

# The Childhood Comorbid Obesity Definitions (Child CODE) Study: a global consensus process protocol

## 1.0 Background:

The development of obesity has increasingly shifted toward childhood<sup>1</sup>. More than one in five children worldwide is classified as having overweight<sup>2</sup> and, in the United States (US), one in six children has obesity<sup>3</sup>. In the absence of effective prevention strategies, the need to evaluate the effectiveness of treatments for childhood obesity is urgent. Research studies examining the outcomes of such treatments do not often report cohorts of more than 100 children or adolescents, making the need for collaboration, data-pooling and comparability between studies even more important. However, within the current literature, outcome reporting is heterogeneous and comparison between different interventions, and even between different studies of the same intervention, is very difficult. Although described as one of the most common limitations within the bariatric surgical literature, this problem extends across the entirety of the child obesity field.

In a rapidly expanding field of primary research, such as that of adolescent bariatric surgery, the opportunity exists to influence the form in which outcomes are reported by emerging manuscripts and facilitate collaborative and amalgamative analysis of pooled data to achieve conclusions more influential than the sum of the individual research studies.

Definitions will be sought for a several major comorbidities of child or adolescent obesity, and severe obesity itself. Guided by preliminary work with key stakeholders, comorbidities will include type 2 diabetes and prediabetes, dyslipidaemia, hypertension, non-alcoholic fatty liver disease and non-alcoholic steatohepatitis, obstructive sleep apnoea, polycystic ovarian syndrome, psuedotumour cerebri, anaemia and health-related quality of life.

## 2.0 Aims:

1. To systematically examine the literature for existing definitions of severe obesity and pre-specified obesity-related comorbidities in children and adolescents.
2. To amalgamate existing definitions of severe obesity and obesity-related comorbidities and identify the most appropriate for use in studies examining child or adolescent obesity using Delphi consensus methodology with wide global participation.

Importantly, it is not within the remit of this study to develop new definitions of comorbidities. This study will identify the most appropriate among existing definitions for unified use across child and adolescent obesity studies.

### **3.0 Methods:**

A three-stage study design will be used to identify existing definitions and then determine consensus regarding the most appropriate among them to use when reporting outcomes in child and adolescent obesity.

#### **3.1 Phase 1:** *Identifying potential definitions and their use (literature review).*

A series of systematic reviews will be conducted, one for each included comorbidity, examining which definitions exist and how they are used in the literature. Medline and Embase will be used to interrogate the literature to identify:

1. All studies reporting the respective comorbidity in child and adolescent obesity studies across the past 5 years (or 10 years where the number of studies retrieved is <100);
2. Reports describing the development or proposal of comorbidity definitions or making recommendations regarding their use in children and/or adolescents.

In order to yield a manageable body of literature and limit the search to the most influential studies, the search will be limited to studies cited 5 or more times at the time of searching. Additional searches and steering group input will permit identification of the newest definitions, which could be missed by the search criteria herein.

A summary will be written for each identified definition outlining (as available) the methodology used to develop the definition, the level of evidence, and the degree of current recommendation in children and adolescents (isolated reports = low; regional guidance or similar or >25% use in literature = moderate; national body recommendation or >50% use in literature = high; multiple national bodies adopting or >75% use in literature = highest). Where feasible, an appropriate original reference for each definition will be identified to supplement the summary for participants to peruse during the Delphi process.

To complete Phase 1, members of the steering group will review the definitions, summaries and original materials following the literature searches, identifying any relevant omissions, removing any inappropriate inclusions, and refining summaries.

#### **3.2 Phase 2:** *Determining consensus among key global stakeholders using Delphi methodology.*

Participants will be chosen to cover a wide geographical reach and a breadth of expertise within the field of obesity. Invited participants will include, but not be limited to, medical obesity specialists (paediatricians), bariatric surgeons (both adult and paediatric), allied obesity professionals (e.g. dietitians, specialist nurses, psychologists), methodologists, and patient and public participants.

Recruitment of Delphi participants will be according to two methods: Firstly the contact details of corresponding authors of relevant papers within the literature reviews will be prospectively recorded in a database. Secondly, members of the Steering Group will be invited to add individuals to ensure broad representation across all professional groups.

**3.2.1 Delphi round 1** - Definitions identified in phase 1 will be formatted into items to allow participants to rate how appropriate they perceive each definition to be for children and adolescents on a nine point Likert scale, ranging from one (inappropriate) to nine (extremely appropriate). This round will also offer the opportunity to contribute additional definitions to the process, which were not identified in Phase 1.

**3.2.2 Delphi round 2** – All participants from round 1 will be invited to participate in round 2. Descriptive statistics from round 1 responses will be presented in order for the initial degree of consensus, and eligibility for inclusion in round 2, to be determined for each definition (see 4.0 Data analyses).

For each comorbidity, definitions will be organised into four groups according to summary scores: “consensus appropriate,” “consensus inappropriate,” “disagreement” and “equivocal” (see 4.0 Data analyses). No further response will be solicited for “consensus inappropriate” definitions.

**3.2.3 Delphi round 3** - All participants from round 1 will be invited to participate in round 3. Descriptive statistics from round 2 responses will be presented (see 4.0 Data analyses).

For each comorbidity, participants will be asked to identify the single definition they perceive to be the gold standard definition of the respective comorbidity. Participants will also be asked which definition they perceive as most appropriate and feasible for use in all clinical studies of child or adolescent obesity. Participants will finally be asked to rate, on a nine-point Likert scale, how strongly they agree that the “consensus appropriate” definitions should be routinely used and how strongly they agree that the “consensus inappropriate” definitions need not be reported in all studies of adolescent bariatric surgery on a nine-point Likert scale.

### **3.3 Phase 3 – Steering group meeting to finalise the definitions**

A consensus meeting will be held by the steering group to validate the final definitions identified as most appropriate and to discuss any areas where <25 percent difference exists between the most and second-most appropriate definition for any particular comorbidity in Delphi round 3. Persistent areas of “disagreement” will also be discussed.

## **4.0 Data analyses**

Data will be entered into a database and statistical analysis completed using SPSS® statistical software. Subgroup analyses will be performed to permit comparison of the results between groups.

**4.1 Analysis of Delphi round 1:** Descriptive statistics will be used to summarise the results of round 1, including the number of participants rating the outcome as either seven, eight or nine (very appropriate / extremely appropriate). Definitions rated seven, eight or nine by at least 20 percent of participants will be retained for the next round. All other definitions will not be carried forward.

**4.2 Analysis of Delphi round 2:** For each definition presented in round 2, the proportion of participants scoring 1-3, 4-6 and 7-9 on the nine-point Likert scale will be calculated for each item. “Consensus appropriate” (consensus that the definition is appropriate to report in all studies of child or adolescent obesity) will be defined as greater than 70 percent of items scoring as 7-9 AND less than 25 percent of participants scoring as 1-3. “Consensus inappropriate” (consensus that the definition is inappropriate to report in all studies of child or adolescent obesity) will be defined as greater than 70 percent of participants scoring as 1-3 AND less than 25 percent of participants scoring as 7-9. “Disagreement” will occur when 33 percent or more score 1-3 AND 33 percent or more score 7-9 for a particular outcome. All other combinations will be considered “Equivocal.” All definitions will be designated into one of these four categories. “Consensus appropriate” items will be brought forward for the third round and “Consensus inappropriate” and “Equivocal” items will be discarded. Definitions designated “Disagreement” will undergo further analysis: mean scores will be calculated, and depending whether the mean is above or below 5 (i.e. tending towards “consensus appropriate” or “consensus inappropriate”) the definition will be included in or discarded for round 3, respectively.

**4.3 Analysis of Delphi round 3:** For each comorbidity, the definition most frequently identified as “gold standard” and “most appropriate and feasible to report in all studies”, respectively, will be designated as the recommended consensus definition(s).

The proportion of participants identifying this definition as “gold standard” and “most appropriate and feasible to report in all studies”, respectively, will be calculated and if there is a difference of <25 percent in the proportion of participants identifying this and any other definition as “gold standard” and “most appropriate and feasible to report in all studies”, respectively, in Delphi round 3, further discussion will take place in the final Steering Group meeting. In addition, the proportion of participants scoring 1-3, 4-6 and 7-9 will be calculated. The definitions of consensus described in round 2 will be applied to these data. Definitions designated “Consensus appropriate” will be defined in the final report as appropriate to report in studies of child and adolescent obesity interventions. Any remaining definitions designated “Disagreement” will be discussed at the final consensus meeting of stakeholders. All other definitions will be discarded.

## **5.0 Write up**

The Steering Group will identify an appropriate writing group and all members of the Steering Group will be invited to contribute to the manuscript and be cited using the collaborative name *The Child CODE Steering Committee*. All participants in the Delphi process will be cited as collaborators for under the collaborative name *The Child CODE Study Group*.

## **6.0 Ethics and dissemination**

As no patient or animal data or tissue will be collected in this study, no ethical approval was required. This was confirmed using the UK National Health Service Health Research Authority ethics decision tool.

Participants will be informed at the outset that their participation will be interpreted as consent to participate in the study and their de-identified responses will be included in analyses. Data will be stored on a password-encrypted computer, stored in a locked office. Data will be available only to researchers and will be destroyed after five years. Data will be published in a peer-reviewed journal and presented at international conferences. The endorsement and support of appropriate national and international professional organisations in this field will be sought.

## **7.0 Funding**

An unconditional travel grant will be provided by the Bioscientifica Trust in order to recruit steering group members.

## **8.0 Conflicts of interest**

No conflicts of interest are reported.

## **9.0 Author contribution**

AB conceived and designed the study. TI and TO developed the study concept. All authors contributed to the writing and approval of the final manuscript.

## **10.0 Guarantor**

Andrew J. Beamish

## **11.0 Research registration**

This project is registered via Open Science Framework (<http://osf.io>).

## **9.0 References**

1. Shah AS, D'Alessio D, Ford-Adams ME, Desai AP, Inge TH. Bariatric Surgery: A Potential Treatment for Type 2 Diabetes in Youth. *Diabetes care* 2016;39:934-40.
2. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 2014;384:766-81.
3. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the United States, 2011-2012. *Jama* 2014;311:806-14.