientific meetings and published in scientific journals.

Who has reviewed the study?

An NHS Research Ethics Committee has reviewed this study. Aston University will continue to monitor the research team during the study to make sure your details are kept private and that information you provide remains confidential.

Who is organising the research?

The research is organised by Aston University in collaboration with Birmingham Children's Hospital. Aston University are sponsoring and insuring the study.

Who can I contact if I have any concerns?

If you have any concerns about any aspects of this study, you should in the first instance contact the research supervisor: Dr Claire Farrow. She will do her best to address your concerns. If she is unable to resolve your concerns you can contact the Secretary to the Aston University Ethics Committee – Mr John Walter – on j.g.walter@aston.ac.uk or telephone 0121 204 4869.

Further information

If you would like to take part in this research or would like further information, please contact Dr Claire Farrow who is supervising the research (email c.farrow@aston.ac.uk Tel: 0121 204 5384).

What do I do now?

If you would like to take part in the research or would like more information, please contact:

Dr Claire Farrow

School of Life & Health Sciences
Aston University
Aston Triangle
Birmingham
B4 7ET

Email: c.farrow@aston.ac.uk

Telephone: 0121 204 5384

Who else can I contact for further information?

Please contact Claire Farrow using the above details to request this information in alternative languages.

Appendix C: Example of an age-appropriate young person participant information sheet

Aston University
Birmingham

NHS
Birmingham Women's and Children's
NHS Foundation Trust

Weight-management in children living with asthma: A qualitative study of families' experiences

Study Sheet (for children who are 8-11 years)
To be shown and read by parent/carer if needed

We would like to ask for your help with our study.

We would like to hear what you think about the advice on eating and exercise given to children who have asthma.

Please read this sheet carefully and talk about it with your parents. Take your time to decide whether you want to join in.

If you have any questions please ask your parents to contact Claire Farrow as she is running the study (they have her details on their own letter).

What is this study about?

Sometimes when people have asthma it can be difficult to exercise and asthma medicine can make it hard to stay a healthy weight.

We would like to know more about what you think of the advice you have had on healthy eating and exercise from the nurses and doctors that you see about your asthma. We hope that what you tell us will make the advice for children who have asthma better in the future.

What will happen if I take part?

If you decide to take part a researcher called Rebecca, Gemma or Claire will explain the study to you and answer any questions that you have. They

will ask you to fill out a form to check that you are happy to take part and will check that one of your parents are happy to you to take part. Your parents can sit with you when you take part.

After the forms have been filled out they will ask you some questions about what you think about the advice you have had on healthy eating and exercise from the nurses and doctors that you see about your asthma.

They can speak to you on the telephone, on skype or face-to-face. They will record what you say on a voice recorder. This is so that they can listen to what you say again and type it up on a computer afterwards.

If you would like to take part please tell one of your parents so that they can arrange it with Claire.

Do I have to take part?

No you don't have to take part at all. If you do take part you can miss any questions you don't want to answer or stop taking part at any time.

What are the possible good and bad parts of taking part?

To say thank you for taking part we would give you a £10 gift voucher. Some children like taking part as the findings could help improve asthma treatment in the future. This can help other children and families going through a similar experience.

We do not think that anything bad will happen if you take part. But if you did become upset the researcher will stop asking you questions and will help you.

Will other people know that I have taken part in the project?

No. Only Rebecca, Gemma and Claire will know that you have taken part.

Your name will be swapped for a number so that no one knows that you took part. The only time when we would need to tell someone else is if we were worried that you or someone else was in danger.

What will happen to the results of the study?

We will write up the results into a report which we will share with Birmingham Children's Hospital so that they can make their healthy eating and exercise services even better. If you would like we can share the results of the study with you. Please ask your parents to email Claire if you would like this.

Has anyone checked the study is OK to do?

This study has been checked by lots of people who look at research studies to make sure that they are OK to do.

I want to take part, what do I do?

If you would like to take part in the research or would like to know more, please ask your parents to contact Claire Farrow (they have her contact details on their letter):

Thank You.

Appendix D: Parent interview schedule

Parent Participant Interview schedule

1. Can you tell me a bit about your child and their asthma?

   Diagnosis, severity, treatments, impact on daily life/school life

2. How does your child's asthma/medication impact on the exercise they do?

   At home… at school
   Child's ability to exercise
   Type of exercise child engages in
   Child's confidence to exercise

3. How does your child's asthma/medication impact on their eating?

   What the child eats
   How much child eats

4. How do you think healthy eating and exercise affects your child's asthma?

   E.g. Symptoms, treatments, outcomes
   Why is this important?

5. What kinds of things do you do to help your child to maintain a healthy weight?

   E.g. Modify diet; encourage exercise
   What makes these things easier or more difficult?

6. What makes healthy eating easier or more difficult for your child/ the family?

7. What makes exercise easier or more difficult for your child/ the family?

8. What are your experiences of talking to health professionals about your child's weight and how it affects their asthma?

   How did/do you feel about the topic of weight being raised for discussion?
   How have these discussions gone?
   What factors make these conversations easier or more difficult?

9. Can you tell me about any specific advice you and your family have received from the Respiratory /General Paediatric team about healthy eating and exercise?

   How helpful was this advice?
   Has your child changed the way they eat or exercise because of this advice?
   Has your child been referred to other services for help? (e.g. dietetics; community weight management services)

If so, how did you feel about this referral; what were your experiences? How did it help?

10. How effective do you think the current advice/services are for children with asthma to maintain a healthy weight?

11. How do you think weight management advice/services could be improved for children who have asthma?

12. What would a programme specifically designed for children with asthma to maintain a healthy weight look like?

    What kinds of things would be covered / included?
    How would it be delivered?
    How would professionals support families to maintain a healthy weight at home?
    How would a programme need to be tailored for a child/family with a child with asthma?

13. Is there anything else that you would like to add?

Appendix E: Young person interview schedule

Young Person Participant Interview schedule

1. Can you tell me a bit about your asthma?

   Diagnosis, severity, treatments, impact on daily life/school life

2. How does your asthma/ asthma medicine affect the exercise you can or can't do?

   At home… at school
   What kinds of exercise can or can't you do?
   How confident do you feel about exercising?
   Does your asthma stop you from exercising at all, if so, why?

3. How does your asthma/asthma medicine affect what you eat?

   What / how much you eat
   Why is that?

4. How do you think healthy eating and exercise affects your asthma?

   E.g. Symptoms, treatments, outcomes
   Why is this important?

5. What kinds of things do you do to stay healthy weight?

   E.g. Modify diet; encourage exercise
   What makes these things easier or more difficult?

6. What makes exercise easier or more difficult for you?

7. What makes healthy eating easier or more difficult for you?

8. Can you tell me about a time when you've talked to nurses or doctors about your weight and how it affects your asthma?

   How did/do you feel about talking to nurses/doctors about your weight?
   What makes it easier or more difficult to talk to nurses/doctors about your weight?

9. Can you tell me about any advice the asthma nurses or doctors have given you about healthy eating and exercise?

   How helpful was this advice?
   Have you changed the way you eat or exercise because of this advice?
   Have you been referred to other services for help? (e.g. dietetics; community weight management services)
   If so, how did you feel about this; what were your experiences? How did it help?

10. What do you think about the current advice/services to help children/young people with asthma to stay a healthy weight?

11. How do you think weight management advice/services could be improved for children/young people who have asthma?

12. What would a programme specifically designed for children/young people with asthma to maintain a healthy weight look like?

    What kinds of things would be covered / included?
    How would it be delivered?
    How would professionals support families to maintain a healthy weight at home?
    How would a programme need to be tailored for a child/family with a child with asthma?

13. Is there anything else that you would like to add?

Appendix F: Extract from a coded transcript

Coding labels	*Parent 1*	Notes
Medication concern and side effects; self-esteem consequences Medication concern and side effects Adherence prompts Information about non-adherence health-consequences	With the steroids they give her, with steroids. The most side effects is prominent. And at the age of 15, 16 girls want to lose weight. I had times with her struggling. I was… she was not taking her steroids. She's come back from hospital… she used to cry "I don't want to take them". She knew what was going to happen, she would put weight on. She used to hide the tablets. She never used to take the tablets. But then I would sit with her and talk to her about it. Look, you have to pretend, once we went with her at the outpatients at the hospital with Dr Jones and I told him that she doesn't like her steroids because it makes her put weight on. And he sat her down and said, "Look, you've got two options. If you have your asthma, you have your asthma, you have to have your steroids. If you don't take your steroids, you can't move from one sofa to another sofa because you can't walk, you can't breathe, you can't do anything. And if you can't do that, you will be sitting in one place you will put on more weight. With steroids, if you are eating with steroids but you can move. Which is better".	Emotional and physical consequences to medication and weight Indirect emotional outcomes of medication. Non-adherence – contrast in asthma/weight management prioritisation to exercise HCPs = greater authority in medication? Balancing asthma and weight management. Weight management as adherence incentive.

Appendix G: Healthcare professional invitation letter

Aston University

Birmingham Children's Hospital NHS
NHS Foundation Trust

Weight-management in children with asthma: A qualitative study of the experiences of health care professionals

Dear Health Care Professional,

The respiratory team at Birmingham Children's Hospital and Researchers based at Aston University are conducting a study to explore how health care professionals feel about the weight management advice and support provided for families where children have asthma and are also overweight.

The research team would like to find out how health care professionals feel about the current services to support weight loss in overweight children who have asthma, and how they believe services could be better tailored to support overweight children with asthma to manage their weight.

If you are a health care profession working with children who have asthma then I am writing to ask if you are interested in taking part in this study.

Taking part would involve you being interviewed by a researcher (whose details are below). Interviews can be scheduled in the most convenient way for you: either at Birmingham Children's Hospital, Aston University or via telephone or skype. Interviews will usually take around 45 minutes and will be recorded. Any personally identifiable information will be removed to ensure confidentiality. Findings of the study will be written up in a report to share with the respiratory team at Birmingham Children's Hospital.

If you are able to take part the researcher will reimburse you for your time with a £10 love to shop voucher which can be spent in a range of high-street stores. Please find attached an information sheet with more details. If you are interested in taking part or would like more information about the study, please contact one of the researchers whose details are:

Researchers: Rebecca Clarke & Mary Unsworth. Email: clarker3@aston.ac.uk

Research Supervisors:
Dr Claire Farrow. Email c.farrow@aston.ac.uk Tel: 01212045384
Dr Gemma Heath. Email g.heath1@aston.ac.uk Tel: 01212044008

Please be reassured that participation is voluntary and will in no way affect your employment at Birmingham Children's hospital.

Yours sincerely,

Lesley Barrett
Birmingham Children's Hospital
Stellhouse Lane
Birmingham
B4 6NH

Appendix H: Healthcare professional participant information sheet

Aston University
Birmingham

Birmingham Children's Hospital NHS
NHS Foundation Trust

Weight-management in children with asthma: A qualitative study of the experiences of health care professionals

Participant Information Sheet

You are being invited to take part in a study exploring how health care professionals feel about the weight management advice and support provided for families where children have asthma and are also overweight. This study is being carried out by researchers, at Aston University, in collaboration with the respiratory service team at Birmingham Children's Hospital.

Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read this information and discuss it with others if you wish. If you would like more information, please contact Dr Claire Farrow the research supervisor, whose contact details can be found overleaf.

What is the purpose of the study?

Children who have asthma are more likely to carry excess weight than other children; this can make it more difficult for children to control their asthma and their symptoms more severe. Although weight management is very important for children with asthma, we do not know much about how weight management support and advice should be tailored to the unique needs of children who have asthma. The purpose of this study is to explore how health care professionals feel about the current services to support weight loss in overweight children who have asthma, and how they believe services could be better tailored to support overweight children with asthma.

Why have I been invited?

You have been invited to take part in this study because you are a health care professional working in this area.

Do I have to take part?

No, it is your choice. If you decide to take part, you are free to change your mind at any time without giving a reason. There will be no consequences for you if you decide not to participate.

What will happen to me if I take part?

You will be invited to an interview with a researcher who will ask you some questions about your views and experiences about the advice and support that is currently offered to support weight management in children with asthma, you will be also asked about your own experiences and attitudes, and how you believe current services could be improved for children with asthma in relation to weight management. The interview will be audio recorded and last around 45 minutes depending on how much you have to say. Interviews can be conducted in a private room at Birmingham Children's Hospital, at Aston University or via telephone or skype; however is most convenient for you.

What are the possible risks or benefits of taking part?

We do not expect there to be any risks to you in taking part in this study. The findings of this study will help us to understand how health care professionals believe that current services could be improved to support weight management in children who have asthma and ultimately this information may be used to improve services in the future.

Will my taking part in the study be kept confidential?

Yes. Only the research team will know that you have taken part. All your study data will be anonymised, which means that your name and any other identifying information will be removed and replaced with an identifier number, so that you cannot be identified by what you have said which may be included in the study report. Confidentiality will only be broken if information regarding risk of harm to a child is disclosed. The research team will ensure that all data is kept securely and confidentially at Aston University. Anonymous transcripts will be securely stored on an Aston University server. Only the research team will be able to access these files.

What will happen to the results of the study?

A final report of the findings will be produced and sent to you if you request it. Anonymised results will also be shared with the respiratory team at Birmingham Children's Hospital. Additionally the results of the study will be written up and may also be presented at scientific meetings and published in scientific journals.

Who has reviewed the study?

Aston University Life and Health Sciences Research Ethics Committee have reviewed the ethics of this study.

Who is organising the research?

The research is organised by Aston University in collaboration with Birmingham Children's Hospital.

Further information

If you would like to take part in this research or would like further information, please contact: Rebecca Clarke (PhD student), Dr Claire Farrow or Dr Gemma Heath who are supervising the research:

Rebecca Clarke (PhD Student, Aston University): clarker3@aston.ac.uk

Dr Claire Farrow (Senior Lecturer, Aston University): Email c.farrow@aston.ac.uk Tel: 01212045384

Dr Gemma Heath (Health Psychologist, Aston University & Birmingham Children's Hospital): Email g.heath1@aston.ac.uk Tel: 01212044008

Appendix I: Healthcare professional interview schedule

Interview schedule

1. Can you tell me about your role within the respiratory service?
   Prompt: What does this involve in terms of contact with families/ children with asthma?

2. What are your experiences of working with children with asthma who are overweight?
   Prompt: Can you tell me about any specific examples?

3. How do you think a child's weight impacts on their asthma?
   Prompts: Symptoms; treatment; outcomes

4. What are your experiences of talking to parents/children about being overweight and the impact this has on their asthma?
   Prompts:
   i. How have these discussions gone?
   ii. How do you feel about raising the topic of weight for discussion?
   iii. What factors make these conversations easier or more difficult?

5. What currently happens when a child with asthma is identified as being overweight?
   Prompts:
   i. How are they managed in terms of their asthma treatment?
   ii. How are they managed in terms of their weight? (e.g. referral to community weight management programmes)

6. What are your views on the current processes for managing weight in children with asthma?

7. How effective do you think community weight management programmes are for children with asthma?
   Prompt: Why?

8. How do you think the treatment of obesity could be improved for children who have asthma?

9. What would a weight management programme specifically designed for children with asthma look like?
   Prompts:
   i. What kinds of things would be covered / included?
   ii. How would it need to be tailored for a child/family with a child with asthma?
   iii. How might the service interact with families to improve weight management at home?

10. Is there anything else that you would like to add?

Appendix J: Example from the thematic framework matrix

	Physical activity: Fear of Exacerbating Asthma	Physical activity: Confidence
Respiratory Consultant 4	Previous episodes of exercise-induced asthma create anxiety when exercising **QQ**; Young people become too scared to push themselves as they don't know how much is safe **QQ**; Children can't tell if difficulty is created by asthma or weight; Some parents are scared exercise will induce asthma and stop children exercising **QQ.**	Patients need physical activity facilities with trainers to build confidence that they can exercise safely; Necessary to build support the whole family and build parents confidence too.
Respiratory Nurse 1	Children with severe asthma are scared to exercise in case it exacerbates their asthma; Some young people avoid P.E. lessons because "who knows if it's going to exacerbate their asthma". Avoiding exercise reinforces child's own perception of their inability to exercise. **QQ**	The hospital doesn't have the exercise programme that families need. Families need to exercise in a safe environment; Families' need to exercise with experts [*at the hospital*] to feel safe. Afterwards they are more likely to engage when they are referred [*to community weight management*]

QQ; quote believed to very interesting.

Appendix K: Questionnaire participant information sheet

Aston University

NHS
Birmingham Women's and Children's
NHS Foundation Trust

Parental Practices Around Feeding and Exercise in Children with and without Asthma

Participant Information Sheet

You are being invited to take part in a study exploring parental practices around feeding, eating and exercise in children. This study is being carried out by researchers, at Aston University, as part of a PhD project, in collaboration with the respiratory service team at Birmingham Children's Hospital.

Before you decide whether to take part, it is important for you to understand why the research is being done and what it will involve. Please take time to read this information and discuss it with others if you wish. If you would like more information, please contact Rebecca Clarke, whose contact details can be found at the end.

Why is this research being carried out?

For children and young people with asthma, difficulty with exercise and asthma medication can make weight management challenging. As a result, asthma symptoms can be more difficult to control. So far, little is known about how feeding, eating and exercise in children living with asthma and without asthma can differ. This research will help improve our understanding of how asthma influences attitudes towards feeding, eating and exercise with the hope that the results will aid the development of more effective ways to support weight management for families of children living with asthma. You can take part in this study if you are a parent: whether or not your child has asthma

What does taking part in the research involve and do I have to take part?

You will be asked to indicate if you are happy to take part in the research. If you are happy to proceed, you will be asked to complete a questionnaire concerning your child's eating behaviours and physical activity, feeding practices and your child's health. It is your choice whether you take part in the research or not. You are free to stop taking part or change your mind at any point without giving a reason.

Will my taking part in the study be kept confidential?

Yes. All information will be anonymised so that no individual can be identified. The research team will ensure that all data is kept securely and confidentially at Aston University. Anonymous data will be securely stored on an Aston University server. Only the research team will be able to access these files.

What will happen to the results of the study?

A final report of the findings will be produced and sent to you if you request it. Anonymised results will also be shared with the respiratory team at Birmingham Children's Hospital. Additionally, the results of the study will be written up and may also be presented at scientific meetings and published in scientific journals.

Who has reviewed this study? Who do I contact if I have any concerns?

Aston University Life and Health Sciences Research Ethics Committee have reviewed the ethics of this study. If you have any concerns about any aspects of this study, you should in the first instance contact the research project Chief Investigator – Dr Claire Farrow – on c.farrow@aston.ac.uk or telephone 0121 204 5384. They will do their best to address your concerns. If the research project Chief Investigator is unable to resolve your concerns you can contact the Secretary to the Aston University Ethics Committee – Mr John Walter – on j.g.walter@aston.ac.uk or telephone 0121 204 4869.

Would you like to take part in another study?

We are carrying out more research about asthma in children. If you are interested in taking part in an interview over the phone or via skype with a researcher to discuss how living with asthma affects eating behaviour, weight and exercise then please contact Rebecca Clarke for more information (PhD Student, Aston University) on clarker3@aston.ac.uk

Anyone who takes part in interviews will receive a £10 voucher as a small thank you for their time.

Further Information

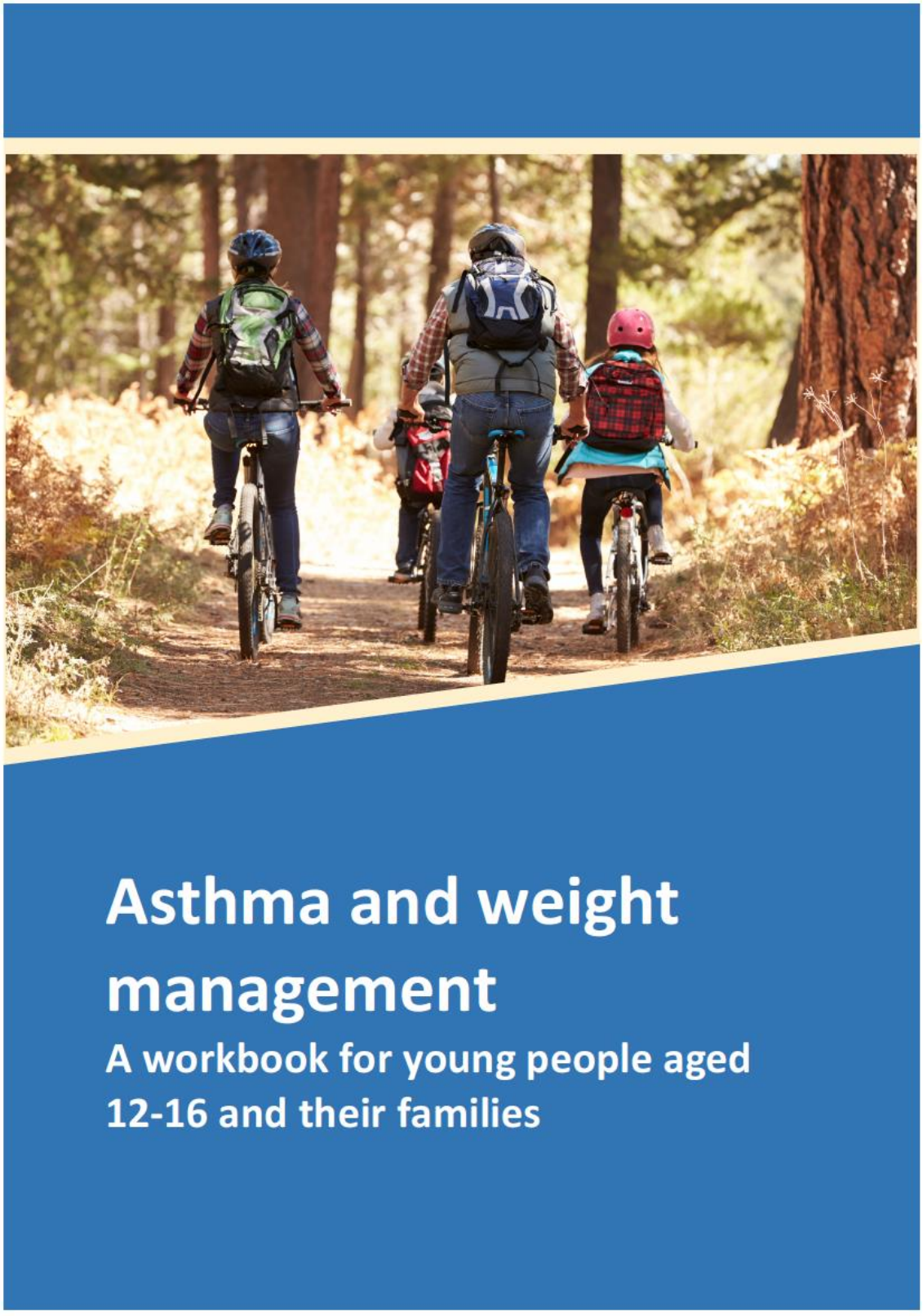
If you would like further information, please contact:

Rebecca Clarke (PhD Student, Aston University): clarker3@aston.ac.uk
Dr Claire Farrow (research project Chief Investigator): Email c.farrow@aston.ac.uk Tel: 01212045384

If taking part in the research raises any concerns about your child's health the following resources may be helpful:

- Asthma UK helpline
  - https://www.asthma.org.uk/advice/resources/helpline/
- Child weight advice
  - https://www.nhs.uk/Livewell/childhealth6-15/Pages/child-health-measurement-programme-healthy-weight-advice.aspx

Appendix L: Asthma and weight management: A workbook for young people aged 12-16 and their families



Asthma and weight management: A workbook for young people aged 12-16 and their families

What is this workbook?

- Sometimes when people have asthma, it can be more challenging to stay a healthy weight.
- This workbook can help you to learn more about your asthma, find ways to overcome the difficulties asthma can create and set weight management goals you are happy with.

Who is this workbook for?

- This workbook is for young people living with asthma aged between 12 to 16 years old and their parents. It contains information and activities that might be helpful to complete together.

What should I do if I have questions?

- If you have any questions about this workbook, please speak to your asthma consultant or nurse. They will be happy to answer any questions that you may have.

Contents

Part 1: Understanding asthma and weight

Part 1: Understanding asthma and weight

What is asthma?

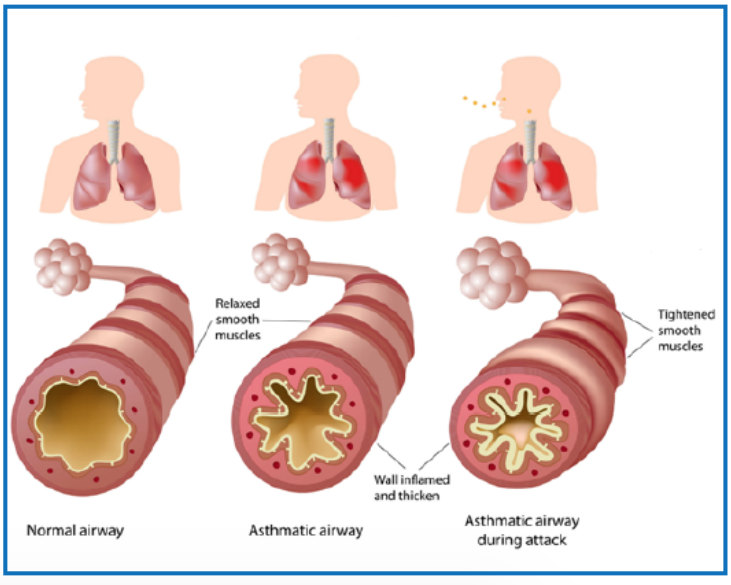
◊ Asthma is a long-term condition that affects 1 in 11 young people in the UK. Asthma affects the airways carrying air in and out of your lungs.

What happens to your lungs when you have asthma?

◊ If you have asthma, your airways are more sensitive. Your airways may react to things they don't like. This can cause the muscles around your airways to become tighter and inflamed.

◊ These reactions can make it difficult for air to move through your lungs in a way they normally do. Symptoms of asthma include:

- Shortness of breath
- Wheezing
- Coughing
- Tightness in the chest



What asthma symptoms do you have?

1.	
2.	
3.	
4.	
5.	

What can trigger your asthma symptoms?

- An asthma trigger is anything that your airways react to that causes symptoms. What causes asthma symptoms for you may be different to someone else. Common triggers include:
  - The common cold
  - Allergies (e.g. pollen, mould, pets)
  - Cold weather
  - Exercise
  - Heightened emotions
  - Pollution

Lifestyle, weight and asthma

- Eating healthy food, taking part in exercise and managing stress are important parts of living a healthy lifestyle.

- At times it can be difficult to pick healthy food options and do exercise when we are busy.

- However, it is important to balance the energy we are taking in from food with the amount we burn through exercise. If we do not burn this energy our body stores it as body fat.

- Talking to doctors and nurses can help us to understand if we have a healthy weight or are carrying excess weight.

You can also check this yourself - have a look at the NHS healthy weight calculator: https://www.nhs.uk/live-well/healthy-weight/bmi-calculator/

What has weight got to do with my asthma?

- Sometimes when people have asthma, it can be more challenging to stay a healthy weight.

- Having excess weight can make it harder to control your asthma symptoms. Scientists believe excess weight increases the risk of:
  - Inflammation in the airways
  - More frequent asthma symptoms
  - More severe asthma symptoms
  - Asthma medication not working as effectively

Why should I maintain a healthy weight?

- You will notice an improvement in asthma symptoms. This means you'll be less likely to have an asthma attack or need emergency help and be able to do more of the things you enjoy.

- Your asthma medication will work better and you won't need to use your reliever inhaler as often to reduce symptoms.

- Maintaining a healthy weight has other health benefits too. You will have more energy, feel stronger and reduce the risk of other long-term health conditions (such as acid reflux or sleep problems that can make it harder to control asthma).

Make a list of reasons why you would like you maintain a healthy weight. It may be helpful to talk to family members or your healthcare professional if you are struggling.

1.	
2.	
3.	
4.	

How can I manage my weight when I have asthma?

- ◊ Even though asthma can make it more difficult to manage your weight, it is possible.
- ◊ Exercise, asthma medication, diet and stress can influence both your asthma control and weight management. It can be helpful to understand how this happens and how you can overcome these challenges.
- ◊ Your healthcare professionals and this workbook can help you to understand how.

Part 2: Asthma and exercise

Asthma and Exercise

Understanding asthma and exercise

- Taking part in exercise is a goal of good asthma management.
- Sometimes exercising can be more challenging with asthma.
- When you exercise, you breathe in faster and through your mouth. This can make the air colder and drier than normal. Your lungs may react to this change and your airways can become narrower.
- To reduce the risk of this happening, it is important to keep taking your asthma medication as directed.
- Doctors and nurses are helpful to turn to for exercise advice and they can check to see if your medication is working as it should be.

Feeling nervous about exercising with asthma?

- You're not alone. Sometimes parents and young people living with asthma feel nervous about taking part in exercise.

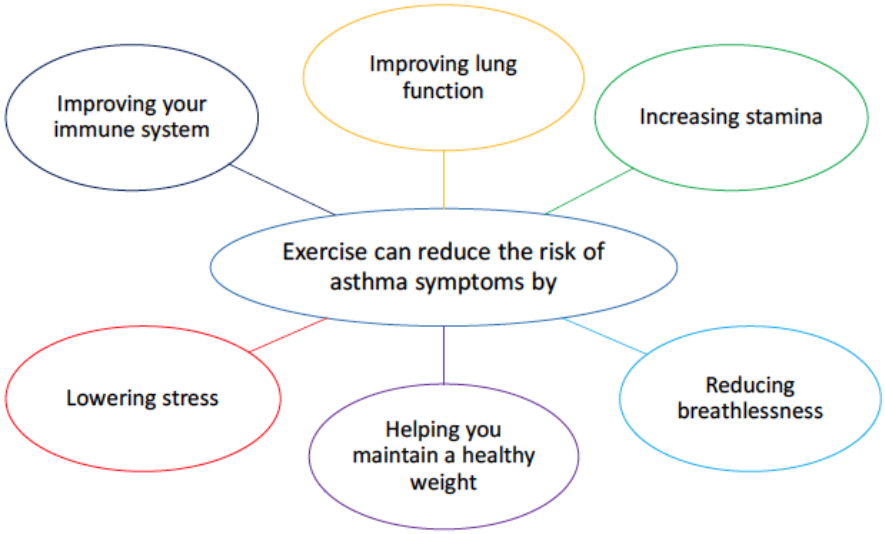
How do you feel about exercising?

- ◊ Feeling nervous about exercise can cause breathlessness.
- ◊ If you worry or expect exercise-induced asthma to happen, you may be more likely to believe your breathlessness is a symptom of asthma.
- ◊ Learning to understand whether your breathlessness is a symptom of asthma or a normal outcome of exercise can help you to do more exercise.

Normal symptoms of breathlessness during exercise	Signs of asthma symptoms
◊ Feeling hot and sweaty ◊ Breathing faster and more deeply ◊ Being flushed	◊ Gasping for air ◊ Coughing/ wheezing ◊ Tightness in your chest

- ◊ Your healthcare professionals are also there to help.

Exercise can be an important part of your asthma management plan



◊ It may help to catch and change your thoughts.

◊ When you find yourself worrying about exercise, remind yourself of how exercise can improve your asthma management.

◊ Here's an example:

"I'm worried that I will have an asthma attack cycling home from school."	→	"Cycling home will help me to improve my stamina. That will reduce my risk of an asthma attack"

◊ Use the spaces below to practice how you can change your own exercise worries.

	→	
	→	

◊ Remind yourself of the positive statements on the right to boost your confidence before taking part in exercise.



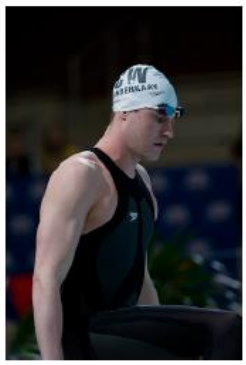
Don't let your asthma hold you back

◊ Lots of professional athletes and Olympic gold medal winners have asthma. Here are a few examples:

Paula Radcliff – marathon runner

David Beckham – professional footballer

Dennis Rodman – basketball player



Peter Vanderkaay – Olympic swimmer

Can you find anymore online?

1.

2.

Check out some more inspiring stories here:

https://www.asthma.org.uk/advice/your-stories/
https://www.asthma.org.uk/advice/your-stories/asthma-doesnt-need-to-hold-anyone-back/

The best types of exercise for asthma

- ◊ There are no 'bad' types of exercise for asthma. Instead, it is important to find an activity that you enjoy to do.
- ◊ Remember to start small and slowly build up how much you do over time.
- ◊ Types of exercise that offer short bursts of activity, provide time for rest in between activity or focus on breathing can improve your ability to do exercise without straining your lungs.

Here are some examples. Circle the activities you enjoy and add your own favourites:

Exercise tips

1. Carry your reliever inhaler with you when you exercise (you may also be advised by your healthcare team to take your inhaler 15 minutes before exercise – this will help you do more and reduce the risk of an asthma attack).
2. If you're exercising with others, make sure they know you have asthma.
3. Warm up and cool down before and after exercise.
4. Instead of avoiding exercise when it is cold or there is pollen, choose indoor exercise activities
5. If you do exercise outside when it is cold, cover your chest, throat and keep a scarf over your mouth. Your airways will react less and you are less likely to have asthma symptoms this way.
6. Recall previous times you have successfully taken part in exercise (this could be anything from walking with your family or riding a bike to school).

Examples of times asthma has not limited my physical activity:

1.

2.

3.

Remind yourself of these achievements before taking part in physical activity.

Let's set some SMART exercise goals

S - specific
M – measurable
A - achievable
R - realistic
T – time-specific

My exercise goals are:

Why is this important to me?

Small steps I can take towards this goal?

Once you reach your goals don't forget to:

- ◊ Celebrate your achievements.
- ◊ Increase your goals slightly for next time.

I will celebrate this goal by...

Why might this be difficult? → How I am going to overcome this:

Who can I tell about these goals? → How they can help me:

You won't achieve goals every day and some days will be more difficult than others. That's okay. Recognise that and try again tomorrow.

Part 3: Asthma and medication

Asthma and medication

How do asthma medicines work?

- Asthma symptoms are commonly treated using preventer and reliever inhalers.
- Preventer inhalers reduce inflammation and swelling in your airways. You may not notice the immediate benefit, but if you use your preventer inhaler every day your airways will be less sensitive. This means that you will be less likely to react to asthma triggers and have asthma attacks.
- Reliever inhalers work quickly to relax the muscles in your airways. They help your airways to open wider so that you can breathe easier.
- If you are struggling to control your asthma symptoms, doctors may prescribe tablets or an injection given in a hospital to reduce inflammation. They work by blocking chemicals created by your immune system that can trigger inflammation.

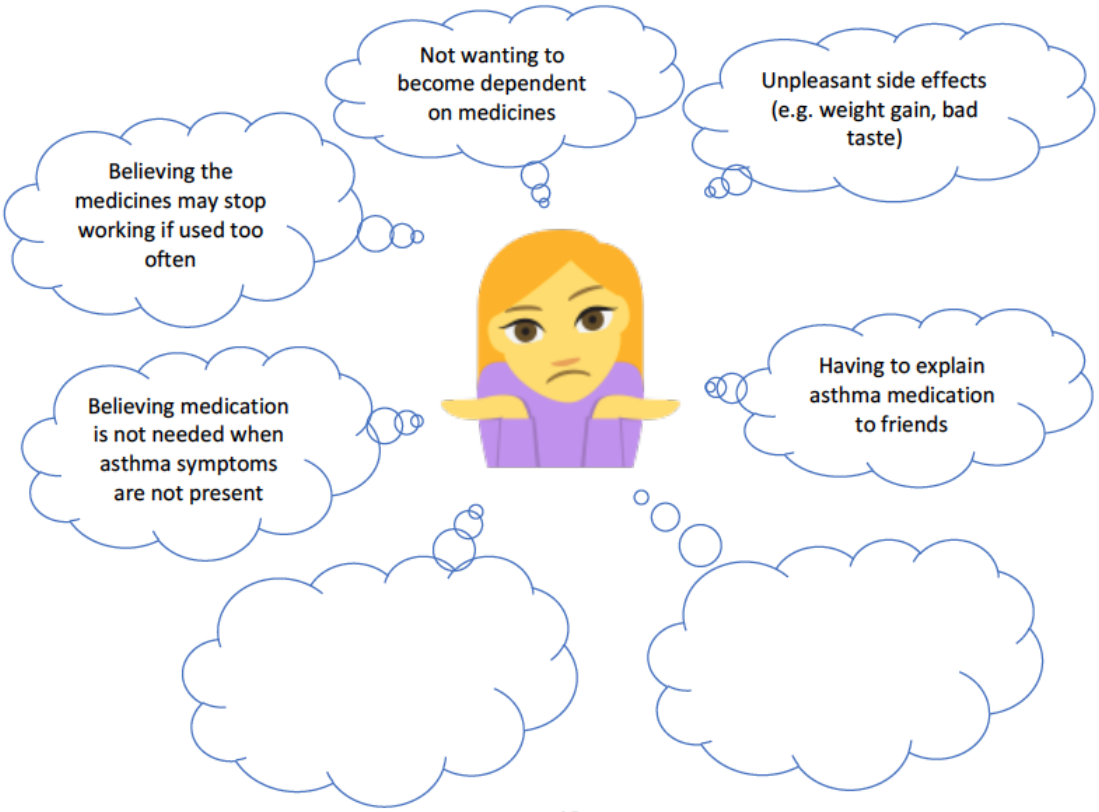
Remember, it is important to keep taking your preventer inhaler even when you have no symptoms (this means it is working).

Asthma is an ongoing condition. You may not be experiencing symptoms now but preventer inhalers are working in the background ready to help protect you when you come into contact with an asthma trigger.

Taking your inhaler means:	Not taking your inhaler means:
◊ Less asthma symptoms over time ◊ Less likely to have to take more medication ◊ More able to take part in the activities you enjoy	◊ Greater risk of asthma symptoms ◊ Greater risk of trips to hospital ◊ Greater risk of being given stronger medication

"But I don't like taking medication"

- ◊ Sometimes people do not like having to take asthma medicines.
- ◊ Can you think of any reasons why you do not like taking your asthma medicine?
- ◊ Add them to the thought bubbles below:



- It can be confusing when you want to control asthma symptoms but worry about taking asthma medication.
- Some people believe it is better to not take asthma medication to avoid unpleasant side effects.
- For some people, avoiding medication may seem like the only way to manage weight.
- However, did you know asthma medication can actually make it easier to manage your weight? Check out the different scenario's below.

Scenario 1

Use of asthma medication → Less asthma symptoms → Ability to take part in some exercise → Increased ability to manage weight

- Taking medication can help to control asthma symptoms and can make it easier for you to take part in exercise. Exercise can help to burn off the energy we take in from food and manage our weight.

Scenario 2

Not taking asthma medication as directed → More asthma symptoms → Increased difficulty taking part in exercise → Increased difficulty managing weight

- In comparison, not taking your asthma medication as directed can increase asthma symptoms and make physical activity more difficult. Engaging in less exercise because of asthma symptoms may make it more difficult to manage your weight.

- Your doctor or nurse may advise that you take your asthma medication before exercise too. This can reduce the risk of symptoms during activity. Check with your doctor or nurse whether you should be doing this.

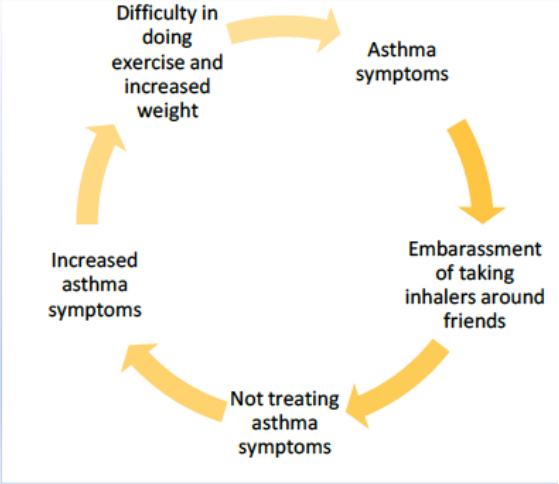
The positives and negatives of taking asthma medication

- Sometimes it helps to weigh up the positives and negatives of taking your medication.
- It may help to talk to your doctors or nurses about how asthma medicines work and why you take them to help you fill in this list.
- Remember what would happen if you didn't take them (e.g. asthma symptoms, missing school and activities with friends, difficulty sleeping) and how this makes you feel.

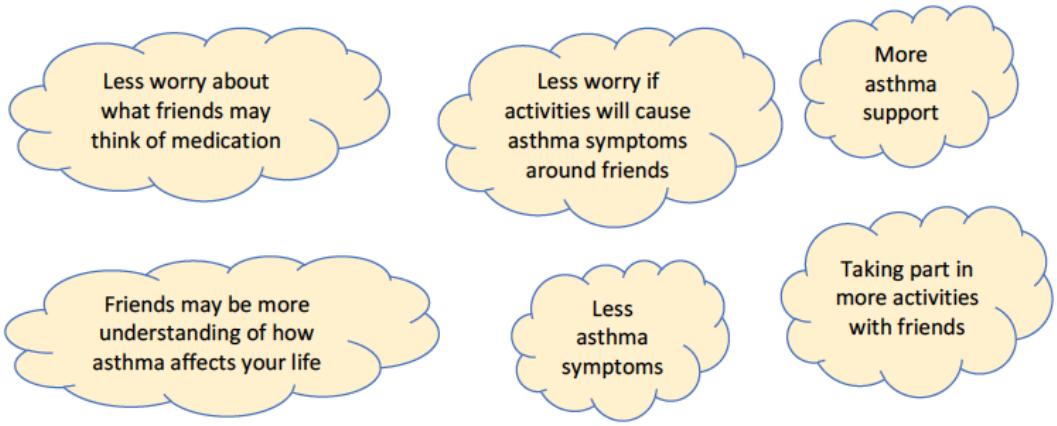
Benefits of taking my asthma medication	Bad parts of taking my asthma medication

Asthma medication and friends

- Sometimes people find it difficult to tell their friends about a health condition, such as asthma, or they may be embarrassed to take medicines in front of their friends.
- This may cause some young people to not take their inhalers.
- This can take away the embarrassment of having to explain asthma medications to friends.



- However, not taking asthma medication could cause other problems. Your asthma symptoms might become worse, physical activities with your friends may become harder and less exercise could make it difficult to manage your weight. In the long term, this cycle can cause more challenges.
- It may be useful to consider the benefits of telling friends about asthma, how your asthma medication helps, and if needed, taking inhalers around friends.



- ◊ Think about what situations or thoughts might make it difficult for you to tell friends about medicines and use medicines in front of them.

- ◊ How could telling friends about asthma medication and taking asthma medications help you?

Challenges of talking to friends about asthma	Benefits of talking to friends about asthma
1.	1.
2.	2.
3.	3.
4.	4.

Changing unhelpful thoughts

- ◊ Changing how you feel about these challenging situations may help you to feel more confident telling friends and using asthma medicines in front of them.

- ◊ Try to think of two encouraging statements you can tell yourself about the benefits of telling friends. Continue to remind yourself of them to help overcome these challenging situations.

Encouraging statements
1.
2.

Practice telling friends

- ◊ It may be helpful to plan how to tell friends about your asthma and asthma medicines.
- ◊ This way you will know what to say if friends ask questions.

How would you explain:

1) What asthma is?

2) How asthma affects you?

3) What asthma symptoms you get and when you get them?

4) How can medication help you?

- ◊ If you are struggling to think of ideas, have a look at your asthma plan.
- ◊ Speak to your doctor, nurses and family members, they may be able to help you express yourself.
- ◊ You don't have to talk to everyone about your asthma at once. Try and think of one or two friends you trust and start there when you are ready.

Part 4: Asthma and diet

Asthma and diet

A beginner's guide to healthy eating

- Eating healthily is important for our health and quality of life as well as weight management.
- A few other benefits of eating healthily include:

Clearer skin
Increased energy
Longer life
Better sleep
Improved mood
Healthier heart
Stronger bones and teeth
Helps to prevent developing health conditions
Improved memory
Saves money
Reduced stress

- The essential nutrients we get from food come from a variety of different food groups.
- To get as many health benefits from food as we can, we need to try and eat a balanced diet of food from different food groups.
- The Eatwell Guide can help show us how to do this.

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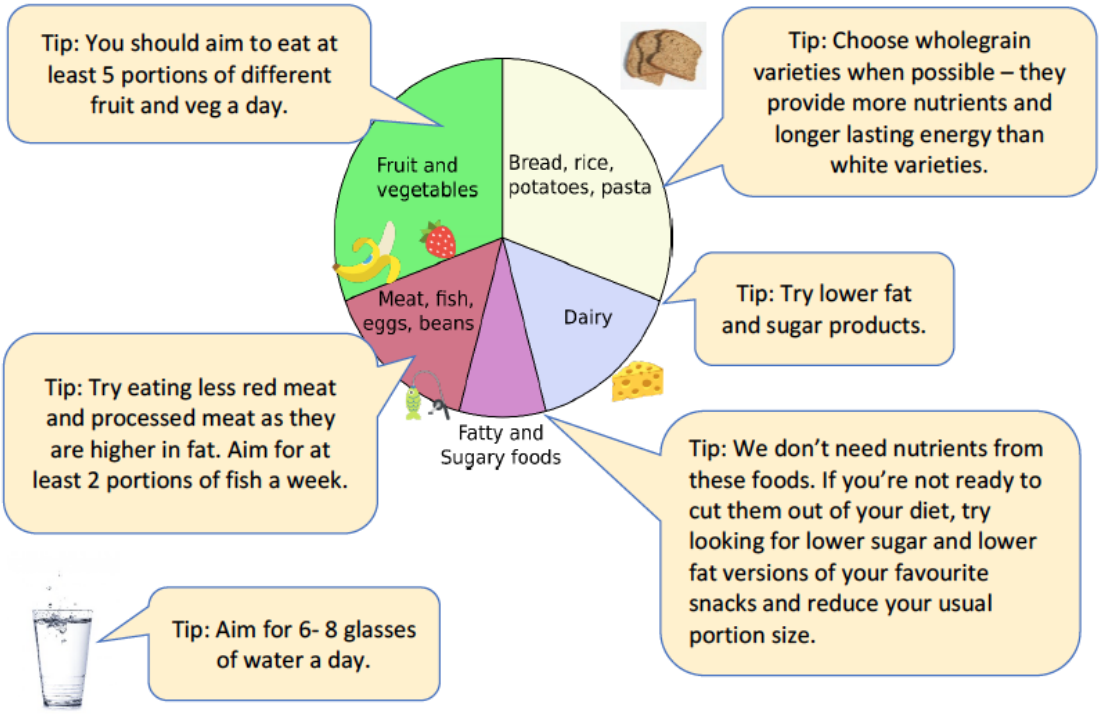


This pie chart shows what we should aim to eat every day to get the nutrients our body needs.
Find out more here:
https://www.nhs.uk/live-well/eat-well/the-eatwell-guide/

Check here for snack ideas: https://www.nhs.uk/change4life/food-facts/healthier-snacks-for-kids/100-calorie-snacks List 3 you would like to try and plan a date that you will try it:		**Check here for meal ideas:** https://www.nhs.uk/change4life/recipes List 3 you would like to try and plan a date that you will try it:	
1.	__/__/__	**1.**	__/__/__
2.	__/__/__	**2.**	__/__/__
3.	__/__/__	**3.**	__/__/__

Asthma and food: What's the connection?

- Scientists believe that the food you eat not only impacts your general health but can also impact on your asthma management.
- It is thought that foods high in fat and sugar, such as red meats and desserts, can increase inflammation in the body.
- Scientists recently found that young people who eat fast food and salty snacks 3 or more times a week are more likely to have more asthma symptoms.
- In comparison, eating more fruits and vegetables have been found to reduce wheezing and improve asthma control.

How can a healthy diet improve asthma symptoms?

- Antioxidants in fruit and vegetables can stop the release of chemicals that damage cells and inflame the airways.
- Antioxidants also improve the immune system and protect against germs that can cause the common cold and affect asthma.
- Omega-3 fatty acids in fish can reduce the antibodies that create asthma symptoms.


What about food allergies?


- If you are living with asthma, you may also have a food allergy.
- Eating food you are allergic to could cause asthma symptoms.
- If you are unsure of what food you are allergic to, it may be useful to keep a food diary at home and make a note of what food you eat and when you have asthma symptoms. If you notice a pattern, it may be the food you eat that influences your asthma control.

"But I still like eating unhealthy foods"

- At times, it can be difficult to choose healthy food options.
- Sometimes it helps to weigh up the positive consequences of eating healthy food against the negative consequences.

Positive consequences of eating healthy food	Negative consequences of eating healthy food
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

Tips for improving your diet

1. Think about why you are eating

Sometimes people eat food when they are bored, feeling alone or stressed to feel better. It may help to change how you view food. Instead of something that makes you feel better, you could view unhealthy food as something that can make your asthma worse.

2. Prepare healthy meals at home

Preparing meals at home means you have greater control of what healthy ingredients you use (you can pick the ones you like) and you can reduce how much sugar and salt is used.

3. Resist quick snacks

It can be easy to grab quick snack food when you are hungry. Prepare healthy snacks in advance. You can still eat if you are hungry between meals, but, for example, a handful of carrots or fruit will be more nutritious than crisps.

4. Eat meals together at the table

Eating meals together as a family is important. As well as hearing about each other's day, you are likely to eat smaller portion sizes. When you are distracted (such as watching television) you are likely to eat more than you need.

5. Change how much unhealthy food is around you everyday.

How easy it is for you to get food can influence your food choices. If there are unhealthy food options around, you are more likely to pick them.

It might help to remove or reduce the unhealthy food available at home to reduce unhealthy food snacking.

Check here for other snack ideas: https://www.nhs.uk/change4life/

6. Plan meals in advance

Fast food or unhealthy meals are a lot more tempting during a busy, stressful week.

Planning meals in advance or prepping meals at the weekend can save time and money and it will mean you can come home to nutritious meals. It will also be easier to control the portion sizes of meals if planned beforehand.

It may help to:

- Choose recipes as a family so everyone is happy.
- Find recipes that are quick and easy to prepare.
- Make extra portions for another day or freeze for the following week.
- Put ideas on a calendar or shopping list.
- Start small – planning or prepping for every day of the week may not seem realistic so start with one day at a time.

Let's set some SMART healthy eating goals

S - specific
M – measurable
A - achievable
R - realistic
T – time-specific

My healthy eating goals are:

Why is this important to me?

Small steps I can take towards this goal?

Once you reach your goals don't forget to:

- ◊ Celebrate your achievements.
- ◊ Increase your goals slightly for next time.

I will celebrate this goal by...

Why might this be difficult? → How I am going to overcome this:

Who can I tell about these goals? → How they can help me:

Do not be too hard on yourself if you slip up. The best thing you can do is get back on track and move forward.

Part 5: Asthma and stress

Asthma and stress

Understanding asthma and stress

- At times, managing asthma can feel overwhelming for some people. It can be hard to balance asthma management alongside school, work and hobbies you want to do.
- For some, it may feel like asthma symptoms are unpredictable and this can create fear of not knowing when asthma symptoms will happen next.
- Stress can make it harder to stay in control of asthma in different ways. For example:
    - Stress can trigger hormones that cause inflammation, increased airway sensitivity and the likelihood of asthma symptoms.
    - Stress can change the way we breathe. You may breathe faster which can exacerbate asthma.

Stress and health behaviours

- Sometimes stress can change our behaviour.
- These changes to behaviour may be a way to help lower our stress or worries but they are not always healthy changes.
- They can affect our exercise, our diet or asthma management.
- Sometimes people change their behaviour to help manage asthma and reduce stress at the same time. For example, avoiding exercise can reduce the risk of asthma attacks and reduce worries about exercise-induced asthma. However, long term this may cause more asthma symptoms.

Worry about exercise-induced asthma symptoms

Avoidance or reduced exercise

Less worry about asthma symptoms

Increased weight due to less exercise and lower exercise ability.

Increased asthma symptoms as a result of increased weight and lower exercise ability.

Learning to recognise unhelpful thoughts that can change behaviour

I won't go to the doctors. They might give me more asthma medication. Maybe the asthma symptoms will get better.

It's easier to stay inside and rest in the warm. Going to the park might cause asthma symptoms.

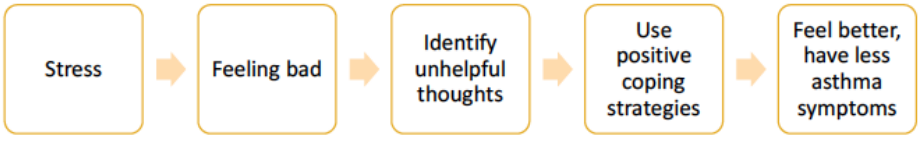
Eating this unhealthy food will make me feel better.

◊ Learning to recognise thoughts and feelings as unhelpful to your exercise, diet and asthma management can help you to change your habits.

Have a go and list examples of thoughts and feelings you have had before that may change your exercise, diet or asthma management:

Unhelpful thoughts
1)
2)
3)
4)

When you recognise unhelpful thoughts and feelings like these, stress management techniques may be useful.



How can you manage stress?

- Unfortunately, stress is part of life and it cannot be avoided.
- It is important to understand that not all stressful situations are in your control and cannot be changed (e.g. the weather, school exams).
- It is still possible to learn ways to manage this stress.
- Stress management techniques can help you to overcome difficulties. Here are some examples of things you can try:

Talk to someone you trust

Write down the things that are making you stressed

Take a time out: listen to music, go for a walk, enjoy a hobby, have a hot bath

Ask yourself the question: Am I being hard on myself? Remember, everyone can have bad days.

Eat well

Exercise regularly

Sleep well

Breathing exercises and mindfulness: (check here for more information and tips how to do this) https://www.verywellhealth.com/meditation-for-better-asthma-control-4064665

Review lifestyle: Are you taking on too much? Can you share this with someone else?

Techniques to manage stress I would like to try:

1:

2:

3:

Seeking support

- Sometimes it is difficult to overcome stress by yourself.
- Finding people to help support you can make you to feel more in control of your asthma and better able to manage stress.
- Talking to your doctors and nurses may help. They may be able to suggest ways to reduce your worries and safely manage your asthma. They could also refer you to other healthcare professionals who can help in different ways.
- Don't worry, there are plenty of other places you can turn to for support too...

Local Support Groups

Sometimes it helps talking to other people who are experiencing the same challenges as you.

It may be worthwhile looking online for asthma support groups local to you. Ask your healthcare professionals if they know of any.

Online support groups

Some people feel more comfortable talking to others online. This could be on asthma forums or social media pages.

Take a look at these suggestions:

Asthma UK - https://www.asthma.org.uk/advice/resources/forum/

British Lung Foundation – https://www.blf.org.uk/support-for-you/web-community

Asthma.net – https://asthma.net/forums/

Helplines

If you have any questions, concerns about asthma or are struggling to cope with difficult feelings, you can speak to asthma nurse specialists:

Asthma UK Helpline (9am-5pm, Mon – Fri)

0300 222 5800

Asthma UK WhatsApp Service (9am-5pm, Mon – Fri. The asthma nurse team aim to reply within 3 days)

07378 606 728

Family and Friends

Don't forget about your family and friends.

Here are some ideas of how they could help:
1) Share how you feel with them.
2) Share your asthma action plan with them so they can help support asthma symptoms and understand how you feel.
3) Exercise together.
4) Ask them to collect prescriptions if you are busy or unwell.
5) Put asthma appointments on calendars or reminders on phones so every family member can see when they are.
6) Stay in touch with friends.
7) Plan other activities with friends or family if you have to cancel arrangements.
8) Invite friends around to your house.

Part 6: Setting SMART weight management goals

Setting SMART weight management goals

- It might help to set weight management goals with your asthma doctor or nurse and a family member.
- Together you can review your progress, celebrate your achievements and set new targets.

S - specific
M – measurable
A - achievable
R - realistic
T – time-specific

My target weight is:

Why do I want to achieve this?

What small steps can I take to reach my target goal?

39

What challenges might I face?	How I am going to overcome this:
1.	1.
2.	2.
3.	3.
4.	4.



Who can help me reach my goal?	How they can help me:
1.	1.
2.	2.
3.	3.
4.	4.

◊ Let's get motivated! Recording your progress can help.

◊ You can do this yourself or ask your healthcare professional to weigh you in appointments.

Current weight:

Date:

Current weight:

Date:

Current weight:

Date:

Current weight:

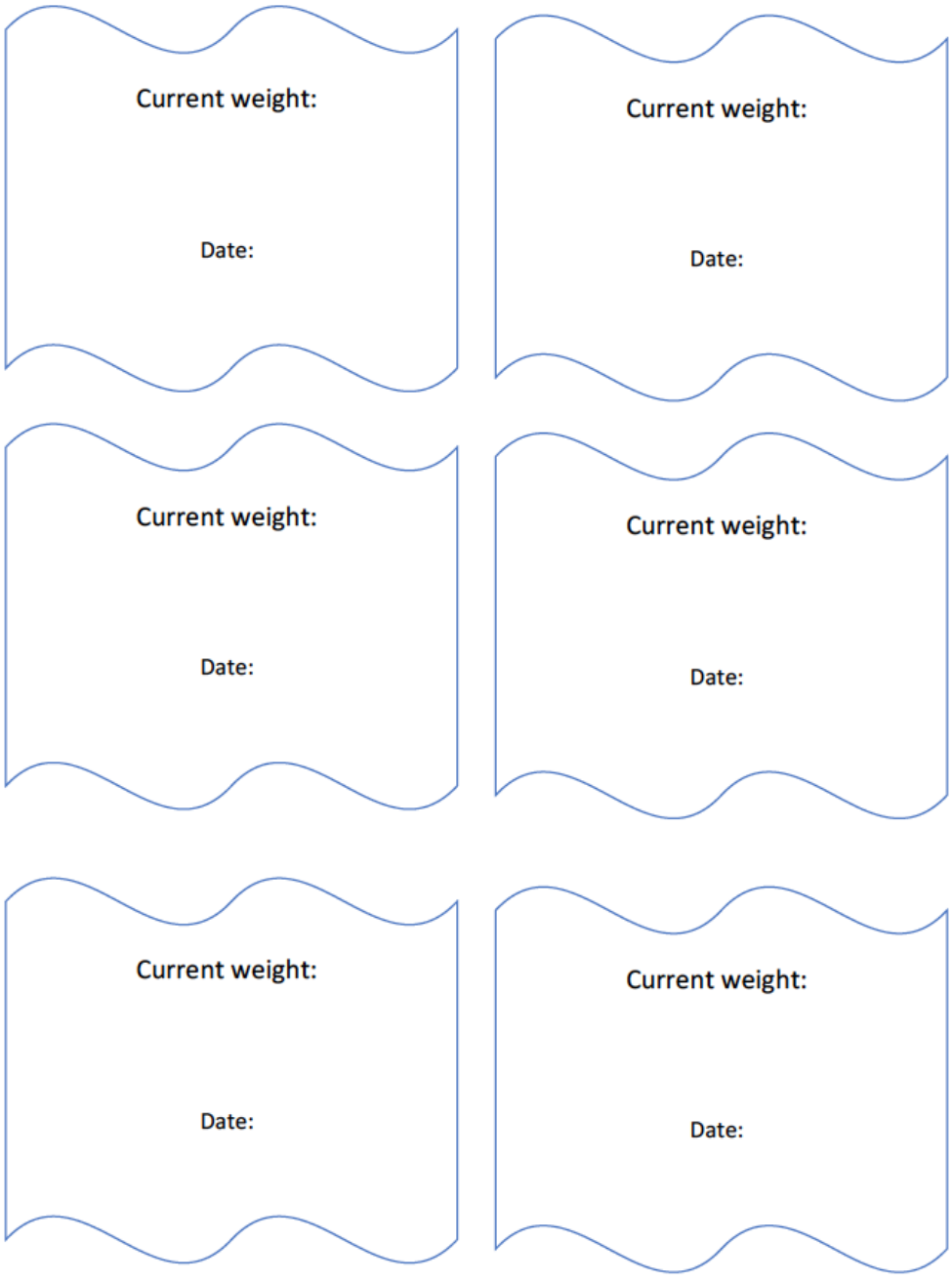
Date:

Current weight:

Date:

Current weight:

Date:


Current weight:
Date:
Current weight:
Date:
Current weight:
Date:
Current weight:
Date:
Current weight:
Date:
Current weight:
Date:

◊ Celebrate your achievements! Plan some rewards for when you reach your goals:

1.

2.

3.

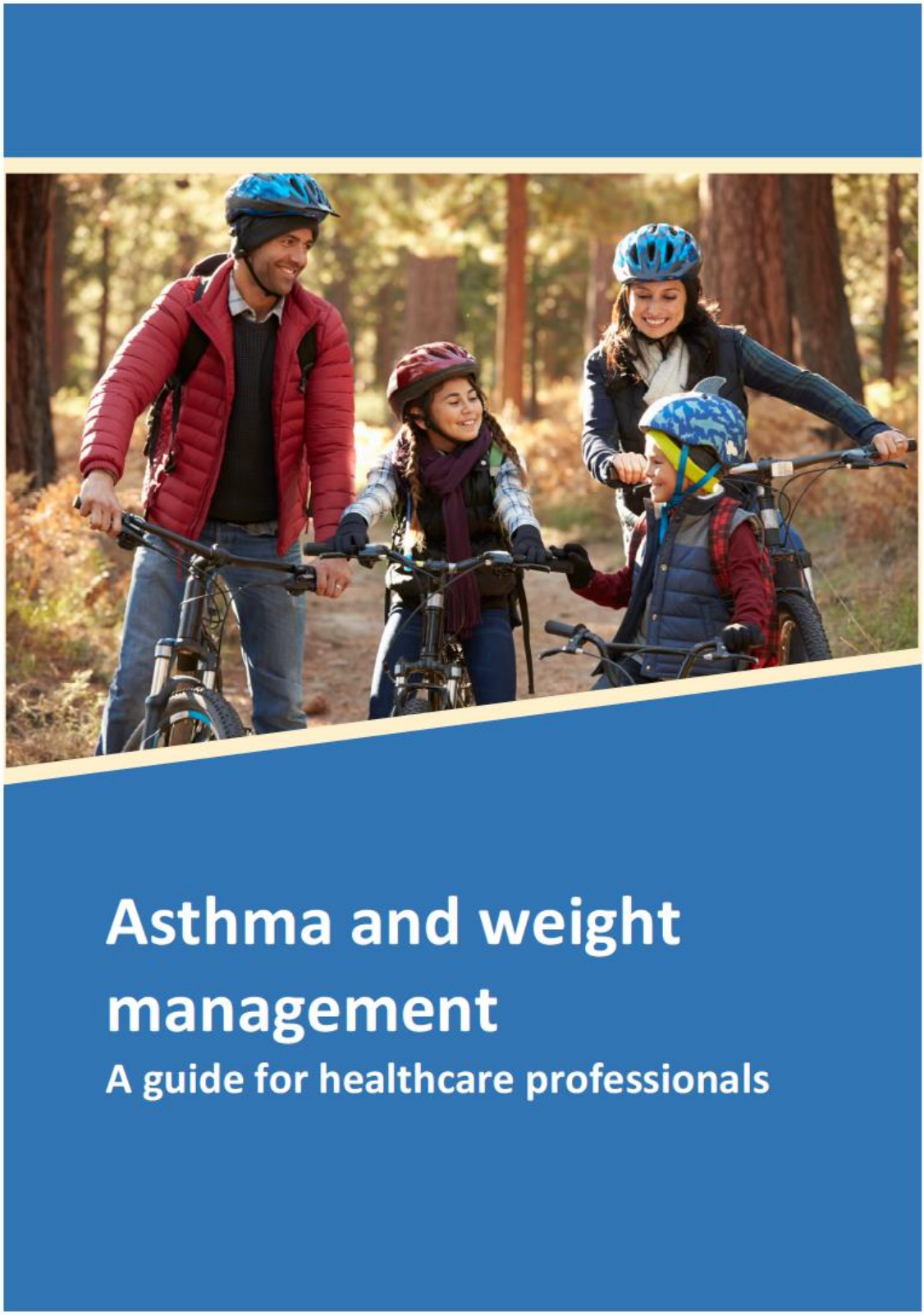
4.

◊ Don't give up! Sometimes it can seem like you are not making much progress and you may not notice immediate results.

◊ Developing new routines can take time and it can be difficult. Remember to review your progress as you go.

◊ Over time being more active, eating healthier and managing your stress and asthma effectively will help you to manage your weight. In turn, you may notice improvements to your asthma control.

Appendix M: Asthma and weight management: A guide for healthcare professionals



Asthma and Overweight/ Obesity

What is childhood obesity?

- Obesity is defined as excess body fat.
- It places young people at a greater risk of serious health conditions and psychological problems.

Prevalence of overweight/ obesity in young people living with asthma

No asthma 31%

Controlled Asthma 36%

Uncontrolled Asthma 44%

Mechanisms behind an obese-asthma phenotype could include:

1. Altered lung volume and energy regulating hormones[1]
2. Increased inflammation[1,2]
3. High energy intake and low exercise engagement[2,3]

Overweight/ obesity can place additional burdens on asthma.

- Asthma control.[4]
- Asthma medication response.[5]
- Quality of life.[4]

- Visits to the emergency department and hospitalisation.[6]

Weight management can improve asthma outcomes and overall health.

- Asthma control.[7]
- Quality of life.[8]

- Physical activity limitations.[9]
- Emergency department use.[9]
- Child BMI-z score.[9]

Weight management conversations

Why talk about child weight in consultations?

- Children living with obesity are five times more likely to become obese adults.[10]
- NHS England advises healthcare professionals commit to 'Make Every Contact Count' (MECC). Implementing MECC includes delivering healthy lifestyle messages that meets healthcare professionals core responsibilities towards improving the local populations health.[11]

A guide to weight management conversations in consultations: Remember AAA

Ask

- Weigh, measure and interpret BMI centile.
- Use open-ended questions to ask about family lifestyle.

Advise

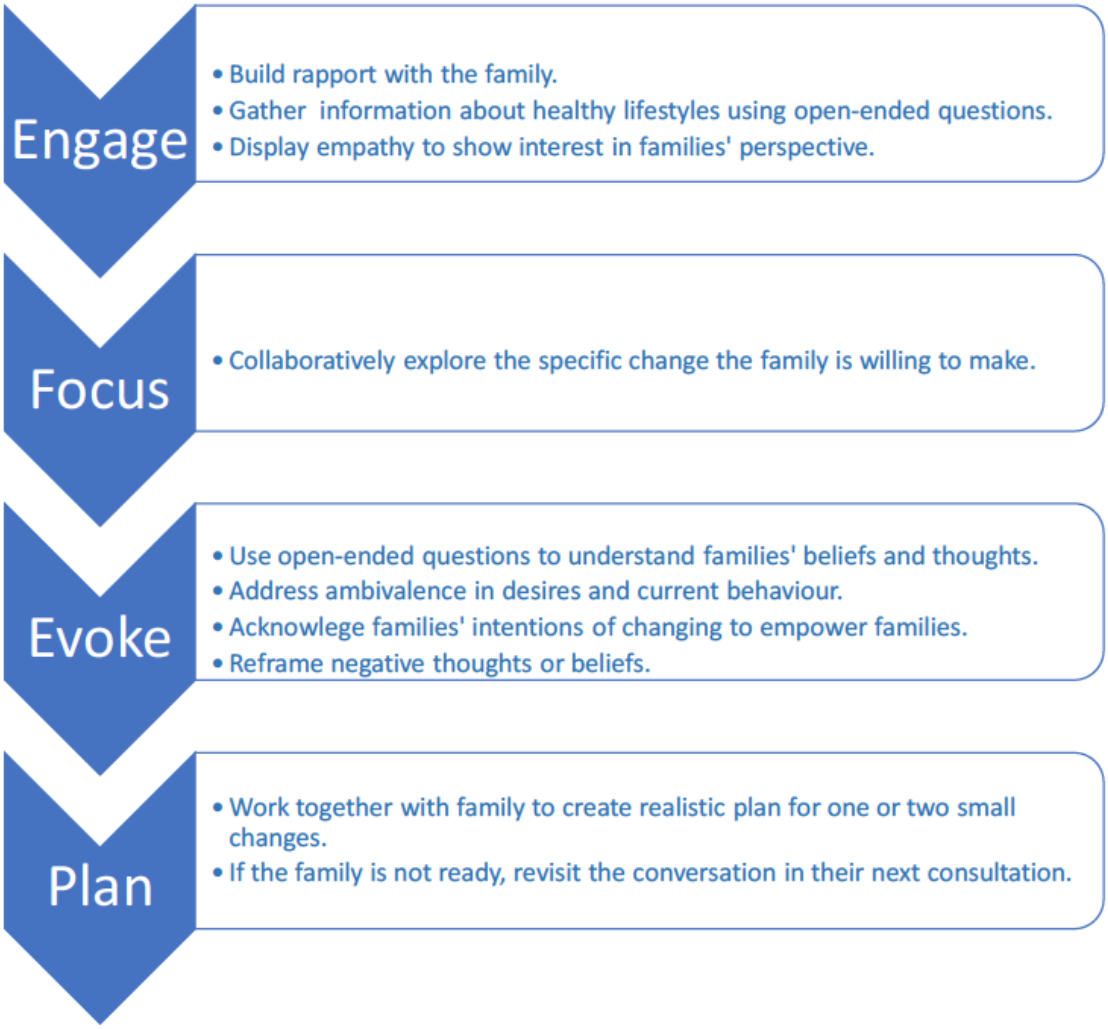
- Show families the young person's growth chart.
- Use positive, encouraging language. Avoid terms such as "obese" and use neutral language such as "weight".[12]
- Link weight to asthma. 77% of young people with asthma are happier to discuss weight in the context of asthma.[13]

Assist

- Explore how families can engage in and maintain a healthy lifestyle.
- Provide practical guidance. Young people feel more satisfied discussing weight when practical guidance is offered.[13]
- Help the family to set 1-2 realistic goals.
- Make referrals to other services when appropriate.

How to motivate and change behaviour in consultations

- Motivational Interviewing (MI) is patient-centred approach that helps patients recognise their own desire for change.
- Using MI, healthcare professionals can identify the families' barriers to weight management, argue for and against change, and develop an individualised weight management plan that families' want to follow.



Common asthma concerns that interfere with weight management

How asthma can influence behaviour and how to support concerns?

- Families living with asthma face unique challenges to weight management.
- Eliciting, understanding and addressing the following concerns may help to increase weight management behaviours in families living with asthma:

Physical activity concerns

Family concern	Behaviour	How to support concerns
Asthma limits young person's ability to engage in exercise	Reduced or restricted exercise to decrease the risk to asthma control	• Reassure families that a goal of asthma management is for young people to be able to engage in exercise and address self-doubts • Ask families to recall times young person has successfully engaged in exercise and suggest they view exercise as a method to improve asthma control • *Suggest families look at p9-14 of the family resource*
Cold weather or high levels of pollen increase risk to asthma control when exercising	Reduced or restricted exercise on days perceived to be a risk	• Recommend families find indoor physical activity opportunities during days perceived to be a risk • Recommend young people cover their chest, throat and keep a scarf over their mouth if exercising in cold weather • *Suggest families look at p11-14 of the family resource*
Breathlessness during physical activity is a symptom of asthma	Reduced or restricted exercise to decrease the risk to asthma control	• Suggest that families view breathlessness as a normal outcome of exercise. • Provide guidance on how to identify differences in asthma symptoms and exercise outcomes • *Suggest families look at p9-14 of the family resource*

Doubt in Physical Education teachers to provide appropriate asthma care	Non-attendance to school on days of poor asthma control or restricted participation in exercise at school	• Identify families concerns about school asthma management and develop strategies to overcome them

Diet concerns

Family concern	Behaviour	How to support concerns
Certain types of food can trigger asthma symptoms	Diet modification to increase control over asthma	• Inform families of the benefit of fruits and vegetables to asthma control, whilst high fat, salt and sugar foods have pro-inflammatory properties that can worsen asthma • Suggest families keep food diaries to identify associations between specific foods and asthma outcomes • *Suggest families look at p27-28 of the family resource*

Medication concerns

Family concern	Behaviour	How to support concerns
Asthma medication will lead to weight gain	Non-adherence to asthma medication	• Help families to list the pros and cons of medication adherence • Highlight that medication can enable exercise engagement and increase capability to manage weight • *Suggest families look at p17-20 of the family resource*
Worry about using asthma medication around peers	Non-adherence of asthma medication or reduced/restricted exercise to reduce risk of asthma exacerbation	• Identify barriers for young people not using asthma medication around peers and develop ways to overcome barriers • Encourage young people to plan how to explain medication use to peers • *Suggest families look at p21-23 of the family resource*

Resources for further information and learning

Childhood obesity:

The Royal College of Paediatrics and Child Health Growth Charts	http://www.rcpch.ac.uk/growthcharts
Public Health Childhood Obesity Impact Pathway	https://www.rsph.org.uk/our-work/policy/measuring-public-health-impact.html
Health education England e-modules	Growth and Nutrition: https://www.minded.org.uk/course/view.php?id=187 Understanding and tackling obesity: https://www.minded.org.uk/course/view.php?id=251 Managing obesity: supporting behaviour change, guiding and enabling behaviour change: http://www.e-lfh.org.uk/programmes/obesity/
Childhood obesity: applying all our health	https://www.gov.uk/government/publications/childhood-obesity-applying-all-our-health/childhood-obesity-applying-all-our-health
Promoting a healthier weight for children, young people and families: consistent messaging	https://www.gov.uk/government/publications/healthier-weight-promotion-consistent-messaging/promoting-a-healthier-weight-for-children-young-people-and-families-consistent-messaging

Guidance on having weight management conversations

Let's Talk About Weight: A step-by-step guide to conversations about weight management with children and families for health and care professionals	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/649095/child_weight_management_lets_talk_about_weight.pdf

Make Every Contact Count resources	https://www.gov.uk/government/publications/making-every-contact-count-mecc-practicalresourceshttp://learning.wm.hee.nhs.uk/mecc http://makingeverycontactcount.org.uk/

Motivational Interviewing:

Change Talk: Childhood Obesity app	https://play.google.com/store/apps/details?id=com.kognito.aap&hl=en_GB https://itunes.apple.com/us/app/change-talk-childhood-obesity/id821851796?mt=8
Motivational interviewing in brief consultations	https://learning.bmj.com/learning/module-intro/.html?moduleId=10051582

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