



Obesity, diet and lifestyle in 9-year-old children with parentally reported chronic diseases: findings from the Growing Up in Ireland longitudinal child cohort study

Michael P. Fitzgerald¹ · Kerrie Hennigan^{1,2} · Clodagh S. O’Gorman^{1,2,3} · Laura McCarron¹

Received: 24 June 2017 / Accepted: 10 April 2018 / Published online: 5 May 2018
© Royal Academy of Medicine in Ireland 2018

Abstract

Background The incidence and prevalence of childhood chronic disease is increasing worldwide. Obesity, poor diet and lifestyle may be more prevalent in children with a chronic disease than in their healthier contemporaries. The Growing Up in Ireland (GUI) study is a nationally representative cohort study of children living in the Republic of Ireland. The study has collected information from 8568 9-year-old Irish children on their experiences within their families, childcare settings, schools and communities, and how these impact on all aspects of children’s development.

Aims This study aims to establish the prevalence of parentally reported chronic disease in children in Ireland and to describe their diet and lifestyle.

Methods This study analyzed data from the Growing Up in Ireland longitudinal child cohort study and compared the diet, lifestyle and prevalence of obesity in children with and without a parentally reported chronic disease.

Results Overall, 954 parents in the sample (11.1%) reported that their child had a chronic illness and 43.4% of these children are hampered by it in their daily activities. Respiratory disorders were the commonest type of chronic disease (46%) reported. Children with a chronic illness were more likely to be overweight or obese (32.9% compared to 25.0% of those without a chronic illness, $p < 0.001$). Children with chronic illness were also found to have a poorer diet, take less exercise and experienced significantly more social isolation than their peers (all $p < 0.05$).

Conclusions Public health measures to address diet and lifestyle choices need to be cognisant of the needs of children with chronic diseases and tailor activities offered to be inclusive of all children. Medical professionals having contact with children with chronic conditions need to remember to reinforce the importance of diet and lifestyle whenever possible and to explore with families solutions to barriers to making healthy diet and lifestyle choices.

Keywords Activity · Chronic disease · Friends · Sedentary · Growing up in Ireland · Obesity · Paediatric · Prevalence · Quality of life

The incidence and prevalence of chronic disease are rising worldwide [1,2]. Among children, the prevalence of chronic disease has quadrupled in the past four decades and it has been suggested that 12–16% of the paediatric population internationally have a chronic disease [3–6]. Many children who previously would have either died early in

life or were institutionalised are now living well into adulthood and functioning in the community [7]. Also, rates of chronic diseases that present in childhood such as asthma, type 1 diabetes mellitus and inflammatory bowel disease are increasing [8, 9]. The impact of paediatric chronic diseases on child health-related cost is significant with respect to health care utilisation, school and work absenteeism and family functioning [5, 10, 11].

Childhood obesity has also grown rapidly in recent years, thereby increasing the burden of both immediate and long-term health effects [12, 13]. In Ireland, childhood obesity is a well-recognised public health challenge with one in four children on the island being obese or overweight [14]. A recent study revealed that the estimated total lifetime costs of childhood overweight and obesity

✉ Michael P. Fitzgerald
michael.pio.fitzgerald@gmail.com

¹ The Ark, University Hospital, Limerick, Ireland

² Graduate Entry Medical School, University of Limerick, Limerick, Ireland

³ Health Research Institute, University of Limerick, Limerick, Ireland

on the island is at 7.2 billion euros from direct health care costs and indirect costs due to absenteeism and premature mortality [15].

This study aims to establish the prevalence of parentally reported chronic disease in Irish children and to describe their diet and lifestyle. The underlying hypothesis is that children with chronic disease are more likely to be overweight or obese, to have poorer diet and lifestyles and to be more at risk of social isolation than their peers without a chronic disease.

Methods

The data analysed are from the first wave of the Growing Up in Ireland (GUI) survey conducted in 2007 and early 2008. The sample consisted of 8568 nine-year-old children participating in the Growing Up in Ireland Study, a nationally representative cohort study of children living in the Republic of Ireland. The study has collected information on children's experiences within their families, childcare settings, schools and communities, and how these impact on all aspects of children's development. These areas of development include children's social, emotional, physical and cognitive functioning.

The study provides a comprehensive understanding of Irish children's development in the current social, economic and cultural environment.

The cross-sectional sample of children was selected through a two-stage sampling method within the national school system. Eligible children were those who were born between 1 November 1997 and 31 October 1998. In the first stage, 1105 primary schools from the national total of 3177 were selected using a probability proportionate to size (PPS) sampling method. In the second stage, a random sample of eligible children was selected within each school. At the school level, a response rate of 82% was achieved yielding a sample of 910 primary schools, while at the level of the household (i.e. eligible child selected within the school), a total of 57% of children and their families participated in the study yielding a final sample of 8568 children. Information was collected from parents, teachers, school principals and the children themselves. The data are reweighted to take account of sample errors using a large range of factors and a minimal distance algorithm. The study received ethical approval from the Research Ethics Committee of the Office for the Minister for Children and Youth Affairs in Ireland.

Chronic illness

Each Study Child was asked "Do you have a long term illness, disability or medical condition (like diabetes, asthma, allergy or cerebral palsy) that has been diagnosed by a doctor?" and

"If yes, does your long term illness, disability or medical condition affect your attendance or participation at school?"

The primary caregiver was asked whether the Study Child has "any on-going chronic physical or mental health problem, illness or disability?" Respondents were also asked about the nature of the illness or disability and these open-ended responses were subsequently coded using the International Classification of Disease (ICD) 10 and whether the child was "hampered in his/her daily activities by this problem, illness or disability?"

The primary caregiver was also asked to describe the Study Child's health in the past year by choosing one of the following options: "Very healthy, no problems"; "Healthy, but a few minor problems"; "Sometimes quite ill"; and "Almost always unwell".

Education and learning

The primary caregiver was asked: "Do you think the Study Child has a Specific Learning Difficulty, Communication or Co-ordination Disorder?" If a positive answer was given, the following tick box question was applied: "what is the nature of the disorder, dyslexia, ADHD, autism, Asperger's, speech and language difficulty, dyspraxia, slow progress (reasons unclear) or other (specify)?"

Diet

Both the child and the primary caregiver were asked to catalogue the child's diet in the past 24 h. The children were given an abbreviated list of common foods and asked to estimate their intake over the past 24 h; the possible answers were "no servings, one serving or more than one serving". The caregiver was given a more extensive list of common foods and asked to estimate the child's intake over the past 24 h; the possible answers were "once, more than once, not at all or don't know".

The caregivers were also asked to estimate how much and what type of milk the child drank in the past 24 h and whether the child was on a special diet e.g. vegetarian, vegan or coeliac etc.? Caregivers were also asked: "Does the child usually have something to eat before school?"

Physical exercise

Both the Study Child and the primary caregiver were asked to estimate the number of times the child engaged in 20 min of hard and light exercise over the past 14 days. Hard exercise was defined as "enough to make him/her breathe heavily and make his/her heart faster e.g. playing football, jogging, or fast cycling". Light exercise was defined as "not hard enough to make him/her breathe heavily and make his/her heart beat fast e.g. walking or slow cycling".

Sedentary activities

The primary caregiver was asked on a normal weekday during term time “How many hours does the Study Child spend watching television, videos or DVDs™, using the computer, playing video games such as PlayStation®, X-Box™, Nintendo® etc.?” The primary caregiver was also asked: “Does the Study Child have the following in his/her bedroom; television, computer or laptop, video/DVD or games console (PlayStation etc)?”

Social activity

The child’s primary caregiver was asked to estimate how many times a week “Does the Study Child do things with friends outside of school hours?” and “How many close friends does the Study Child have?”

BMI

Body mass index (BMI) was calculated by dividing independently recorded weight in kilogrammes by height in metres squared. This report uses the age and sex-specific cut-off measurements provided by the International Obesity Task Force (IOTF) [16]. As children could be interviewed at any stage between their ninth and tenth year of age, the IOTF cut-offs for children aged 9.5 years were used in the present analysis.

Results

Data was returned on 8568 children, which represents 57% of the eligible population.

Chronic illness

Overall, 954 (11.1%) parents/caregivers in the sample reported that their child had an “on-going chronic physical or mental health problem, illness or disability”. In contrast, 1170 (13.8%) children self-reported as having a chronic illness. The perceptions of the children and their caregivers with regard to the presence of chronic illness did not always correspond. One third ($n = 316$) of children reported by their primary caregiver as having a chronic illness were unaware they had a chronic illness. Conversely, 559 (6.6% of the study population) children reported by their caregivers as not having a chronic illness self-reported as having a chronic illness. The subsequent analysis conducted as part of this study utilised the caregiver’s reported prevalence of chronic illness (11.1%) as opposed to the children’s self-reported prevalence of chronic illness (13.8%). This reflects the perceived limitations of a 9-year-old child’s understanding of chronic illness and their inability to give an accurate report of their own health status.

Figure 1 outlines the characteristics of the most frequently illness reported according to system involved using ICD10 classification. Respiratory disorders accounted for 46% of reported chronic illness (438/954) and asthma accounted for 93% of all respiratory disorders. This equates to asthma alone representing 43% of all chronic illnesses in our study population.

With regard to daily activities, primary caregivers reported that 414/953 (43%) of children with a chronic illness were hampered in their daily activities; of these, 350/414 (85%) were hampered to some extent and 64/414 (15%) were hampered severely.

Children with a chronic illness were statistically less likely to be described as very healthy compared to children without a chronic illness (331/953 vs. 5924/7614, 34.7 vs. 77.9%, $p < 0.001$). Children with a chronic illness were also statistically more likely to be described by their primary caregiver as almost always unwell compared to children without a chronic illness (83/954 vs. 137/8568, 8.7 vs. 0.7%, $p < 0.001$).

Education and learning

Significantly more children in the chronic illness category had a concurrent diagnosis of a specific learning difficulty, communication or co-ordination disorder compared to children without a chronic illness (301/953 vs. 604/7609, 31.6 vs. 7.9%, $p < 0.001$).

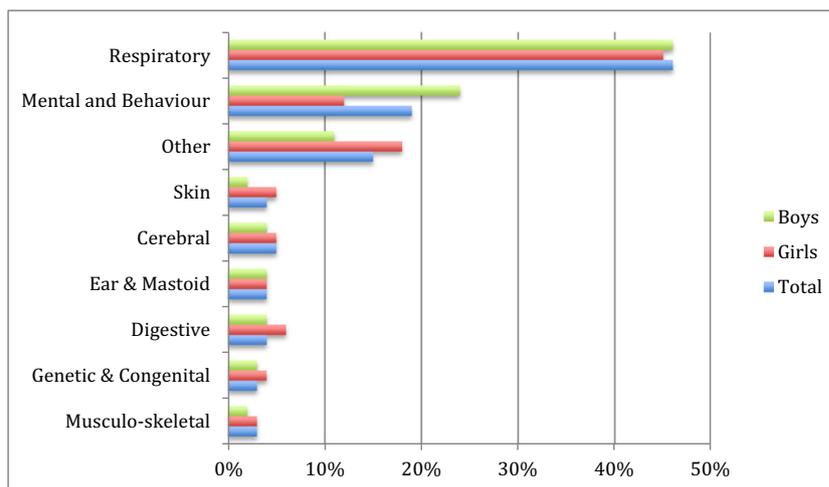
Diet

All children on special diets were excluded from analysis comparing food consumption by category and there were no significant differences found when comparing consumption of the following foods by children with and without a chronic illness: fresh fruit, fruit juice, meat/chicken/fish, eggs, crisps or savoury snacks, bread, cereals, cheese/yoghurt/fromage frais, low fat cheese/low fat yoghurt, soft drinks/minerals/cordial/squash (not diet), skimmed milk/skimmed milk products, consumption of an evening meal.

Children with a chronic illness were statistically more likely not to have consumed raw vegetables or salad (690/878 vs. 5565/7444, 78.6 vs. 74.8%, $p = 0.011$), potatoes, pasta or rice (153/879 vs. 1002/7442, 17.4 vs. 13.5%, $p = 0.004$) or have drunk tap, still or sparkling water (148/880 vs. 1057/7439, 16.8 vs. 14.2%, $p = 0.03$) in the 24 h prior to the study than children without a chronic illness. Children with a chronic illness were also more likely to have consumed hot chips or French fries (352/880 vs. 2569/7445, 40 vs. 34.5%, $p = 0.005$) but less likely to have consumed biscuits, doughnuts, cake, pie or chocolate (608/880 vs. 5511/7441, 69 vs. 74.1%, $p = 0.006$) compared to children without a chronic illness.

Further analysis was conducted focusing on the population of children with chronic illnesses. Children with chronic

Fig. 1 Characteristics of most frequent chronic illnesses in Study Children as reported by primary carers (ICD 10)



illnesses associated with severe impairment in daily activities were statistically more likely not to have consumed meat, chicken or fish (10/47 vs. 32/510, 21.3 vs. 6.3%, $p < 0.001$) and cooked vegetables (23/48 vs. 151/511, 47.9 vs. 29.5%, $p = 0.048$) in the 24 h prior to the study than children with chronic illnesses who were not reported to be severely hampered in their daily activities.

Finally, 7.8% (74/954) of children with a chronic illness are on a special diet compared with only 2.2% (238/8566) of children without a chronic illness.

Children with a chronic illness more frequently missed breakfast than children without chronic illnesses (38/880 vs. 207/7448, 4.3 vs. 2.8%, $p = 0.011$).

Social activity

Children with a chronic illness were statistically more likely not to do something with a friend during the week compared to children without a chronic illness (103/953 vs. 421/7610, 10.8 vs. 5.5%, $p < 0.001$). Children who were severely hampered in their daily activities and those who were hampered to some extent in their daily activities were even less likely to never do something with a friend during the week (23/36 and 37/350, 36.5 and 10.6%, respectively, $p < 0.001$).

Children with a chronic illness were more likely not to have any close friends compared to children with no chronic illness (51/995 vs 116/7604, 5.4 vs. 1.5%, $p < 0.001$). Amongst children with a chronic illness, 19.4% (12/62) of those whose daily activities are severely hampered, 6.3% (22/349) of those who were hampered to some extent and 3.1% (17/92) of those whose daily activities were unaffected were reported not to have any close friends.

Sedentary activity

Children with a chronic illness statistically spent more time watching television ($p = 0.012$) and playing video games

($p < 0.001$) and were more likely to have a TV (52.8 vs. 43.6%, $p < 0.001$) and a DVD/video player (43.3 vs. 34.7%, $p < 0.001$) in their bedroom. There was no statistically significant difference in time spent using personal computers between children with and without chronic illnesses.

Exercise

Children with chronic illnesses were statistically more likely not to have engaged in hard exercise in the past 14 days when compared to children without a chronic illness (53/953 vs. 158/7612, 5.6 vs. 2.1%, $p = 0.001$). Children with chronic illnesses were also statistically more likely not to have engaged in light exercise in the past 14 days when compared to children without a chronic illness (23/955 vs. 92/7613, 2.4 vs. 1.2%, $p = 0.001$).

Amongst children with chronic illnesses, those with severely hampered daily activities were more likely not to have exercised at all compared to children with somewhat affected daily activities and children whose daily activities were not affected (17.5 vs. 9.2 vs. 1.8%).

BMI

Children with a chronic illness were more likely to be above a healthy BMI compared to children without a chronic illness (32.9 vs. 25%, $p < 0.001$).

Discussion

Our study highlights that children in Ireland with parentally reported chronic diseases are less active and more sedentary, have fewer friends, see those friends less often and have a poorer diet with a higher BMI than their contemporaries who do not report a chronic disease. These findings paint a worrying if not entirely unexpected picture of the

poor quality of life of our vulnerable child populations with chronic disease.

Regular exercise and social interaction along with a balanced diet are essential for the growth and development of all children. This is especially true of children with chronic diseases. The data in this study are concerning, as they suggest that these children are living with the negative consequences of having a poor diet and lifestyle along with being socially isolated from their peers. A child's diet and lifestyle largely reflects the choices their parents present them with and any targeted approach to improve these areas must acknowledge the necessity to educate and facilitate both parents and children.

Obesity is a significant comorbidity for children with a chronic disease, and in many cases, we can identify increased complications of the primary disease attributable to the comorbid obesity. Additionally, any condition that limits diet and lifestyle may predispose to obesity. Depression and low self-esteem are more prevalent in both children with chronic diseases and in children with obesity, but unfortunately were not measured in this study [17–19]. Further studies assessing mood in these children would be very important.

Studies have shown that children who are obese at the ages of 7 to 11 years are five times more likely to be obese as adults compared with non-obese children [20]. Obesity in adulthood is associated with a spectrum of chronic diseases and it appears from our results that for some children, a chronic childhood disease may be at risk of developing a significant second chronic disease also [21].

Obesity and sedentary behaviour in a child with a chronic disease may exacerbate the disease itself. Our study found that asthma is the most common chronic disease in Irish children and studies have shown that obese and overweight children have poorer control of asthma control than other children, leaving them less able to exercise and maintain a healthy weight [22].

An approach to paediatric obesity will be difficult and will require multifaceted interactions between organisations (e.g. schools) and families. It is likely to be in effect for a long period before any potential results are seen. An approach to tackling obesity in children with a chronic disease is likely to be even more complicated than that in the general population, given that their chronic disease itself may confer dietary and movement restrictions. As clinicians, we should approach every consultation with patients and their parents as an opportunity to educate and advise regarding exercise and diet. Children with chronic disease need greater access to dietitians and physiotherapists for dietary and exercise education. Schools play an important role and many now have healthy eating policies. Public health measures such as the tax on high sugar beverages may be helpful; however, their impact has yet to be established (due to be implemented in April 2018). Other measures might include making healthy food

cheaper with subsidies and improving public access to and awareness of health and social amenities. Public health promotion websites such as www.safefood.eu contain easy to access and valuable resources such as videos and recipes that promote healthy eating. Medical, societal and school-based interventions aimed at tackling paediatric obesity will not succeed unless the therapy is family-based and the whole family subscribes to the changes. The challenge for doctors and society is to educate and support our patients and their families in understanding the nature of obesity, its consequences and identifying all the multifaceted potential solutions.

This study has a number of strengths: the GUI data have been rigorously collected, are methodologically sound and are representative of the population. Also, this study is the first of its kind to establish the incidence of parentally reported chronic disease in Irish children and to explore the impact chronic disease has on quality of life. The results of this study will be an important asset in the future planning of health care services for children with chronic diseases in Ireland. Children with a medical requirement for an altered diet were excluded from the dietary analysis of this study; thus, the results more accurately reflect the impact chronic disease has on children's diet.

This study also has weaknesses: the definition of chronic disease in children is based not on medical investigations or clinical examination but rather on parental perception. Inconsistent and inaccurate parental reporting of chronic disease may lead to potential misrepresentation of the prevalence of chronic disease in the study population. Had the study group cross-referenced the reported diagnosis with the child's medical notes, this limitation may have been avoided. However, the parentally reported incidence of chronic disease of 11.1% is in keeping with other international estimates [3–6]. This is a limitation of the GUI methodology, and therefore not one which we can control for in our study. Also, there is always some uncertainty regarding a child's past medical history when a medical practitioner first encounters a patient and must solely rely on the information delivered by the parents and we believe our study reflects this. The number of children in the study is too small to distinguish between effects on diet and lifestyle of different types of chronic disease, e.g. respiratory versus metabolic disorders. Finally, the study does not try to establish the causality for increased weight and poor lifestyle choices, e.g. whether chronic disease or its treatment limits a child's lifestyle choices.

Conclusions

Based on data from the Growing Up in Ireland Study, children in Ireland with chronic diseases are more likely to have higher BMI, be less active, spend more time in sedentary activities

and overall make poorer diet choices than children without chronic diseases. Public health measures to address diet and lifestyle choices need to be cognisant of the needs of children with chronic diseases and tailor activities offered to be inclusive of all children. Medical professionals having contact with children with chronic conditions should remember to reinforce the importance of diet and lifestyle whenever possible, and to explore with families solutions to barriers to making healthy diet and lifestyle choices.

The results of this study suggest particular consideration needs to be given to children with chronic disease and their increased risk of obesity, poorer quality of life and social isolation. We suggest that theirs is an under-recognised crisis within a larger obesity and lifestyle crises.

Acknowledgements We acknowledge the contributions of Prof Ailish Hannigan and Dr. Helen Purtill, biostatisticians at the Graduate Entry Medical School, University of Limerick.

Funding The authors of this paper received no funding for its creation however Growing Up in Ireland is a government-funded study of children being carried out jointly by the ESRI and Trinity College Dublin.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval No animals were involved in this study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Growing Up in Ireland is being conducted under ethical approval from the Health Research Board's Research Ethics Committee. This involves a rigorous ethical review of each part of the study including international reports on the project's design and content.

Informed consent Detailed information sheets were prepared for all potential participants in Growing Up in Ireland, including parents, children, teachers, principals, non-resident parents and regular carers. These sheets described the type of information that would be gathered, what would be involved for participants, the longitudinal nature of the study and details about the researchers and funding bodies. All participants were informed of the voluntary nature of the study and of their right to refuse to answer any questions that they did not wish to answer. Signed consent was obtained from a parent/guardian and the Study Child concerned before any data were collected about that child.

References

- (2001) Innovative care for chronic conditions. World Heal. Organ. Geneva
- Epping-Jordan J, Bengoa R, Kawar R, Sabaté E (2001) The challenge of chronic conditions: WHO responds. *BMJ* 323:947–948
- Newacheck PW, Halfon N (1998) Prevalence and impact of disabling chronic conditions in childhood. *Am J Public Health* 88: 610–617
- Van Dyck PC, Kogan MD, McPherson MG, Weissman GR, Newacheck PW (2004) Prevalence and characteristics of children with special health care needs. *Arch Pediatr Adolesc Med* 158:884–890
- Perrin J, Bloom S, Gortmaker S (2007) The increase of childhood chronic conditions in the United States. *J Am Med Assoc* 297: 2755–2759
- Bethell CD, Read D, Blumberg SJ, Newacheck PW (2008) What is the prevalence of children with special health care needs? Toward an understanding of variations in findings and methods across three national surveys. *Matern Child Health J* 12:1–14
- Newacheck PW, Taylor WB (1992) Childhood chronic illness: prevalence, severity, and impact. *Am J Public Health* 82:364–370
- Selnes A, Bolle R, Holt J, Lund E (2002) Cumulative incidence of asthma and allergy in north-Norwegian schoolchildren in 1985 and 1995. *Pediatr Allergy Immunol* 13:58–63
- Henderson P, Hansen R, Cameron FL, Gerasimidis K, Rogers P, Bisset MW, Reynish EL, Drummond HE, Anderson NH, van Limbergen J, Russell RK, Satsangi J, Wilson DC (2012) Rising incidence of pediatric inflammatory bowel disease in Scotland. *Inflamm Bowel Dis* 18:999–1005
- Van der Lee J, Mokkink L, Grootenhuis M, Heymans H, Offringa M (2007) Definitions and measurement of chronic health conditions in childhood—a systematic review. *JAMA* 297:2741–2751
- Coonley WC, McAllister JW (2004) Building medical homes: improvement strategies in primary care for children with special health care needs. *Pediatrics* 113:1499–1506
- National Taskforce on Obesity (2005) Obesity: the policy challenges. The Report of the National Taskforce on Obesity
- Cameron N, Hastings G, Ellison G (2005) Childhood obesity contemporary issues, society for the study of human biology series. (CRC Press), p 25–38
- Layte R, Mccrory C (2011) Growing up in Ireland National Longitudinal Study of Children overweight and obesity among 9-year-olds. Government publications dublin
- Perry JJ, Millar SR, Baland KP, Dee A, Bergin D, Carter L, Doherty E, Fahy L, Hamilton D, Jaccard A, Knuchel-Takano A, McCarty L, McCune A, O'Malley G, Pimpin L, Queally M, Webber L (2017) What are the estimated costs of childhood overweight and obesity on the island of Ireland. <http://www.safefood.eu/SafeFood/media/SafeFoodLibrary/Documents/Publications/Research%20Reports/Cost-of-childhood-obesity-Report.pdf>
- Cole TJ, Bellizzi MC, Flegal KM, Dietz WH (2000) Establishing a standard definition for child overweight and obesity worldwide : international survey. *Br Med J* 320:1240–1243
- Pinquart M, Shen Y (2011) Depressive symptoms in children and adolescents with chronic physical illness: an updated meta-analysis. *J Pediatr Psychol* 36(4):375–384. <https://doi.org/10.1093/jpepsy/jsq104>
- Rankin J, Matthews L, Cobley S, Han A, Sanders R, Wiltshire HD, Baker JS (2016) Psychological consequences of childhood obesity: psychiatric comorbidity and prevention. *Adolesc Health Med Ther* 7:125–146
- Seigel WM, Golden NH, Gough JW, Lashley MS, Sacker IM (1990) Depression, self esteem and life events in adolescents with chronic diseases. *J Adolesc Health Care* 11(6):501–504
- Simmond M, Llewellyn A, Owen C, Woolacott N (2016) Predicting adult obesity from childhood obesity: a systematic review and meta-analysis. *Obes Rev* 17:95–107
- Guh D, Zhang W, Bansback N et al (2009) The incidence of comorbidities related to obesity and overweight: a systematic review and meta-analysis. *BMC Public Health* 88:9–88
- Lavoie K, Bacon SL, Labrecque M, Cartier A, Ditto B (2006) Higher BMI is associated with worse asthma control and quality of life but not asthma severity. *Respir Med* 100(4):648–657