

Where are Family Theories in Family-based Obesity Treatment?: Conceptualizing the Study of Families in Pediatric Weight Management

By: J.A. Skelton, [Cheryl Buehler](#), M.B. Irby, J.G. Grzywacz

Skelton, J. A., Buehler, C., Irby, M., & Grzywacz, J. G. (2012). Where are family theories in family-based obesity treatment?: Conceptualizing the study of families in pediatric weight management. *International Journal of Obesity*, 36(7), 891-900. doi:10.1038/ijo.2012.56

Made available courtesy of Nature Publishing Group: <http://dx.doi.org/10.1038/ijo.2012.56>

*****© Nature Publishing Group. Reprinted with permission. No further reproduction is authorized without written permission from Nature Publishing Group. This version of the document is not the version of record. Figures and/or pictures may be missing from this format of the document. *****

Abstract:

Family-based approaches to pediatric obesity treatment are considered the ‘gold-standard,’ and are recommended for facilitating behavior change to improve child weight status and health. If family-based approaches are to be truly rooted in the family, clinicians and researchers must consider family process and function in designing effective interventions. To bring a better understanding of family complexities to family-based treatment, two relevant reviews were conducted and are presented: (1) a review of prominent and established theories of the family that may provide a more comprehensive and in-depth approach for addressing pediatric obesity; and (2) a systematic review of the literature to identify the use of prominent family theories in pediatric obesity research, which found little use of theories in intervention studies. Overlapping concepts across theories include: families are a system, with interdependence of units; the idea that families are goal-directed and seek balance; and the physical and social environment imposes demands on families. Family-focused theories provide valuable insight into the complexities of families. Increased use of these theories in both research and practice may identify key leverage points in family process and function to prevent the development of or more effectively treat obesity. The field of family studies provides an innovative approach to the difficult problem of pediatric obesity, building on the long-established approach of family-based treatment.

Keywords: pediatric | theory | family | treatment | obesity | healthcare

Article:

Nearly one-third of the American children are overweight or obese,¹ and there is an acute need for effective treatments. If the prevalence of pediatric obesity remains epidemic, more children will become obese adults, resulting in an entire generation with lower life expectancies than their parent’s generation.² Obesity heightens the risk for medical comorbidities³ previously associated

with adults⁴(for example, diabetes, hypertension, arthritis and gallstones), and may lead to a diminished quality of life.⁵ Current medical care expenditures for obese children exceed \$14 billion annually.^{6, 7}

Comprehensive behavioral interventions are considered the ‘gold standard’ for treating pediatric obesity.⁸ Incorporating families into treatment^{9, 10, 11, 12, 13, 14,15} acknowledges the parents as authority figures and role models who guide their child’s weight-related behaviors. Clinicians in these settings influence child nutrition and activity indirectly through the parents. As children grow older and develop autonomy, there is more direct interaction with the child.¹⁶ Additional family members also are encouraged to participate in treatment, as the home environment and family relationships are key in behavior change.¹⁷ However, the role of other adults and family members has not been determined.

Inclusion of the family, namely parents, into obesity intervention is commonly called ‘family-based’ treatment,¹⁰ though this approach is not currently well defined. In Epstein’s original study of obesity treatment in children six to twelve years old, both children and parents were included as targets of behavior change and weight loss.¹⁰ Alternatively, clinical studies describe parents or caregivers as ‘participants’ in treatment, where parents accompany their child to treatment visits and engage in family-focused behavior changes.^{18, 19, 20} Most reports of family-based treatment approaches exclude parent gender^{12, 13, 14, 15, 21} or focus primarily on mothers,^{9, 22, 23, 24, 25} which does not necessarily constitute ‘family-based’ treatment.

Kitzmann and Beech²⁶ classified interventions as ‘narrowly family-focused’ if parents were asked to modify only weight-related behaviors, or ‘broad’ if the approach incorporated parenting skills and family therapy. Of the reviewed studies, 21 had a narrow focus on the family’s role and 8 had a broad focus. Kitzmann and Beech advocate for ‘a broader focus on the family context in the treatment of childhood obesity,’ noting the successful incorporation of family-focused approaches in other areas of child health.²⁶ However, intervention trials are often conducted with motivated families, limiting their applicability. A more comprehensive and in-depth family approach to pediatric obesity may be more pertinent for diverse populations and improving outcomes.

The existing paradigm of treatment, in research or practice, does not adequately address ‘family.’ Eliciting family behavior change requires an understanding of family function and processes, but it is unknown if multiple family factors must be addressed to elicit a change in weight-related behaviors. For example, clinicians often recommend limited television viewing or decreased intake of sugar-sweetened beverages, but families still fail to implement these strategies. It is often a mystery to clinicians as to why a simple, high-impact behavior change can be difficult to implement. Improved understanding of how families operate day-to-day is necessary to establish healthier behaviors. Approaching obesity treatment from an alternative perspective may help address present challenges in the field. A recognized problem in obesity treatment is the high rates of attrition, noted as high as 91%.^{27, 28} Further, with increasing rates of severe

obesity,²⁹ there is a need for increased effectiveness of treatment.^{8, 30} Finally, there is no longer a standard definition of ‘family.’ Therefore, family-based interventions must account for the complexities of blended, single and multi-generational families.

In this paper, we review existing research and literature to identify family-focused theories in relation to pediatric obesity, combined with prominent theories of family process and function to: (1) describe theories relevant to family-based obesity treatment, and (2) share what is known about how these theories have been, and could potentially be used in pediatric obesity research.

Objective

The goal of this review is to advance the study of families in obesity treatment and bring a better understanding of family complexities to family-based treatment. More specifically, we aim to systematically review the scientific literature to identify what family theories have been utilized in pediatric obesity research; and introduce family theories pertinent to obesity treatment to pediatric clinicians and researchers. This review will highlight theoretical frameworks as a means of guiding researchers in determining what and how data are collected, analyzed and interpreted.³¹ Overall, the objective of this review is to outline an approach to families in obesity treatment that is carefully comprehensive to unique family systems.

The complexity of pediatric obesity is magnified by the inclusion of parents and families in treatment, where relationships, family routines and individual personalities influence a child’s health behaviors. Using theories, clinicians and researchers can unravel some of these complexities to predict risky behaviors, design interventions, and understand health behaviors and behavior change. No one theory will explain all aspects; but collectively, they have a profound influence on the study and treatment of childhood obesity. We contend that greater inclusion of family theories will bolster the field of pediatric obesity treatment.

Methods

For this paper, we performed and present findings from two distinct reviews: (1) family theories of possible interest to pediatric obesity researchers and clinicians, and (2) a formal, systematic review of the literature.

Family theories

Drawn from human development and family studies (CB), family health research (JGG) and pediatric obesity interventions (MBI, JAS), we have identified prominent theories of family process and function: Family Systems Theory (FST), Circumplex Model, Double ABCX Model, Family Stress Model (FSM), Family Development Theory (FDT) and Ecologic Systems Theory (EST). Within this review, key points from each theory are delineated and applied to the cruxes of pediatric obesity research.

Literature review

To explore how these theories have been utilized in pediatric obesity research, we systematically searched Medline (Pub Med) and PsycInfo for English-language studies of pediatric obesity incorporating the family theories listed above. Search terms included pediatric obesity, childhood obesity, weight management, and obesity treatment. Each of these terms was cross-searched with each of the family theories listed above. We also reviewed studies referenced in the original papers and those by authors known in the field. We considered all studies published between 1990 and 2011. Studies were included in the analysis if they were conducted in a pediatric age group or pertained to pediatric obesity, included any of the aforementioned family theories in research design or data analysis, or mentioned any of the family theories in the manuscript. Given the scarcity of data found on initial searches, we included studies of interventions, correlations, reviews or commentaries. Two investigators (JAS and MBI) independently screened titles and abstracts of studies identified by the searches. The full articles were obtained if they appeared to meet inclusion criteria or if the titles and abstracts provided insufficient information to determine inclusion. Full-text articles were then reviewed to determine final inclusion in the analysis. Disagreement between reviewers was resolved by consensus, using a third investigator as needed.

Significant interest has been placed on parenting styles and childhood obesity,³² which is relevant in studies involving only maternal-child dyads. However, approaching obesity treatment from a parenting perspective is focused more on parent-child dyads and not family functioning, which is the focus of this review. Therefore, in-depth discussions of parenting will not be presented here.

Results 1

Family theories

Prominent theories of family process and function are summarized below, grouped into general categories of: family as a systems, stress, and families in time and space (Table 1):

Table 1 - Theories of Family.

Theory	Summary	Implications for Obesity Treatment
Family Systems Theory	<ul style="list-style-type: none"> • Family is a complex interacting system: • Elements of a system are interconnected and it must be viewed as a whole • Behavior of the system interacts as a feedback loop with the environment, and pertains to goals • Systems are not reality, but heuristic models for understanding • Family systems determine 	<ul style="list-style-type: none"> • Domains of equilibrium and stability are important considerations when asking families to change behaviors • Understanding rules and rituals within systems and subsystems will facilitate the goal-setting process • Clinicians should account for interactions between family members and the environment when planning

	<p>membership criteria and set boundaries for the flow of information; rules of transformation govern relationships with the environment and expected responses from relationships</p> <ul style="list-style-type: none"> • Adaptability or variety refers to resources of the system to adapt and evolve with changes; families strive to maintain equilibrium inside and outside of the system • Subsystems exist within the main system, and can influence the family as a whole • Levels exist in the system; action in higher orders results in change in lower orders 	<p>interventions</p> <ul style="list-style-type: none"> • Targeting change in higher order levels will have a greater influence over total family function and allow for more sustainable behavior change • Understanding relationships within the system and its subsystems facilitates the family-based treatment approach
<p>Circumplex Model of Family Functioning</p>	<ul style="list-style-type: none"> • There are three central dimensions of marital and family systems that function optimally when in balance: • Cohesion: the emotional bonding family members have toward one another • Flexibility: the amount of change in leadership, role relationships and rules • Communication: a facilitating dimension, critical for facilitating movement on the other two dimensions 	<ul style="list-style-type: none"> • Balanced families are better able to set and achieve goals for behavior change in obesity treatment • Families who are unbalanced will have greater difficulty adhering to treatment • Families who are unable to communicate effectively will struggle in treatment as a collective unit, and treatment information may not be disseminated or accepted by the system
<p>Double ABCX Model of Family Stress</p>	<ul style="list-style-type: none"> • A mechanism for studying family stress using categorical variables: abcx and ABCX • abcx • (a) a stressor event • (b) existing resources that assist in addressing the event • (c) family's perception of the event • (x) the crisis; the product of the interaction between a, b and c • ABCX • (A) the 'pile up' of 	<ul style="list-style-type: none"> • Family response to stress can lead to unhealthy habits: poor nutrition, decreased activity and increased sedentary activity • Inadequate resources to handle stress may hinder the ability to adapt to change • Perception of obesity and treatment affects families differentially; perceived importance • threat may influence adherence and attrition • Greater understanding of

	<p>demands and stressors, pre- and post-crisis</p> <ul style="list-style-type: none"> • (B) like 'b,' represents existing resources • (C) like 'c,' represents family perception • (X) a continuum of adaptation from maladaptation to bonadaptation 	<p>family-coping response and resource utilization may inform the treatment process</p>
Family Stress Model of Economic Strain	<ul style="list-style-type: none"> • Low income and financial pressures lead to economic strain in the family due to parent emotional distress and marital conflict • Disrupted parenting due to stress and conflict influences the well being of other family members 	<ul style="list-style-type: none"> • Economic pressures and strain may limit the family's ability to afford treatment and resources necessary for behavior change • Marital functioning influences family participation in treatment and behavior change in the home • Marital discord and disagreements on parenting hinder the ability to change behaviors • Parents with significant emotional distress may be unable to provide sufficient support for their child in the change process
Family Development Theory	<ul style="list-style-type: none"> • A framework for conceptualizing families over time; families are small group associations • Families are comprised of dynamic individuals with interacting personalities, interconnected by increasingly complex developmental tasks over the lifespan • Growth or change in roles influences change in reciprocal roles, causing a transition to a new life stage and rearrangement of developmental tasks • Capacity to anticipate stress and adapt to change determines the ease of stage transition 	<ul style="list-style-type: none"> • Families who struggle with change in task roles may have difficulty participating in treatment, requiring more assistance from clinicians • Treatment strategies may vary based on life cycle stages, age of family members, task roles and ability to transition to new stages when change occurs
Ecologic Systems Theory	<ul style="list-style-type: none"> • External factors influence individuals and groups, and cannot be viewed independently from the 	<ul style="list-style-type: none"> • Can be used to model predictors of obesity, as it is largely the result of the nutrition and activity

	<p>surrounding environment</p> <ul style="list-style-type: none"> • Ecological components interact with the family directly and indirectly in layers: • Microsystem: immediate environment • Mesosystem: connection between elements of the microsystem • Exosystem: the larger social environment • Macrosystem: the outer most layer, the cultural environment • Chronosystem: the dimension of time accounting for change 	<p>environment</p> <ul style="list-style-type: none"> • Understanding the mesosystem provides information about family health behaviors • Recognizing environmental barriers to change could reveal why families are unsuccessful in treatment • Exo- and macrosystems can be targeted for policy-level interventions
--	--	--

Family as a system

Families are complex phenomena that include individual members, relationships between those members and their interaction with external influences. Other scientific fields, such as biology, robotics and mathematics, have been conceptualized and studied as systems, or complex aggregates of interconnected parts.³³ Approaching phenomena as a system solidified in the 1960s, credited to biologist von Bertalanffy, as General Systems Theory developed into a research framework³⁴ with increasingly diverse applications.

Family Systems Theory

FST, often referred to as family process theory,³⁵ summarizes the family as a complex interacting system, providing a framework for understanding and exploring family processes and functions. It is not a single defined theory of family behavior, and does not seek to explain why families engage in certain behaviors. FST asserts that a family is an ‘open, ongoing, goal-seeking, self-regulating, social system,’ with four basic assumptions³³: (1) elements of a system are interconnected, (2) the system is best understood when viewed as a whole, (3) the behavior of the system interacts in a feedback loop with the environment and (4) systems are not reality, but heuristic models for understanding. Although open to interpretation, the core tenets of FST are summarized below: *Interrelated and interconnected elements making up a system.* The family system is defined as separate from, while still interacting with, the environment. Individuals within the system function both independently and together, creating a structure that changes as individuals interact and influence one another. *Membership and boundaries.* Criteria for family membership can differ dramatically; the system itself determines who is a member. The family system is maintained by a boundary; the extent to which that boundary is flexible and permeable is managed by the family.

- *Rules of transformation.* Internal rules guide relationships among family members, including their behavioral patterns and responsiveness to other members, and guide interactions between family members and the broader environment, influencing what ‘outside’ material will be brought into the family and which members can introduce such material.
- *Positive and negative feedback loops.* Consequences of interactions among family members or with the broader environment are ‘outputs,’ which are then fed back into the system as ‘input,’ resulting in amplified or dampened deviation from the goal.
- *Adaptability or variety.* These refer to the system’s resources that facilitate adaptation, or the family’s options to evolve with a changing environment.
- *Equilibrium.* Families strive to maintain equilibrium within and outside of the system; equilibrium is determined by elements of the system defined above.
- *Subsystems.* Distinct subsystems exist within the main family system, often in reference to relationships between individuals (for example, parents, siblings or a parent–child subsystem).
- *Levels.* All systems have levels, and in families there are first- and second-order levels, mostly concerning rules and change. A first level or first-order system is comprised of environmental input into the system and the subsequent output. The second level or higher-order system can modify first-order systems if such change is needed to reach a goal. A simplistic example of levels is parents establishing the goal of healthy family meals, which might incorporate a first-order change or ‘rule’ to limit the family’s fast food intake. However, in order to achieve this first-order ‘rule,’ there may be a need for the parent to modify a second-order system, such as parents learning to shop for and prepare healthy meals, which may be influenced by parenting skills, family communication and time management.

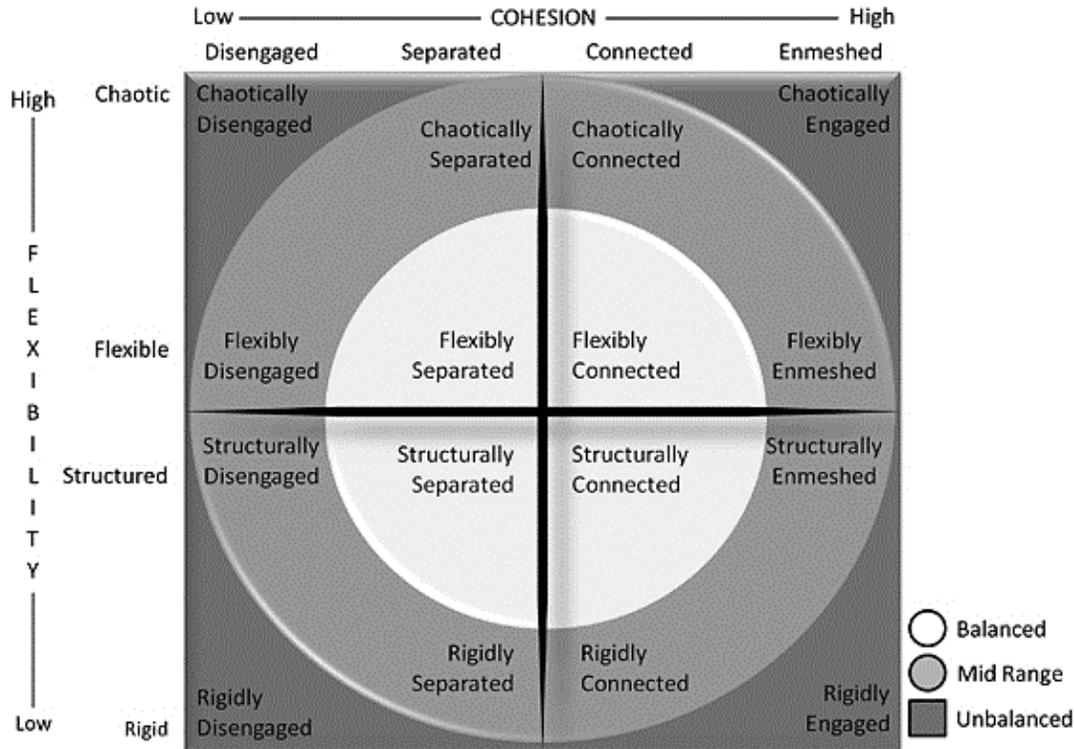
This brief overview of FST provides several insights for approaching obesity from a family-based perspective,^{36, 37, 38} particularly if exploring within-family correlates of behavior change. With interconnected elements of a family, there will be unique rules of transformation to that family. If asking a family to change behaviors, those interconnected elements and rules must be considered, as a change in one element, or person, will impact another. Further, families are geared toward equilibrium, so change is inherently against that desire for stability. Behavioral plans counter to family rules and rituals are unlikely to be adopted and should be re-evaluated if change is not achieved. It will also be important to recognize family subsystems; significant past research has focused on parent–child dyads (mainly with the mother); most clinical interactions are similar, where one parent accompanies the child to treatment. Engaging more of the family could account for complex relationships within the system influencing key health behaviors.

Understanding first-order levels is vital when attempting to elicit behavior change within the family, because it reflects the input and output of a family system with their environment. But targeting change in second-order levels is even more important, due to the influence over total family function and lower order levels. It may be difficult to sustain a first-order change in a family, such as eating out less, without a second-order change to improve time management, communication, cooking knowledge and parenting skills. As obesity is primarily seen as the result of unhealthy interactions with the nutritional and activity environment, accounting for the family’s interaction with their surroundings could provide useful avenues for intervention.

Many theories of the family have roots in elements of FST, and have been adapted to address specific topics, such as stress. The Circumplex Model of Marital and Family Systems is an outgrowth of systems theory. Developed by Olson,^{39,40} the Circumplex Model focuses on internal functions of a family. Highly relevant in marriage and family therapy, this model has been applied to healthcare settings, such as diabetes management.⁴¹

The Circumplex Model encompasses family cohesion, flexibility and communication, which together represent a family’s ‘balance’ (Figure 1). According to this model, the family system functions optimally when each dimension is balanced, and becomes dysfunctional when they exist in extremes. Olson described these three dimensions on a spectrum of low to high.^{39,40}

Figure 1.



Circumplex Model of Marital and Family Systems (adapted from Olson³⁹).

Cohesion: Emotional bonding of family members in four levels:

- Disengaged (very low): family members have little or limited attachment or commitment to one another.
- Separated (low–moderate): some emotional separateness, where time apart is of greater importance to family members; there are still some elements of joint decision-making, support and time together.
- Connected (moderate–high): increasing emotional closeness and loyalty between family members, with greater importance on time spent together; an emphasis on family togetherness and shared interests, but some separate activities.
- Enmeshed (very high): Very little independence and few or no separate interests among family members; consensus within the family is too high.

Flexibility: amount of change in leadership, relationships and rules. The important concepts are: leadership (including control and discipline), negotiation styles, role relationships and relationship rules. The four levels of flexibility are: rigid (very low), structured (low–moderate), flexible (moderate–high) and chaotic (very high). *Communication*: no defined levels, but assists movement in cohesion and flexibility; it is measured by listening skills (particularly empathy), speaking skills, self-disclosure, clarity, staying on topic and respect.

Balanced cohesion falls between ‘separated’ and ‘connected’ on the cohesion spectrum; extremes of enmeshed and disengaged relationships within the family are more likely to cause problems. A healthy blend of separated relationships (allowing for independence and individuality) and connected relationships (providing emotional intimacy, closeness and loyalty with common interests) allows optimal functioning in a family. Similarly, families characterized by mid-level flexibility (‘structured’ and ‘flexible’) function most optimally, as they are balanced in family leadership, roles and rules. Open negotiations that include children, shared roles and flexibility of rules, particularly when it allows for age-appropriate adaptation, best equip families to adjust to environmental and situational changes. Operating differently from cohesion and flexibility, communication is not measured with the intention of reaching a balancing point; rather, communication facilitates balance in the other dimensions.

Flexibility of family rules, how decisions are negotiated and the roles of family members are likely to impact the ability to change health habits. If a parent from a rigid family is attending treatment with their child, and is not a ‘leader’ for the family, change is unlikely to occur. In chaotic families, regardless of who is participating, change is less likely given erratic leadership and impulsive decision-making. Thus, disengaged families may not be successful with a family-based approach, whereas an enmeshed family might show greater success despite imbalances in cohesion. However, the Circumplex Model has not been sufficiently used in obesity treatment to determine how families with varying levels of cohesion, flexibility and communication will

respond to treatment, although it seems likely that key behavioral changes in the family will be influenced by these dimensions and their balance. For example, a family’s ability to effectively communicate feelings, listen to one another and show respect may be important in successful behavior change. While there is little empirical evidence of this in obesity treatment, one study found high prevalence of ‘unhealthy’ communication in families with obese children.⁴²

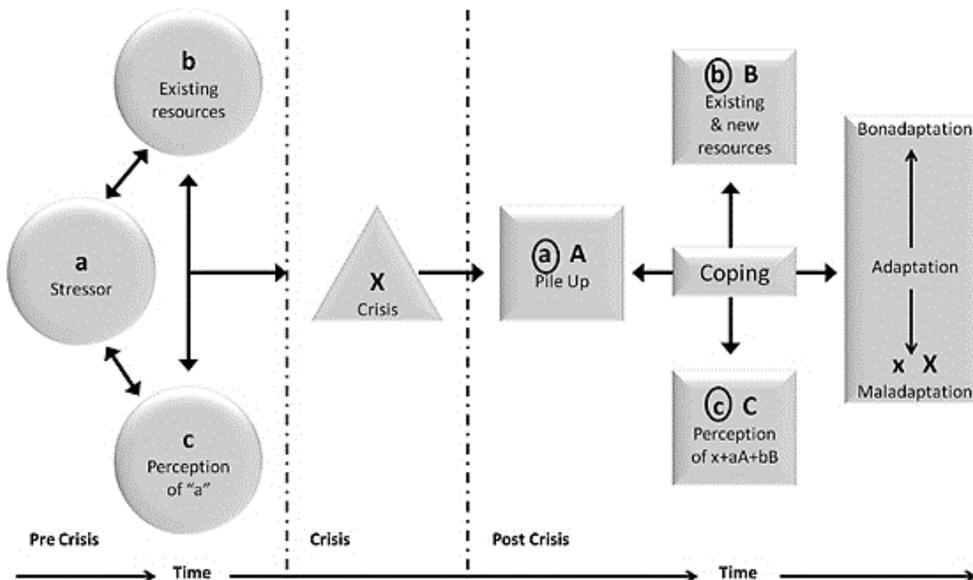
Stress

Family stress is difficult to conceptualize, as it can encompass physiological or emotional responses to a situation or a process, and is a subjective phenomenon. While there is an established link between stress and development of obesity in children, incorporation of theoretical stress models into family-based treatment approaches is lacking. Physiological and behavioral links exist between the two,^{43,44} and a reciprocal relationship indicating obesity may exacerbate psychosocial stress. Financial, environmental and personal stressors influence a family’s ability to participate in intensive interventions. The following theories and models demonstrate the influence of stress on a family system.

The Double ABCX Model of family stress and adaptation

This model comes from Reuben Hill’s ABCX family crisis model.^{45, 46} He used categorical variables to define ‘A’ as the stressor event; ‘B’ as existing resources for a family to address the event, such as individual (economic, social and psychological), family, neighborhood or community resources; and ‘C’ is the family’s perception of the event. The product of these interactions is the crisis, ‘X’. McCubbin and Patterson modified this concept to develop the Double ABCX Model^{47, 48, 49} (Figure 2), which extends beyond a crisis period to emphasize stress adaptation.

Figure 2.



Double ABCX Model (adapted from McCubbin and Patterson⁴⁸).

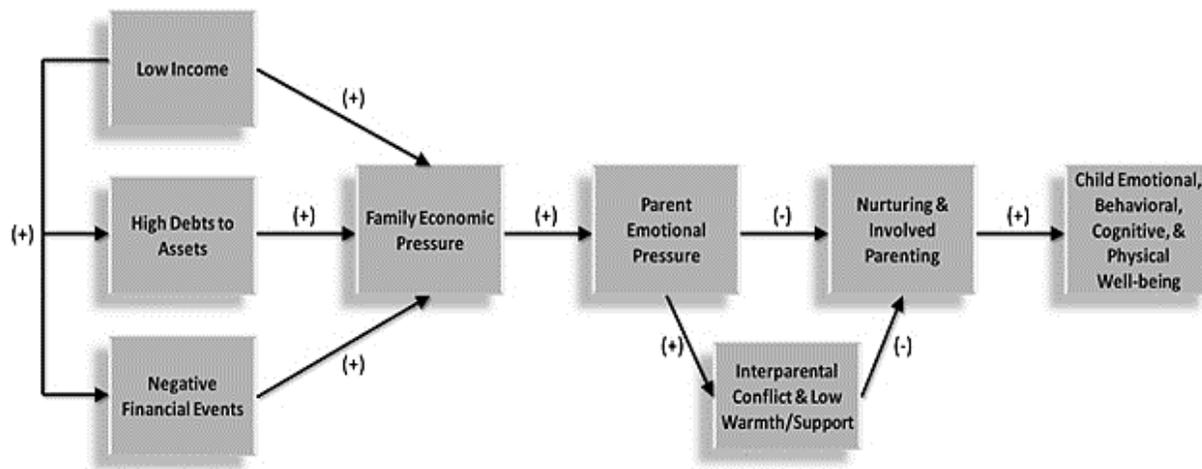
The extended model presented (now seen in lower case letters, abcx) includes four additional variables (upper case, ABCX). 'A' represents the 'pile-up' of demands and stressors, both pre- and post-crisis, and the concept that stress is not always singular, but can be cumulative (often conceptualized continuously from low to high). This signifies the post-crisis phase of stress and adaptation. 'B' and 'C' continue to represent resources and perception, respectively, but are post-crisis factors. Adaptive or new resources are used to function with 'piled-up' demands and stress, and perception of stress changes based on the family's adaptation and cognitive reframing. Finally, 'X' signifies a continuum of adaptation, from maladaptation (negative, imbalance between demands and family's capacity) to bonadaptation (positive, balance between demands and capacity).

The Double ABCX Model has many implications for the study and treatment of pediatric obesity, framing stress as an event focusing on a family's reaction and adaptation. Pertinent to the development of obesity, the family's response to stressful events could lead to unhealthy habits, depending on their resources. Families may not sufficiently adapt to a crisis and modify unhealthy behaviors, particularly if the child's weight is not perceived as an immediate threat to the child or family. The model also highlights how stress exposure impacts a family over time and the deeper functions of a family in crisis. Obesity treatment can increase burden on a family, with frequent clinic visits, tracking of behaviors and associated costs. A greater understanding of how families cope with stress and utilize resources, and how stress can stunt progress in treatment, could inform future investigations and interventions.

The FSM of economic strain

The FSM of Economic Strain developed by Conger and commonly called the Family Stress Model^{50, 51} is based on research in farming communities during economic recession. The model proposes that low income and financial pressures lead to economic strain, primarily manifested in parent emotional distress, marital conflict or dysfunction in two-parent families. Individual emotional distress and parent conflict influences parenting practices and may lead to disrupted parenting, affecting their child's well being (Figure 3).⁵² Like the Double ABCX model, this model dissects the influence of stress on family, but more specifically on the parents' marital well being, parenting processes and the link to the child's physical and emotional outcomes.

Figure 3.



FSM of Economic Strain (adapted from Conger and Donnellan⁵²).

Marital discord or dysfunction is not only likely to disrupt a family's participation in weight management, but could affect attempts to change behaviors in the home. Parents who disagree on basic health behaviors for their family (such as meal planning, physical activity and setting appropriate limits) are unlikely to succeed in treatment. The psychological well being of parents has obvious implications for weight management, as a parent experiencing significant emotional issues (depression and anxiety) is unlikely to support their child sufficiently in behavior change. The link between a child's and a parent's well being is firmly established,⁵³ and is likely pertinent to the study of pediatric obesity treatment. Given that obesity differentially affects poor populations,⁵⁴ and there is evidence to suggest that economic strain influences parent emotional well being and interparental conflict (Figure 3), these may be important family factors to consider when assessing families in pediatric obesity treatment.⁵²

Families in time and space

Two additional theories address the dynamic nature of families and broadening the view of family interaction with the environment.

Family Development theory

FDT provides an organized framework for conceptualizing generalizations about families as they change over time,⁵⁵ and attempts to bridge key concepts from various fields (rural sociology, child psychology and human development) to study family development.^{56,57,58} Given the interdependent nature of the family system, a change in an individual's role spurs a change in the role of others, leading to reorganization and a new stage of development, whether it is due to a birth, death, marriage or simply growing up. This framework allows us to anticipate stress in the life cycle,⁵⁵ and is characterized by eight developmental stages⁵⁹: married without children, child-bearing families (oldest child <30 months), families with preschool children, families with

school children, families with teenagers, families that are launching (first child to last child to leaving), middle years (empty nest) and aging family (retirement to death of both spouses).

FDT posits that problems within families commonly arise when there is a lack of consensus regarding tasks, resources, competencies and the needs of the family. In family-based obesity treatment, all family members should be viewed collectively as the 'patient' and encouraged to work together. Families struggling with change who cannot relinquish their current roles may require the assistance of counselors or other professionals before making behavioral changes.⁶⁰ Implementation of home-based changes may be complicated by different ages, life stages and task roles. For example, interventions in families with young children may differ from those with adolescents.

Ecologic Systems theory

EST was developed by psychologist Urie Bronfenbrenner, a cofounder of Head Start, and has been adapted as Human Ecology Theory, Family Ecologic Theory and Social Ecology Theory. The core concept of EST is that individuals and groups exist in contexts, and their behavior cannot be understood without attending to the surrounding environment or context. EST considers ecological surroundings and their impact on a child, an idea that 'matured' for the study of families and relationships.

The ecological components interacting with a child and family exist in increasing layers surrounding them,^{61, 62, 63} interacting directly and indirectly with the family:

Microsystem: the immediate environment of an individual or family, including relationships and interactions within the system, such as family, friends and communities.

Mesosystem: the connection between elements of the microsystem and the processes involved; that is, the effect home environment has on a child's school performance and vice versa.⁶¹

Exosystem: the larger, external social environment influencing a child or family.

Macrosystem: the cultural milieu including established customs, cultural values and societal laws.

Chronosystem: the dimension of time-shaping family development, emphasizing unique aspects of developmental, calendar and historical time.

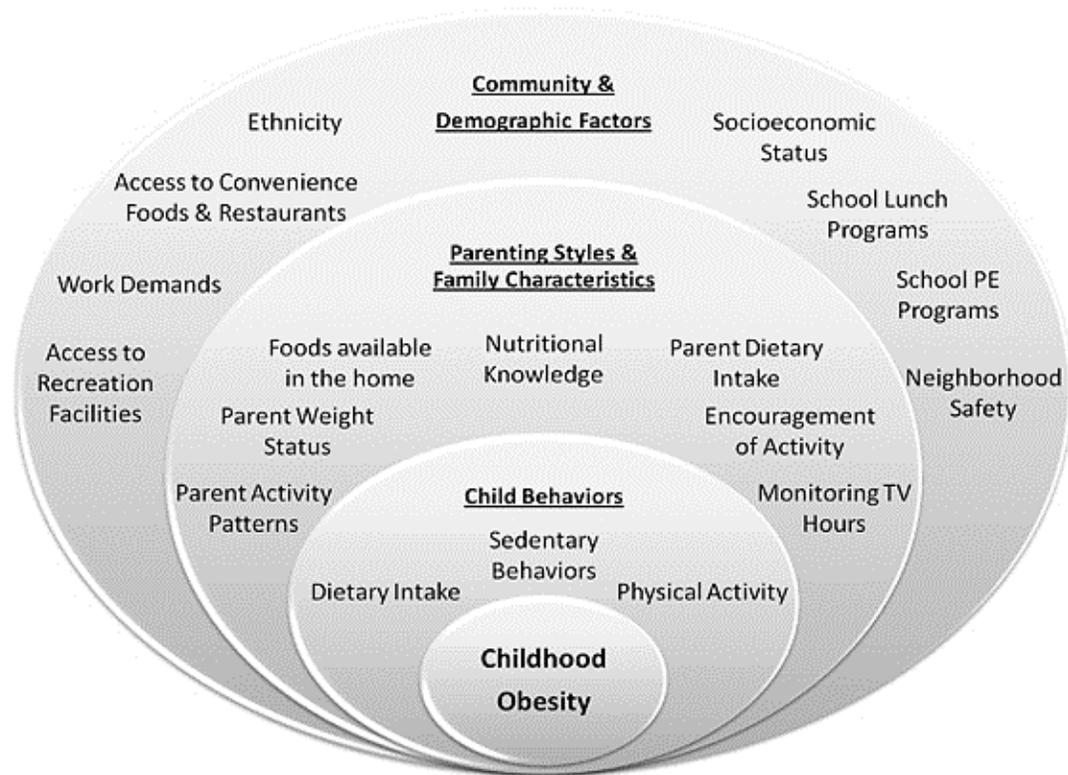
Processes of human development were later integrated into EST, referring to the connection between an outcome and individual factors or contexts. This developed into the Process-Person-Context-Time model,⁶³ with four interrelated concepts:

1. Process: the reciprocal interaction between a person and features of the immediate external environment, including other people, occurring regularly over time.

2. Person: individual characteristics of a person brought into any social situation.
3. Context: four interrelated systems comprising the environment (microsystem, mesosystem, exosystem macrosystem).
4. Time: all aspects of the model can change over time.

EST has been used to model predictors of childhood obesity (Figure 4),⁶⁴ as obesity is largely influenced by environmental pressures over nutrition and activity. EST is useful for gauging how families function in, and how greatly they are influenced by, an environment made up of unhealthy stimuli. The exo- and macrosystems are also important considerations in policy-level interventions.

Figure 4.



EST demonstrating contextual influences on the development of childhood obesity (adapted from Davison and Birch⁶⁴).

EST also could be used in family-based treatment settings and research interventions. Improved understanding of the micro- and mesosystems influencing health behaviors could reveal why families are unsuccessful in weight management even with necessary knowledge and resources. For clinicians implementing family-centered approaches, recognizing that environmental barriers to behavior change extend beyond unhealthy food and activity environments is useful.

Relationships within families and the immediate environment must also be considered; one qualitative study of families in weight management noted a lack of support from other nuclear and extended family members.⁶⁵ In designing interventions, the family's immediate environment is highly relevant, and includes interpersonal relationships influencing health behaviors of the child and family.

Results 2

Family theories and pediatric obesity research and treatment

Our literature search yielded 76 relevant abstracts. Of these, 17 were selected to be reviewed more thoroughly based on face validity of the abstracts. Thirteen manuscripts were selected for inclusion based on our a priori criteria.

Many theories and models discussed have been used in child health fields, but rarely in pediatric obesity research. FST was used as a framework in four reviews/commentaries of pediatric obesity,^{36, 37, 38, 66} but only once was it used to guide intervention.⁶⁷ In this instance, the ideals of FST were combined with Social Cognitive Theory to guide a 16-week randomized controlled trial in female adolescents aged 12–15 years. Results were promising, as the intervention reported successful reduction in energy intake by incorporating family variables into treatment.⁶⁷ EST was referenced in a discussion of childhood obesity predictors,⁶⁴ guided a review of neighborhood factors and obesity,⁶⁸ was discussed as an alternative approach to obesity treatment,⁶⁹ and was used in interventions with minority adolescent populations.^{70, 71} The Family Adaptability and Cohesion Evaluation Scale, derived from the Circumplex Model, was suggested for the psychological assessment of families who present for treatment,⁷² but its use has been otherwise limited. In an European study, use of the scale was not studied with weight outcomes,⁷³ but some association was found between family cohesion and weight-related behaviors in a cross-sectional study of girls aged 9–19 years.⁷³ Another construct of the Circumplex model, communication, was explored as a correlate of family functioning in a larger assessment of families with chronically ill children (mentioned previously).⁴²

In summary, 8 of the 13 manuscripts used theories of the family as a framework for commentaries on obesity or for topical reviews. Two studies in this review were cross-sectional; only three were interventions. From our review, only three theories, FST, EST and the Circumplex Model, were mentioned.

Discussion

Several of the prominent family theories discussed in this review were not found in our search of the pediatric obesity literature: the Double ABCX model, FDT and the FSM of Economic Strain. FST was primarily mentioned as a theme in discussions or reviews, and was used to guide an intervention only once. Similar to Circumplex Model, its use in etiological or intervention studies is scarce. Despite these 13 studies identified, our review of the literature demonstrates

limited use of family theories in the study of pediatric obesity, particularly in weight management. Perhaps, the relative youth of these fields explains why prominent theories of the family have been incorporated so sporadically.

The multiple theories presented in this review can be overwhelming when applied to pediatric obesity treatment. However, we found the following themes emerged from all of the theories highlighted:

1. Families are a system, made up of interdependent units. Intervening on one unit (that is, mother–child dyads) will influence other units, and interventions should involve all members in the unit. It is unknown how or if this occurs during obesity interventions.
2. Families are goal-directed systems desiring balance and homeostasis. This desire allows an opportunity for clinicians to engage families in setting health-oriented goals, especially when coupled with techniques to overcome barriers and diminish resistance to change. Child-specific or parent–child-oriented goals are unlikely to succeed in the context of the system, unless they address the family’s greater goals. Further, the family’s desire for homeostasis and stability may counteract the external pressure to change. This tension between change and stability should be recognized and anticipated by clinicians.
3. The environment imposes demands; family characteristics and available resources determine family responses. Family-based obesity treatment must be contextual and account for both internal and external resources.

There are other noteworthy themes in these models. There are significant complexities in intra-family relationships, with likely influence on the child and reciprocal impact of the child on the family. Families strive for balance in both interpersonal relationships and response to external stressors; dysfunction occurs if these relationships and responses are unbalanced. Individual and collective family interactions with the proximal environment also shape family well being beyond family dynamics, function and processes. The impact of stress on a family is dynamic, variable and important to consider when planning interventions. The key elements of these family theories may be useful in the planning and implementation of an intervention.

Greater conceptual knowledge of family units and unique behaviors of those in treatment addresses three challenges to successful pediatric obesity treatment: high attrition from treatment, limited treatment success and lack of a clear definition of ‘family.’ These limitations can be more aggressively addressed by viewing the family as a system in ‘family-based treatment,’ where treatment becomes part of the system.

Attrition from treatment

Many clinical programs report attrition rates of 27–73%,²⁸ with comparable rates in clinical trials. If, as we believe, family processes have a central role in attrition, minimizing attrition

requires family-specific approaches. However, translating results from controlled trials of homogenous populations into clinical programs may decrease treatment efficacy. This leaves little evidence on which to base treatment of complex families, which may explain high attrition rates in clinical programs. Development of generalizable and family-focused frameworks may allow treatment approaches to better meet the needs of families, and be implemented more broadly across populations.²⁶

Limited success

In 2010, the US Preventive Services Task Force noted improvements in the quantity and quality of interventions, but these were primarily short-term benefits.⁸ Evaluations of real-life clinics are also short-term, and demonstrate little improvement in patients' weight status.^{18, 20} Additionally, recent Cochrane reviews identified a need for 'high quality research that considers psychosocial determinants for behavior change'.³⁰ Behavioral interventions utilize self-monitoring, stimulus control and goal setting to elicit changes in habits and weight,⁷⁴ but do not address family dynamics at the foundation of unhealthy habits. While parenting style, family stress and self-esteem are included in some interventions, there is a dearth of family-focused interventions modifying processes that facilitate unhealthy habits. As shown in adolescent eating disorders, family function can be positively changed, with subsequent improvement in health outcomes for the child.⁷⁵ It is worth investigating if positive outcomes can be achieved in obesity treatment as well.

Definition of Family

A two-parent household with a stay-at-home mother and working father is no longer normative, and no standard definition of the 'family' exists in pediatric obesity treatment. Inability to define the family makes it difficult to apply a straightforward model of family function to child health. Including an adult caregiver in treatment assumes there will be an influence over the home environment, the child's routines and their behaviors, which speaks to the importance of household members who interact and influence one another's behaviors. In a clinic setting, families are often represented by a child and parent, typically the mother. However, this dyadic representation often does not accurately reflect family complexity. Existing research has not informed interventionists which family members should be included in treatment. Family theories may help identify key influences over a child's health, and could provide guidance for clinicians to educate families on treatment expectations and who should be involved in the treatment process.

There is evidence in other health-related areas of study to suggest that improved family function positively impacts overall child health, notably connectedness and open communication.⁷⁶ Interventions with children undergoing treatment for eating disorders have shown promise, indicating that family-based therapy can facilitate change in family function in order to achieve desired outcomes.^{75, 77} Investigations with families of children with Type 1

diabetes also indicate that elements of family function, such as cohesion and adaptability, should be assessed as they relate to treatment adherence.⁷⁸ Other studies in family-based diabetes treatment settings have shown positive correlations between the family's level of cohesion and the amount of family support received by the child's treatment provider.⁷⁹ While few in number, these studies suggest, at a minimum, that further research in this area is warranted.

The next step in approaching family function and process as it relates to pediatric obesity is daunting. The complexities of the theories are demonstrated in the sheer number of family function-related measures. Pritchett *et al*⁸⁰ provided an overview of 107 questionnaires of family relationships appropriate for use in primary-care and research settings. Given the vast number of potential assessments, it is difficult for a researcher to discern which measures provide the most accurate depiction of family function. As one theory is not superior to another, the investigator should choose from the general categories of theories: family systems, stress or ecological/developmental. From there, domains can be selected that are intuitive to the research question or intervention, such as communication or cohesion. For the clinician, the three themes found throughout the theories can provide guidance. Families are: interconnected systems; goal-oriented and geared towards stability; and are impacted by their interactions with the environment. Increased clinical focus on these areas, be it through a brief measure or focused clinical interview, may uncover useful information about a family struggling in weight management. Greater awareness of the complexities of families may provide useful insight into the equally complex problem of childhood obesity.

Conclusion

Established theories of the family are seldom used in pediatric obesity treatment. Given the acute need for more effective treatment,⁸¹ integrating elements of family systems and family theories may provide insight for improving treatment, particularly regarding attrition, outcomes and in determining who participates. If family-based approaches are considered the 'gold standard,' then the study of family is likely to highlight important leverage points for treatment. Even if interventions do not target theoretical concepts of family communication, flexibility or stress, accounting for these factors in intervention design and delivery could improve the reach and effectiveness of pediatric obesity treatment.

Conflict of interest

The authors declare no conflict of interest.

References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *JAMA*2012; **307**: 483–490.

2. Olshansky SJ, Passaro DJ, Hershow RC, Layden J, Carnes BA, Brody J *et al.* A potential decline in life expectancy in the United States in the 21st century. *N Engl J Med* 2005; **352**: 1138–1145.
3. Krebs NF, Himes JH, Jacobson D, Nicklas TA, Guilday P, Styne D. Assessment of child and adolescent overweight and obesity. *Pediatrics* 2007; **120**(Suppl 4): S193–S228.
4. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. *Pediatrics* 1998; **101**: 518–525.
5. Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. *JAMA* 2003; **289**: 1813–1819.
6. Wang G, Dietz WH. Economic burden of obesity in youths aged 6 to 17 years: 1979–1999. *Pediatrics* 2002; **109**: E81–E81.
7. Hampl SE, Carroll CA, Simon SD, Sharma V. Resource utilization and expenditures for overweight and obese children. *Arch Pediatr Adolesc Med* 2007; **161**: 11–14.
8. Whitlock EP, O'Connor EA, Williams SB, Beil TL, Lutz KW. Effectiveness of weight management interventions in children: a targeted systematic review for the USPSTF. *Pediatrics* 2010; **125**: e396–e418.
9. Brownell KD, Kelman JH, Stunkard AJ. Treatment of obese children with and without their mothers: changes in weight and blood pressure. *Pediatrics* 1983; **71**: 515–523.
10. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioral, family-based treatment for obese children. *JAMA* 1990; **264**: 2519–2523.
11. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year outcomes of behavioral family-based treatment for childhood obesity. *Health Psychol* 1994; **13**: 373–383.
12. Golan M, Crow S. Targeting parents exclusively in the treatment of childhood obesity: long-term results. *Obes Res* 2004; **12**: 357–361.
13. Janicke DM, Sallinen BJ, Perri MG, Lutes LD, Huerta M, Silverstein JH *et al.* Comparison of parent-only vs family-based interventions for overweight children in underserved rural settings: outcomes from project STORY. *Arch Pediatr Adolesc Med* 2008; **162**: 1119–1125.
14. Golan M, Fainaru M, Weizman A. Role of behaviour modification in the treatment of childhood obesity with the parents as the exclusive agents of change. *Int J Obes Relat Metab Disord* 1998; **22**: 1217–1224.

15. Golan M, Weizman A, Apter A, Fainaru M. Parents as the exclusive agents of change in the treatment of childhood obesity. *Am J Clin Nutr* 1998; **67**: 1130–1135.
16. Spear BA, Barlow SE, Ervin C, Ludwig DS, Saelens BE, Schetzina KE *et al*. Recommendations for treatment of child and adolescent overweight and obesity. *Pediatrics* 2007; **120**(Suppl 4): S254–S288.
17. Davis MM, Gance-Cleveland B, Hassink S, Johnson R, Paradis G, Resnicow K. Recommendations for prevention of childhood obesity. *Pediatrics* 2007; **120**(Suppl 4): S229–S253.
18. Kirk S, Zeller M, Claytor R, Santangelo M, Khoury PR, Daniels SR. The relationship of health outcomes to improvement in BMI in children and adolescents. *Obes Res* 2005; **13**: 876–882.
19. Savoye M, Shaw M, Dziura J, Tamborlane WV, Rose P, Guandalini C *et al*. Effects of a weight management program on body composition and metabolic parameters in overweight children: a randomized controlled trial. *JAMA* 2007; **297**: 2697–2704.
20. Skelton JA, Demattia LG, Flores GA. Pediatric weight management program for high-risk populations: a preliminary analysis. *Obesity (Silver Spring)* 2008; **16**: 1698–1701.
21. Beech BM, Klesges RC, Kumanyika SK, Murray DM, Klesges L, McClanahan B *et al*. Child- and parent-targeted interventions: the Memphis GEMS pilot study. *Ethn Dis* 2003; **13**: S40–S53.
22. Munsch S, Roth B, Michael T, Meyer AH, Biedert E, Roth S *et al*. Randomized controlled comparison of two cognitive behavioral therapies for obese children: mother versus mother-child cognitive behavioral therapy. *Psychother Psychosom* 2008; **77**: 235–246.
23. Ostbye T, Zucker NL, Krause KM, Lovelady CA, Evenson KR, Peterson BL *et al*. Kids and adults now! Defeat obesity (KAN-DO): rationale, design and baseline characteristics. *Contemp Clin Trials* 2011; **32**: 461–469.
24. Wadden TA, Stunkard AJ, Rich L, Rubin CJ, Sweidel G, McKinney S. Obesity in black adolescent girls: a controlled clinical trial of treatment by diet, behavior modification, and parental support. *Pediatrics* 1990; **85**: 345–352.
25. West F, Sanders MR, Cleghorn GJ, Davies PS. Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change. *Behav Res Ther* 2011; **48**: 1170–1179.

26. Kitzmann KM, Beech BM. Family-based interventions for pediatric obesity: methodological and conceptual challenges from family psychology. *J Fam Psychol* 2006; **20**: 175–189.
27. Pinelli L, Elerdini N, Faith MS, Agnello D, Ambruzzi A, De Simone M *et al*. Childhood obesity: results of a multicenter study of obesity treatment in Italy. *J Pediatr Endocrinol Metab* 1999; **12**(Suppl 3): 795–799.
28. Skelton JA, Beech BM. Attrition in paediatric weight management: a review of the literature and new directions. *Obesity Rev* 2011; **12**: e273–e281.
29. Skelton JA, Cook SR, Auinger P, Klein JD, Barlow SE. Prevalence and trends of severe obesity among US children and adolescents. *Acad Pediatr* 2009; **9**: 322–329.
30. Oude Luttikhuis H, Baur L, Jansen H, Shrewsbury VA, O'Malley C, Stolk RP *et al*. Interventions for treating obesity in children Evid.-Based Child Health. *Cochrane Rev J* 2009; **4**: 1571–1729.
31. Alderson P. The importance of theories in health care. *BMJ* 1998; **317**: 1007–1010.
32. Rhee KE, Lumeng JC, Appugliese DP, Kaciroti N, Bradley RH. Parenting styles and overweight status in first grade. *Pediatrics* 2006; **117**: 2047–2054.
33. White JM, Klein DM. The Systems Framework. *Family Theories*. Third Edition edn Sage Publications: Thousand Oaks, CA, 2008; pp 151–177.
34. Bertalanffy LV. Theoretical models in biology and psychology. In: Krech D, Klein GS (eds) *Theoretical Models and Personality Theory*. Duke University Press: Durham, NC, 1953.
35. Broderick CB. *Understanding Family Process: Basics of Family Systems Theory*. Sage Publications: Newbury Park, CA, 1993.
36. Kitzman-Ulrich H, Wilson DK, George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. *Clin Child Fam Psychol Rev* 2010; **13**: 231–253.
37. Berge JM. A review of familial correlates of child and adolescent obesity: what has the 21st century taught us so far? *Int J Adolesc Med Health* 2009; **21**: 457–483.
38. Berge JM, Everts JC. Family-based interventions targeting childhood obesity: a meta-analysis. *Child Obes* 2011; **7**: 110–121.
39. Olson DH. Circumplex model of marital and family systems. *J Fam Ther* 2000; **22**: 144–167.

40. Olson DH, Gorall DM. Circumplex Model of Marital & Family Systems. In: Walsh F (ed) *Normal Family Processes*. 3rd edn. Guilford: New York, 2003. pp 514–547.
41. Tubiana-Rufi N, Moret L, Czernichow P, Chwalow J. The association of poor adherence and acute metabolic disorders with low levels of cohesion and adaptability in families with diabetic children. The PEDIAB Collaborative Group. *Acta Paediatr* 1998; **87**: 741–746.
42. Herzer M, Godiwala N, Hommel KA, Driscoll K, Mitchell M, Crosby LE *et al*. Family functioning in the context of pediatric chronic conditions. *J Dev Behav Pediatr* 2010; **31**: 26–34.
43. Gundersen C, Mahatmya D, Garasky S, Lohman B. Linking psychosocial stressors and childhood obesity. *Obes Rev* 2010; **12**: e54–e63.
44. Puder JJ, Munsch S. Psychological correlates of childhood obesity. *Int J Obes (Lond)* 2010; **34**(Suppl 2): S37–S43.
45. Hill R. *Families Under Stress: Adjustment to the Crises of War Separation and Reunion*. Harper & Brothers: New York, 1949.
46. Hill R. Generic features of families under stress. *Soc Casework* 1958; **49**: 139–150.
47. McCubbin HI, Patterson JM. Family adaptation to crisis. In: McCubbin HI, Cauble AE, Patterson JM (eds) *Family Stress, Coping, and Social Support*. Charles C. Thomas: Springfield, IL, 1982.
48. McCubbin HI, Patterson JM. Family stress and adaptation to crises: a Double ABCX Model of family behavior. In: Olson DH, Miller RC (eds) *Family Studies Review Yearbook vol. 1* Sage: Beverly Hills, CA, 1983. pp 87–106.
49. McCubbin HI, Patterson JM. The family stress process: the Double ABCX Model of family adjustment and adaptation. In: McCubbin HI, Sussman M, Patterson JM (eds) *Social Stress and the Family: Advances and Developments in Family Stress Theory and Research*. Haworth: New York, 1983. pp 7–37.
50. Conger RD, Conger KJ, Elder GH, Lorenz FO, Simons RL, Whitbeck LB. A family process model of economic hardship and adjustment of early adolescent boys. *Child Dev* 1992; **63**: 526–541.
51. Conger RD, Ge X, Elder GH, Lorenz FO, Simons RL. Economic stress, coercive family process, and developmental problems of adolescents. *Child Dev* 1994; **65**: 541–561.
52. Conger RD, Donnellan MB. An interactionist perspective on the socioeconomic context of human development. *Annu Rev Psychol* 2007; **58**: 175–199.

53. Schor EL. Family pediatrics: report of the Task Force on the Family. *Pediatrics* 2003; **111**: 1541–1571.
54. Lee H, Harris KM, Gordon-Larsen P. Life course perspectives on the links between poverty and obesity during the transition to young adulthood. *Popul Res Policy Rev* 2009; **28**: 505–532.
55. Hill R. Life cycle stages for types of single parent families: of family development theory. *Fam Relations* 1986; **35**: 19–20.
56. Rodgers RH. Toward a theory of family development. *J Marriage Fam* 1964; **26**: 262–270.
57. Duvall E. Family development's first forty years. *Fam Relations* 1988; **37**: 127–134.
58. Mead H. *Mind, Self, and Society*. Chicago University Press: Chicago, 1934.
59. Duvall E. *Family Development*. J. H. Lippencott: New York, 1957.
60. Barnhill LR, Longo D. Fixation and regression in the family life cycle. *Fam Process* 1978; **17**: 469–478.
61. Bronfenbrenner U. Ecology of the family as a context for human development: research perspectives. *Dev Psychol* 1986; **22**: 723–742.
62. Bronfenbrenner U, Morris PA. The ecology of human developmental processes. In: Damon W, Eisenberg N (eds) *The Handbook of Child Psychology*. John Wiley & Sons: New York, 1988. pp 993–1027.
63. Tudge JRH, Mokrova I, Hatfield BE, RB. Karnik. Uses and misuses of Bronfenbrenner's Bioecological Theory of human development. *J Fam Theory Rev* 2009; **1**: 198–210.
64. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. *Obes Rev* 2001; **2**: 159–171.
65. Stewart L, Chapple J, Hughes AR, Poustie V, Reilly JJ. Parents' journey through treatment for their child's obesity: a qualitative study. *Arch Dis Child* 2008; **93**: 35–39.
66. Eliadis EE. The role of social work in the childhood obesity epidemic. *Soc Work* 2006; **51**: 86–88.
67. Kitzman-Ulrich H, Hampson R, Wilson DK, Presnell K, Brown A, O'Boyle M. An adolescent weight-loss program integrating family variables reduces energy intake. *J Am Diet Assoc* 2009; **109**: 491–496.

68. Galvez MP, Pearl M, Yen IH. Childhood obesity and the built environment. *Curr Opin Pediatr* 2010; **22**: 202–207.
69. Goetz DR, Caron W. A biopsychosocial model for youth obesity: consideration of an ecosystemic collaboration. *Int J Obes Relat Metab Disord* 1999; **23**(Suppl 2): S58–S64.
70. Ellis DA, Janisse H, Naar-King S, Kolmodin K, Jen KL, Cunningham P *et al*. The effects of multisystemic therapy on family support for weight loss among obese African-American adolescents: findings from a randomized controlled trial. *J Dev Behav Pediatr* 2010; **31**: 461–468.
71. Naar-King S, Ellis D, Kolmodin K, Cunningham P, Jen KL, Saelens B *et al*. A randomized pilot study of multisystemic therapy targeting obesity in African-American adolescents. *J Adolesc Health* 2009; **45**: 417–419.
72. Von Almen TK. Behavioral and psychological assessment tools. In: Sothorn MS, Gordon ST, Von Almen TK (eds) *Handbook of Pediatric Obesity: Clinical Management*. CRC Taylor & Francis: Boca Raton, 2006. pp 105–111.
73. Franko DL, Thompson D, Bauserman R, Affenito SG, Striegel-Moore RH. What's love got to do with it? Family cohesion and healthy eating behaviors in adolescent girls. *Int J Eat Disord* 2008; **41**: 360–367.
74. De Santis-Moniaci D, Altshuler L. Comprehensive behavioral treatment of overweight and the pediatric practice. *Pediatr Ann* 2007; **36**: 102–108.
75. Eisler I, Dare C, Hodes M, Russell G, Dodge E, Le Grange D. Family therapy for adolescent anorexia nervosa: the results of a controlled comparison of two family interventions. *J Child Psychol Psychiatry* 2000; **41**: 727–736.
76. Mellin AE, Neumark-Sztainer D, Story M, Ireland M, Resnick MD. Unhealthy behaviors and psychosocial difficulties among overweight adolescents: the potential impact of familial factors. *J Adolesc Health* 2002; **31**: 145–153.
77. Robin AL, Siegel PT, Moyer A. Family versus individual therapy for anorexia: impact on family conflict. *Int J Eat Disord* 1995; **17**: 313–322.
78. Hauser ST, Jacobson AM, Lavori P, Wolfsdorf JI, Herskowitz RD, Milley JE *et al*. Adherence among children and adolescents with insulin-dependent diabetes mellitus over a four-year longitudinal follow-up: II. Immediate and long-term linkages with the family milieu. *J Pediatr Psychol* 1990; **15**: 527–542.
79. Hanson CL, De Guire MJ, Schinkel AM, Kolterman OG. Empirical validation for a family-centered model of care. *Diabetes Care* 1995; **18**: 1347–1356.

80. Pritchett R, Kemp J, Wilson P, Minnis H, Bryce G, C. Gillberg. Quick simple measures of family relationships for use in clinical practice and research. A systematic review. *Fam Pract* **28**: 172–187.
81. Robinson TN. Treating pediatric obesity: generating the evidence. *Arch Pediatr Adolesc Med* 2008; **162**: 1191–1192.

Acknowledgements

This study was supported in part by a grant from The Duke Endowment No. 6110-SP and NICHD/NIH Mentored Patient-Oriented Research Career Development Award K23 HD061597 (JAS), and by a grant from The Kate B. Reynolds Charitable Foundation (MBI). We would like to thank Karen Klein (Research Support Core, Office of Research, Wake Forest School of Medicine) for providing helpful edits of this manuscript.