



## Review

## Review of upstream social factors contributing to childhood obesity

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## 1. Background

In the United States, childhood obesity rates have steadily risen for more than three decades. As of 2018, 16.1% of U.S. children and adolescents (2–19 years of age) have a body mass index (BMI) greater than the 85th percentile for age and sex (overweight) and 19.3% have a BMI greater than the 95th percentile (obesity) [1]. Multiple obesity prevention and treatment efforts, with particular attention directed to the first 1000 days of life, have been implemented with the goal of improving childhood nutrition and health [2]. Despite countless efforts, the prevalence of obesity in U.S. preschool children (2–5 years) currently approaches 13 percent [3,4].

Pediatric obesity does not affect communities equally, with minoritized groups and specific geographic areas experiencing disproportionately higher obesity rates. Among children and adolescents aged 2–19 years, prevalence of obesity affects non-Hispanic Blacks (25.1%), Mexican Americans (24.9%), Hispanics (23.0%), American Indian/Alaska Native (AI/AN) (29.7%), and Native Hawaiian or Other Pacific Islander (NHPI) (23% at 8 years of age) at higher rates compared to non-Hispanic Whites (14.7%) [1,5,6].

Many of the racialized differences in obesity rates reflect inequities that are “neither natural nor inevitable” [7] but rather the result of unfair social structures or institutional practices that confer unearned privilege to one group while subjugating another group [8]. Additionally, obesity is a complex disease that results from complicated interactions with, and

reactions to, social, environmental, and biological variables that can affect mood, energy regulation, and health status.

The complexity of obesity spans a lifetime. Obesity in childhood increases the risk of pediatric cardiovascular disease, diabetes, depression, and anxiety while also increasing the risk of obesity and premature death in adulthood. To develop a comprehensive, inclusive and equitable framework for the treatment and prevention of childhood obesity, clinicians are encouraged to evaluate the root causes of the inequitable access, prevalence, and outcomes observed among minoritized communities. Insight into lived experiences and the context in which the child and family views historical and present-day life are invaluable in this effort. This paper will shed light on upstream contributors to obesity, provide actionable steps for clinicians, identify gaps in obesity-related care, and propose future directions for childhood obesity management and research (Fig. 1).

## 2. Upstream factors contributing to obesity

## 2.1. Epigenetic modification, toxic stress, and adverse childhood experiences

## 2.1.1. Case study 1: Antonia and Daniela

15-year-old Daniela is accompanied by her mother, Antonia, to establish care and discuss weight gain and a dark rash on her neck. Past medical history is negative; however, Antonia was recently diagnosed

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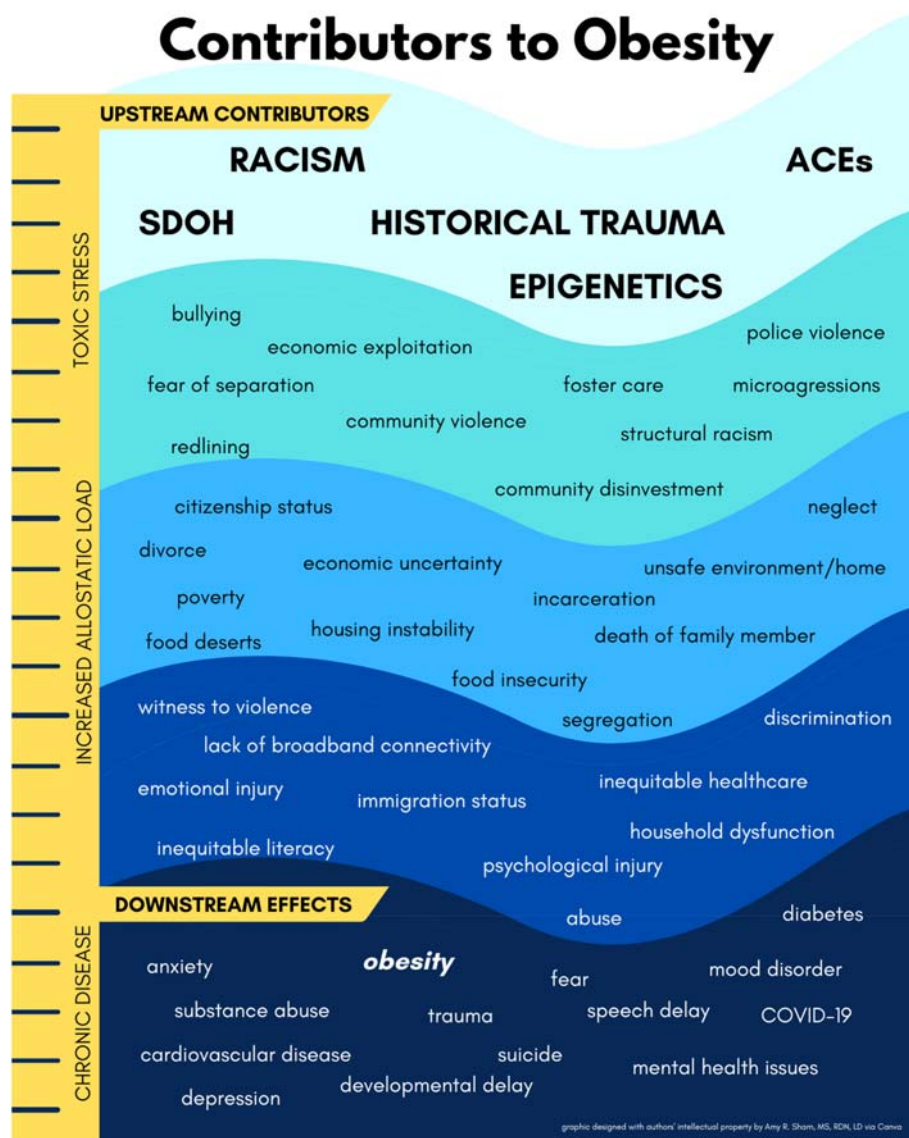


Fig. 1. Factors contributing to obesity.

with type 2 diabetes (T2D) after suffering from gestational diabetes (GDM) with each of her pregnancies. Daniela's pattern of weight gain and dark rash have worsened in the past year. Two years ago, Daniela and her family immigrated from Honduras after her father was killed during an armed home invasion. She now lives in a multigenerational household that includes her mother, 2 younger siblings, maternal grandmother as well as maternal aunt and her 3 children. She attends the local public high school where she plays on the soccer team – which was unavailable at her former school due to neighborhood violence. The family eats traditional Honduran meals for dinner, otherwise Daniela eats very little during the day; she skips breakfast most days and drinks soda with chips for lunch. On physical exam, the BMI is 38 (>95<sup>th</sup> percentile) and acanthosis nigricans is noted on the neck and axillae.

### 2.1.2. Epigenetic modifications

Daniela's story introduces the concept of epigenetics, or the study of how environment and behavior may lead to changes that affect gene function. Whereas genetic changes are irreversible and alter DNA sequences within genes, epigenetic changes are modifiable, reversible, and exert their influence on the gene expression of DNA sequences [9]. Epigenetic modifications may affect infants as they develop in-utero, and later in childhood. Maternal factors during pregnancy such as gestational

diabetes, excessive weight gain, or tobacco use can manifest as epigenetic modifications that contribute to the development of pediatric obesity [10]. In the case of Daniela, her mother suffered from gestational diabetes during all 3 of her pregnancies and lived in a neighborhood affected by community violence. Postnatal environmental factors (high carbohydrate diet with few fruits and vegetables, inadequate sleep, and physical inactivity) are associated with epigenetic changes that increase the risk of obesity [2]. Additional associated threats for epigenetic changes include racial inequities and structural racism, adverse childhood events (ACEs), food insecurity, food deserts, housing instability, and community violence and disruption [11,12].

### 2.1.3. Toxic stress

Current literature suggests that chronic, toxic stress experienced through poor social determinants of health (SDOH), and life events can lead to obesity in children through two distinct physiological pathways: disruption of the hypothalamic-pituitary-adrenal (HPA) axis from allostatic overload and through epigenetic modifications [13–16]. The body normally responds to stress through heightened energy and hormonal responses to meet the perceived threat until the stress is passed. Threats that are severe, constant or ongoing become toxic and may overtax the normal stress response [17]. Allostatic load is the term for the cumulative

**Table 1**  
Strategies for trauma informed care (TIC).

Core Principles of Trauma-Informed Care & Related Actions		
<b>Realize</b> <i>Understand broad impact of trauma</i>	Understand short and long-term impact of ACEs and toxic stress on development and health	Shift perspective from “what is wrong with you?” to “what happened to you?”
<b>Recognize</b> <i>Signs &amp; symptoms of trauma in families</i>	Use open ended questions	Assess for physiological, biological, psychological, social, and spiritual effects: suicidality, depression, anxiety, substance abuse, self-injurious behavior, developmental delay, sleep disorders, disordered eating and relational health.
<b>Respond</b> <i>Coordination of response to trauma particularly with family, community, and health care systems</i>	Anticipatory guidance: Resilience promotion, ACEs education, consistency in parenting skills	Tool: Pediatric ACEs screening and related life-events screener
<b>Resist Re-traumatization</b> <i>Universal trauma precautions for both caregivers and care receivers</i>	Approach all children & families with trauma universal precautions mindset Promote a culture of TIC in organizations and communities	TIC and resiliency training for all personnel interacting with children and families.
	Screen for trauma for every child, every visit	

ACEs = Adverse Childhood Experiences; TIC = Trauma informed care.

effect of life stressors (chronic or episodic) on the body [18]. Allostatic overload occurs when the body is unable to successfully manage these stressors. Chronic inflammation, diminished immune response, and energy dysregulation are end-results of allostatic overload [18]. In a comprehensive approach to patients and families similar to Daniela who are affected by obesity, clinicians are encouraged to consider the role of chronic, pervasive, toxic stress in the development and progression of obesity.

2.1.4. Adverse childhood experiences (ACEs)

The landmark study on ACEs identified 3 major categories of adversity experienced in childhood (household dysfunction, abuse, and neglect) which were strongly associated with increased risk of poor health [19]. As the number of ACEs that an individual experienced increased, so did the risk for adverse health outcomes such as obesity, cardiometabolic diseases, diabetes, substance abuse, depression, and suicide attempts [19,20]. Amongst middle-class, insured individuals, greater than two-thirds experienced at least one ACE and nearly 25% experienced 3 or more ACEs [20].

ACEs are associated with childhood obesity, albeit signs may be delayed, presenting as many as 5 years after the traumatic event [21]. The prevalence of ACEs is higher in children and adults from minoritized groups compared to predominantly White communities [22–26]. This association may partially explain the higher burden of poor health and life outcomes experienced by minoritized groups. The original ACEs study measured conventional ACEs (ACE-C) which assessed individuals in middle to upper middle-class communities, focusing on parameters within the home such as abuse, neglect, and household dysfunction [19]. Cronholm et al. studied a more socioeconomically and racially diverse urban population, expanding the ACE-C to include experiences within the community [27]. The expanded ACEs (ACE-E) include witnessing or experiencing community violence, placement in foster care, death of

**Table 2**  
Case study 1: Antonia and Daniela – epigenetics, toxic stress, and ACEs.

<b>Actionable Steps</b>	<ol style="list-style-type: none"> <li>Utilize Trauma-Informed Care Practices with immigrant youth and families</li> <li>Consider potential sources of trauma for immigrant and refugee youth                             <ul style="list-style-type: none"> <li>Bullying or victimization at school</li> <li>Physical or sexual abuse</li> <li>Dangerous conditions during migration</li> <li>Family conflict or intrafamilial violence</li> <li>Unsafe neighborhoods or gun violence (in country of origin and after relocation)</li> <li>Racism and microaggressions (both in country of origin and after relocation)</li> <li>Anxiety about possible parental deportation or safety of family members in the country of origin</li> <li>Family separation, either planned separation or as a result of immigration policy or detention</li> </ul> </li> <li>Screen for and address health literacy</li> <li>Provide culturally and linguistically appropriate care</li> </ol>
<b>Plan</b>	<ul style="list-style-type: none"> <li>Daniela and Antonia read the “All are welcome here” sign in the clinic and appreciate staff and physicians utilizing translation services since Spanish is their preferred language. Trauma-informed care interviewing reveals that Daniela is good at drawing and sketching. After asking permission to discuss her journey to the United States, Daniela shares that she was seldom allowed outside for fear of gang violence. She also shares that she is bullied by girls at her new school because her English is limited, and she frequently asks people to repeat things. She fears that her mother could be deported at any moment. She also worries about her mother’s health since everyone in her family is uninsured except for her two younger siblings who were born in the U.S. Lastly, Daniela is concerned about her weight and thinks if she eats less (by skipping breakfast and drinking caffeine) it will help her lose weight. She acknowledges that she feels tired and irritable by mid-morning.</li> <li>After a brief discussion about the body’s need for fuel, Daniela agrees to eat a piece of fruit with yogurt or milk from the school’s breakfast at least 3 times per week. She also shares that she plans to sign up the intramural soccer team at school.</li> </ul>
<b>Follow-up</b>	<p>Daniela returns to clinic 8 weeks later with evidence of weight stabilization and linear growth (BMI 37.5). She’s eating breakfast at 4 times per week and has noticed that she has more energy. After a few weeks in intramural soccer, she had to quit because the family couldn’t afford childcare for the younger siblings and cousins. However, now that they’re living in a safer neighborhood, Daniela takes them to the park to play games (i.e. soccer, kickball, etc.) at least 3 times per week and once on the weekend. If it rains, they have a dance party at home.</p>

family member, and witness to frequent interpersonal or community conflict. Cronholm’s results revealed that 72.9% of 1784 respondents experienced at least one ACE-C, 63.4% at least one ACE-E, and 49.3% experienced at least one of both. Most importantly, 13.9% experienced only ACE-E, suggesting that conventional ACE assessment would have missed risk factors more common in communities with more racial, ethnic and socioeconomic diversity [27].

2.1.5. Upstream contributors for immigrants

Some immigrant children like Daniela, are at high risk for chronic stress or trauma from racism, unsafe neighborhoods in country of origin, and relocation to another community or country [28]. Other potential stressors include food insecurity, limited (if any) access to health care, and fears of family separation. Poor health literacy, exacerbated by the absence of written materials and instructions in the patient’s preferred language, can hinder an immigrant family’s ability to manage chronic diseases including obesity and diabetes [29].

2.1.6. Case 1 actionable steps

Providers can (1) strive to learn more about patient’s history and living situation, (2) use Trauma Informed Care (TIC) principles, and (3) address health literacy and cultural barriers. TIC asks clinicians to consider the role that trauma and lingering traumatic stress plays in the

lives of their patients. Trauma-informed care considers physical, emotional, social, or historical trauma which can all have harmful effects on mental and physical health [30]. Clinicians can use a “trauma lens” to provide patients and their families with the tools for building supportive relationships and fostering resilience [31,32]. With over 40% of children and adolescents experiencing four or more different types of traumas and adversity [33] and because trauma is more common in families experiencing health inequities, all health systems and practices treating child obesity are encouraged to increase awareness and uniformly implement trauma-informed care techniques [34]. Table 1 describes strategies for the use of trauma informed care principles.

Daniela's history indicates a high risk of epigenetic changes from toxic stress related to ACEs, maternal GDM and T2DM, community violence, and witnessing the death of her father. Learning more about Daniela's history and current living situation helps her clinician consider and address sources of trauma. In order to provide care that supports the family and does not retraumatize, the clinician uses TIC principles to recognize the impact of potential, unspoken traumas brought to any clinical encounter. TIC technique are provided in Table 1 [32,34,35]. By addressing health literacy, language and cultural barriers, the clinician provides patients like Daniela with culturally relevant counseling and resources. Table 2 illustrates the impact of epigenetics, toxic stress, and ACEs through the case study of Antonia and Daniela.

## 2.2. Historical trauma

### 2.2.1. Case study 2: Susan and Charlie

Charlie is a 32-week male born vaginally to a 27-year-old Choctaw mother, Susan, after premature rupture of membranes and labor. Charlie was born at the local hospital near the Choctaw reservation but required transfer to a regional neonatal intensive care unit (NICU) 50 miles away. The pregnancy was complicated by late prenatal care, gestational diabetes, and depression. After learning of the gestational diabetes, Susan became distraught and afraid, thinking about her many relatives with diabetes who required daily injections, experienced blindness, or underwent limb amputation. She has watched her relatives attempt to follow both tribal and western medicine. Susan lives on the Choctaw Indian Reservation with her husband and 3 generations of her family, as most of them have been awaiting housing assistance for years. Though she has remained sober for 11 years, multiple family members continue to struggle with alcohol use disorder.

### 2.2.2. The impact of historical trauma

The story of Susan and Charlie invokes images of historical trauma or the cumulative, multigenerational, collective experience of emotional and psychological injury experienced by specific cultures, races, or ethnic communities [36]. Intertwined through the interpersonal and collective experience, examples of historical trauma include enslavement, displacement (i.e. internment camps, Indian reservations), exploitation, and cultural disruption, often resulting in unresolved grief [36]. The combined emotional and psychological stresses of historical trauma impact individuals over the lifespan and across generations, stemming from massive group trauma experiences that result in cumulative and self-perpetuating consequences [37]. Younger generations of traumatized groups, who did not experience the original traumatic event, may still manifest symptoms of trauma such as low self-esteem, self-destructive behaviors, depression, anxiety and suicidality [37,38]. Susan's multigeneration household struggles with housing instability, substance use disorder and chronic disease, likely related to historical trauma, ACEs, toxic stress and epigenetic modification.

Because of familiarity with Choctaw culture, beliefs, and historical trauma, the NICU clinical team understood the barriers that Susan experienced in seeking care at the Indian Health Service, as well as her fears, mental health, and substance abuse issues. After his premature birth, Charlie's NICU clinical team screened for ACEs, SDOH, and used TIC methodology. This enabled Susan's clinician to provide more

informed, empathetic care for Charlie and his family as well as offer appropriate community and cultural resources.

### 2.2.2. Case study 2 actionable steps

Clinicians can develop an understanding of the histories and cultures of the communities they serve, mindful that not all members of a community will have the same experiences or beliefs. Knowledge of traditional beliefs are helpful in designing integrative approaches to healing and incorporating them into clinical practice to provide culturally appropriate and safe care [33]. Trauma informed technique are included in Table 1 and resources in Appendix [32,34,35]. Table 3 illustrates the impact of historical trauma through the case study of Susan and Charlie.

**Table 3**  
Case study 2: Susan and Charlie - historical trauma.

<b>Assessment</b>	Charlie is a 32-week gestational age Choctaw male, born to a mother with obesity, gestational diabetes and a history of alcoholism.
<b>Additional History</b>	<p>Social determinants of health screening enable the NICU staff to learn that:</p> <ul style="list-style-type: none"> <li>• Susan and her husband work to provide housing, and food to over 15 family members. Susan is caregiver to many family and community members but neglects her own health.</li> <li>• Living on the reservation of a federally recognized tribe, Susan has access to health care through the Indian Health Service (IHS) but rarely utilizes the IHS due to a previous negative experiences. Her last experience with the IHS was spending three months at a Youth Regional Treatment Center for substance abuse as a teenager. She has been sober for the past 11 years.</li> <li>• Both Susan's grandmother and great-grandmother were separated from their families and sent to Indian Boarding schools as young children, and both later developed alcoholism as teenagers.</li> </ul>
<b>NICU Course &amp; Discharge</b>	<ul style="list-style-type: none"> <li>• After delivery, Charlie is moved to the NICU. Susan is reminded of stories of child separation told by the women in her family. Even after she is discharged, Susan visits Charlie every day, sometimes multiple times a day to make sure he hasn't been moved.</li> <li>• After 6 weeks in the NICU, Charlie is discharged. When Susan brings him home, she shares with her family that she constantly worried that the medical staff would take Charlie away from her against her wishes. In the weeks that follow, she becomes more despondent. Unbeknownst to her family, Susan resumes substance use after 11 years of sobriety.</li> </ul>
<b>Follow-up</b>	<p>At the 2-month well visit, Susan is relieved when a Community Health Worker (CHW) greets her in Choctaw and offers to take Charlie's car seat.</p> <ul style="list-style-type: none"> <li>• When asked how things are going at home, Susan shares that being a parent to Charlie as well as a caregiver to other family members has been very difficult. Susan quietly shares with the CHW that after she puts Charlie to bed, she sometimes pours herself a drink. She is afraid to tell anyone because she fears Charlie will be taken away, much like her grandmothers were taken. Susan becomes tearful when the CHW praises her for taking such good care of Charlie and bringing him to his medical appointments.</li> <li>• Susan learns that CHWs work with the medical staff to care for families and identify resources. She also learns that there are childcare and home-based programs available. Susan is surprised to hear that the CHW has a similar story of trauma, recovery and relapse but chose to serve the community to help other women like her. She accompanies Susan and Charlie when the nurse calls them back.</li> </ul>
<b>Actionable Steps</b>	<ol style="list-style-type: none"> <li>1) Screen for ACEs and SDOH</li> <li>2) Utilize Trauma-Informed Care in communities with historical trauma</li> <li>3) Understand historical experiences and their intergenerational trauma effects and those potential effects on epigenetic changes</li> <li>4) Provide culturally and linguistically appropriate care</li> </ol>

IHS=Indian Health Service.

### 2.3. Structural racism and social determinants of health

#### 2.3.1. Case study 3: Rachel and Macy

Macy is a 9-month-old African American female who presents with her grandmother, Rachel, for an office visit to discuss decreased intake. Macy's weight-for-length is at the 99<sup>th</sup> percentile for age. Macy's 20-year-old mother, Renee, died within hours of delivery. The family was told it was from complications of high blood pressure but Rachel seems unsure. She has cared for Macy since birth. Macy's diet currently includes formula, juice and some table foods. Macy lives in a 2-bedroom apartment with her grandmother and boyfriend, and 2 other children ages 14 and 16 years – Macy's maternal aunt and uncle. The family would like to move out but have not been approved for home loans to afford a big enough house in a better neighborhood. They tried to rent a house, but each time the home suddenly becomes “unavailable” when the landlord meets Rachel and her boyfriend in person. The last time they looked at a property, one of the neighbors called the police complaining of “dangerous looking people lurking around.”

#### 2.3.2. Structural racism

Black maternal health inequities. Food deserts. Redlining. Profiling. Structural racism serves as a chronic and insidious accelerator of adverse environments and experiences which contribute to inequities in the prevalence of childhood obesity, infant mortality and low birth weight, and higher maternal morbidity and mortality among Black women [39, 40]. A systematic review examining the relationship between racial discrimination and child health in 121 studies found significant results in 76%, and associations between racial discrimination and negative mental health [40]. The 2021 National Healthcare Quality and Disparities Report found that quality measures tracking person-centered care, patient safety, healthy living, effective treatment, care coordination, and affordable care were worse for Black (43% of quality metrics), Hispanic (36%), AI/AN (40%), Asian (28%), and NHPI (28%) individuals when compared to White counterparts [41]. The report noted that reduced health care access in minoritized groups was unchanged from annual reports over previous two decades [41]. The historical and intentional exclusion of certain minoritized groups coupled with disinvestment of specific neighborhoods that include predominantly Black, Indigenous and People of Color have contributed to the modern-day racial segregation of neighborhoods and communities. The inadequate resources of healthcare facilities and fewer primary care and subspecialty clinics result in reduced access to healthcare in these minoritized communities [42], leading to higher rates of obesity and other chronic diseases [15]. Chronic stress from racism as experienced through practices exemplified by racialized residential segregation (redlining), police violence and mass incarceration, and healthcare inequities affects individual and community health [14]. The combined interactions of ACEs, SDOH, racism, epigenetics, and historical trauma and the resultant toxic stress can accelerate and exacerbate the risk of obesity in susceptible children and adults [43].

#### 2.3.3. Structural racism and immigrants

A literature review by Misra et al. considers how structural racism uniquely impacts the health of racialized immigrants [29]. The authors propose that structural disadvantages for immigrants are embedded into governmental and institutional policies and impact immigrant health via three pathways: formal racialization via immigration policy and citizenship status; informal racialization via disproportionate immigration enforcement and criminalization including ongoing threats of incarceration and deportation; and economic exploitation and disinvestment [29]. Racialized policies impact immigrant health through psychosocial experiences (fear, stress, and trauma); inequitable access to essential resources (food, employment, housing, and health care quality); and experiences of discrimination, neglect, violence, and abuse [44–48].

**Table 4**

Case 3: Rachel and Macy - social determinants of health and structural racism.

<b>Birth &amp; Family Medical Histories</b>	<b>Birth History:</b> Macy's mother, Renee, worked part-time while going to school to become a nursing assistant. She did not realize she was pregnant until 10 weeks due to a history of irregular periods but was not able to establish prenatal care until the second trimester (16 weeks) because of appointment availability and her work schedule. Renee later developed gestational diabetes and pregnancy-induced hypertension. <b>Family Medical History: Mother:</b> Renee had a history of obesity since childhood. Maternal Grandmother: Rachel has a history of obesity and tobacco use. Rachel has been divorced for more than 10 years – after enduring years of fear and uncertainty related to her husband's substance abuse disorder. For years afterward, she and her children, including Renee, lived “hand-to-mouth” despite her working as Program Coordinator of a youth literacy program. Rachel is discouraged. She feels Macy's health and Renee's death are due to being under constant stress, not to mention the lack of access to fresh affordable food and produce. There are no grocery stores in her neighborhood – only overpriced corner stores that sell mostly alcohol and cigarettes. The closest grocery store is a 30-minute bus ride away.
<b>Assessment</b>	Macy is a 9-month-old female with elevated weight-for-length with multiple negative social determinants of health
<b>Actionable Steps</b>	1) <b>Medical Assessment: Screen every patient with obesity for SDOH</b> 2) <b>Screen parents and caregivers for depression</b> 3) <b>Take steps to deliver trauma informed care and address structural racism</b>
<b>Additional History &amp; Discharge Plan</b>	<ul style="list-style-type: none"> <li>• SDOH screening reveals that Rachel has concerns about unreliable transportation and fluctuating food insecurity</li> <li>• Edinburgh Postnatal Depression Scale [53] reveals that Rachel is experiencing signs of depression, specifically guilt, anxiety, sadness and feeling overwhelmed. Upon discussion of her screening results Rachel explains her depression is aggravated by grief, family and social stressors, including racism. Rachel is overworked and feeling depressed. She tends to feed Macy anytime she cries and will continue to offer the bottle despite signs of satiety. She feels like she is unable to bond with Macy due to stress.</li> <li>• Based on the SDOH and depression screens, the clinic social worker meets with Rachel prior to discharge to help her identify resources and schedule transportation for Macy's 12-month well visit using her insurance.</li> </ul>
<b>Follow-up</b>	<ul style="list-style-type: none"> <li>• At Macy's 12-month visit, weight gain continues. However, she is reaching her developmental milestones. Rachel reports that she used the recommendations from the social worker to identify a Primary Care Mobile Health Unit and nonprofit counseling center that are a short bus ride from her home. Volunteers at the nonprofit provide up to 4 hours/week of free babysitting, which Rachel uses when she needs to run errands or go to counseling. The Center also has a weekly farmer's market with fresh produce.</li> <li>• Overall, Rachel's mood is improved. She feels less overwhelmed and better able to respond to Macy. You praise Rachel's progress and encourage her to keep up with counseling appointments. The clinic social worker also meets with Rachel and is heartened by the progress she sees in both Rachel and Macy. She helps schedule transportation for the 15-month well visit.</li> </ul>

#### 2.3.4. Social determinants of health

The case of Rachel and Macy underscores how social determinants of health can influence a child in utero and after delivery (Table 4). SDOHs

**Table 5**  
Steps to address racism and develop resiliency.

Steps to Address Structural Racism	
	<ul style="list-style-type: none"> <li>Involve the staff, multidisciplinary team to simulate “Walk in their shoes”</li> <li>Work to assemble teams that reflect the communities you serve</li> <li>Invite community leaders into your practice or institution</li> <li>Take the Implicit Association Test to understand your own unconscious bias</li> <li>Commit to authentic allyship</li> <li>Seek out a Diversity, Equity and Inclusion champion in your organization or community</li> <li>Join or create a Diversity Committee at your organization</li> </ul>
Steps to Develop Resiliency in Children & Families	
Assess every child, every visit	<ul style="list-style-type: none"> <li>ACEs</li> <li>Developmental milestones</li> <li>Family and peer relationships</li> <li>Caregiver mental health</li> <li>Social Determinants of Health</li> </ul>
Education	<ul style="list-style-type: none"> <li>Promote protective factors</li> <li>Mitigate risk factors</li> <li>Enhance adaptation skills</li> <li>Support positive parenting skills: nurturing, belonging, role modeling, family organization, family structure and rituals</li> <li>Emphasize stress management skill development; self-awareness</li> </ul>
Promote Self-care	<ul style="list-style-type: none"> <li>Problem-solving</li> <li>Emotional skill building</li> <li>Hope, faith, optimism</li> <li>Self-confidence</li> <li>Self-efficacy and identity</li> </ul>

Adapted from Garner et al., 2021; Goddard, 2021; National Association of Pediatric Nurse Practitioners, 2019.

are environmental conditions which influence a wide range of health outcomes and quality of life. Poor SDOHs are disproportionately experienced by children from racial and ethnic minoritized groups [49]. The common theme among the constructs of SDOH and structural racism is that upstream factors have downstream effects that manifest in measurable adverse health outcomes including obesity in children [50]. SDOHs are influenced by economic, political, and social factors, including racism, and are not the result of individual behavior choices or a genetic predisposition [51]. The American Academy of Pediatrics states that racism is a core social determinant of health that drives health inequities in children [52].

2.3.5. Case Study 3 Actionable Steps

Approaching the patient and family with respectful curiosity of their story unmask upstream contributors, directs areas of concern to better focus treatment, and suggests possible interventions. Root causes of chronic stress emerge as clinicians ask “What has happened to you and your family? Tell me your story.” Strictly counseling on diet and physical activity can be ineffective if upstream barriers are not considered. Upstream barriers include, among others, unaddressed food insecurity, lack of transportation, and undiagnosed maternal or caregiver depression which may lead to difficulty maintaining employment for financial stability, adhering to subsequent health maintenance appointments, and contribute to abnormal growth and mental health issues for the child. A more nuanced awareness of intentional exclusion and historical disinvestment of neighborhoods aids treatment plans when considering the family’s living environment, housing stability, community safety, and proximity to services including food, school, and healthcare. Table 4 demonstrates, through the story of Macy and Rachel, the intersectionality of structural racism and SDOH with factors described in other cases, i.e., toxic stress, adverse childhood experiences, health inequities. Table 5 offers practice and personal-level opportunities for clinicians to address structural racism.

**Table 6**  
Case 4: Elizabeth and Gary - Easy to miss ACEs.

Assessment	Gary is an 18-month-old male with weight-for-length > 95 <sup>th</sup> percentile and possible speech delay. There are no obvious risk factors for obesity or speech delay.
Actionable Steps	<p><b>Medical Assessment: Screen every patient with obesity for ACEs and home environmental safety</b></p> <ol style="list-style-type: none"> <li>SEEK (Safe Environment for Every Kid) Questionnaire [53]: screens for parental depression, parental substance abuse, major parental stress, intimate partner or domestic violence, food insecurity and harsh punishment</li> <li>Screen for ACEs</li> <li>Perform screenings for early identification of mental health and medical issues</li> <li>Use the electronic medical record to document and share screenings and other medical information</li> </ol>
Additional History & Discharge Plan	<ul style="list-style-type: none"> <li>Elizabeth answered “yes” on the SEEK Questionnaire for symptoms of parental stress, parental depression and intimate partner violence. She explains that she is still breastfeeding Gary, but it consumes much of her time. Among other things, she and Gary’s father disagreed about when to wean. For years, disagreements often became violent but worsened with the pregnancy which prompted Elizabeth to seek divorce.</li> <li>She has utilized toddler milk and sometimes juice in an effort to wean Gary from the breast as she is not able to keep up with the demands of work, household chores and caring for Gary on her own.</li> <li>During anticipatory guidance, you attempt to reassure Elizabeth that if Gary is eating table food, then it’s okay for him to have milk with meals and water the rest of the day. Try to limit juice to 4 oz/ day.</li> <li>You ask Elizabeth if she would like to meet with the lactation consultant (LC) during today’s visit. She declines. You offer her a list of community resources for victims of domestic violence. She declines. Finally, you refer Gary to speech therapy. Elizabeth again declines and explains with frustration that she cannot afford to miss work. She leaves without scheduling the 2-year well visit.</li> </ul>
Follow-Up	<ul style="list-style-type: none"> <li>You call Elizabeth a few weeks later to apologize for not being sensitive to her work schedule and her being Gary’s primary caregiver. She admits that she is interested in all of the services you offered but just doesn’t know to fit it in the day without missing work.</li> <li>After some discussion, Elizabeth remembers seeing signs at work about telemedicine visits with EAP. She agrees to look into it. Since she has access to the patient portal, you offer to have the LC reach out so they can find a time to talk more. Elizabeth agrees.</li> <li>Elizabeth asks if it’s true that singing and reading to children can help with their speech development. She read it in a parent magazine when she was pregnant but with the divorce, she hasn’t been doing any of those things.</li> <li>Before hanging up, Elizabeth thanks you for reaching out. She reassures you that she will look into EAP. She asks to hold off on the speech referral until the 2-year well visit. She wants to get back to singing and reading to Gary.</li> </ul>

EAP = Employee Assistance Program.

2.4. Latent adverse childhood experiences

2.4.1. Case study 4: Elizabeth and Gary

Gary is an 18-month-old White male who presents for a well child visit. His mother, Elizabeth, is concerned because Gary is very clingy and doesn’t talk as much as his 16-month-old cousin. Gary’s weight-for-length is at the 99<sup>th</sup> percentile for age. His birth and medical histories are uncomplicated. Elizabeth received early prenatal care and experienced a “healthy” pregnancy that included adequate exercise, normal weight

gain, blood sugar, and blood pressure. Gary was delivered at 39 weeks (birth weight 7 lbs. 14 oz). He was exclusively breastfed until six months of age then transitioned to baby food. Gary continues breastfeeding in addition to eating a variety of table foods, fruits and vegetables. Elizabeth works as elementary school teacher and has employer-sponsored health insurance that covers the cost of the breast pump she uses while at work. Since his parents' divorce, Gary lives with mother.

Despite having adequate financial resources, a safe community, access to health care, healthy affordable foods, and employer-sponsored health insurance, 18-month Gary developed obesity and speech delays possibly due to other risk factors. Using the Safe Environment for Every Kid (SEEK) Questionnaire, Gary screened positive for ACEs including maternal depression, domestic violence, and divorced parents [54]. Parental stressors, parental divorce and intimate partner violence can increase the risk of obesity as well as mood disorders, speech delay, and other developmental issues [55]. Unconscious or implicit bias may lead some to believe there are no “obvious” risk factors for ACEs and obesity in this case. Though the risk factors may be “hidden,” universal ACEs screening and careful history-taking assists in the discovery of such risk factors and guides clinical care. The ultimate goals are to decrease chronic stress and optimize treatment strategies.

#### 2.4.2. Case study 4 actionable steps

ACEs constitute any potentially traumatic events that are perceived stressful to the recipient. While some ACEs may seem obvious, other events such as maternal history of depression, intimate partner violence, weight-based victimization, or peer rejection may be more difficult to detect. Consider ACEs screening for every child, but especially children with obesity, developmental delay, risk for historical trauma, or parental history of mental health disorders.

When medical practices strive to develop medical homes where every parent feels acknowledged and supported, the practice can build supportive relationships that cultivate resilience in children. Vigilance is needed to provide systematic, routine screenings to help with early detection of changes in social or household resources. To potentially mitigate the harmful effects of ACEs, clinicians are encouraged at every encounter to ask about, and listen to the stories of parents, caregivers, and children, regardless of their perceived risk.

While evaluating for past trauma is important, assessment must be balanced with the ability to provide appropriate support of what is discovered at the encounter. Providers can become familiar with supportive community resources, such as social workers, counselors, shelters or support groups, food banks, and cultural centers. Universally employ the four “R” components of trauma informed care as hidden trauma may exist in any patient or family: Realize, Recognize, Respond, and Resist Re-traumatization (Table 1) [32,34,35] [Appendix 1]. Finally, the Substance Abuse and Mental Health Services Administration (SAMHSA) publication on trauma informed approach can further inform providers and their practices [56]. Table 6 illustrates the impact of ACEs through the story of Elizabeth and Gary.

### 3. Discussion

Childhood obesity is a challenging disease to treat. To devise effective strategies for prevention and treatment of childhood obesity, we need to first acknowledge and understand the factors contributing to disparate prevalence and inequitable outcomes found in minoritized and other communities. By acknowledging the role of upstream contributors, pediatric clinicians are able to engage in strategies to optimize the health and well-being of their patients [52].

In addition to the actionable steps discussed earlier, clinicians can benefit from utilizing tools such as The Implicit Association Test to help explore personal biases [57]; engage in community activities or educational offerings that augment an understanding of upstream contributing factors to obesity; and continue to be curious to learn their patients' histories and stories in order to build empathy and reduce frustration in



Fig. 2. Barriers to Pediatric Obesity Care\*. \*Figure used with permission [59].

treatment progress [58]. Providers can also consider universal screening for ACEs and SDOH.

The treatment approach to obesity has historically been overly simplified with a narrow focus of “energy in = energy out”. While diet and exercise are important, they do not tell the whole story or begin to explain the complex interactions of the upstream factors discussed in this paper. Providers are encouraged to look beyond this insufficient model of energy balance, to address historical trauma and other external contributors to health disparities including childhood obesity.

The cases of Daniela, Charlie, Macy, and Gary highlight why the status quo has not been successful in reducing childhood obesity. Providers cannot effectively treat childhood obesity without exploring and addressing the impact of upstream contributors like epigenetics, ACEs, toxic stress, structural and immigrant racism, SDOH, and latent ACEs. By understanding health disparities, we can reframe obesity and its disproportionate prevalence to focus on addressing modifiable risk factors.

### 4. Conclusion

While this review describes several upstream factors contributing to childhood obesity and offers actionable steps to incorporate into in clinical practice, there are likely many other factors yet to be identified. Furthermore, implementation of actionable steps may come with challenges as clinicians often encounter barriers to optimize obesity management in their practices [59]. Fig. 2 depicts several barriers to both clinicians and patients, not to mention additional barriers like unmet or unrealistic expectations, inadequate practice space or support services to deliver weight management, and lack of clinical experience. Future research can help to determine best practices in integrating new information into obesity and weight management, clinician education, and the healthcare systems. Continued diligence and curiosity combined with additional investment in clinical research and community resources will assist clinicians in providing targeted care to children and adolescents with obesity.

Clinicians may also benefit from acknowledging how their approach to childhood obesity may be influenced by their beliefs and lived experiences, and their lack of familiarity with these and other upstream contributors. Clinicians can reimagine clinical care and practice workflow to address obesity by incorporating the practice of trauma-informed care, and implementing the actionable items discussed in this article. Given the increasing rate of obesity among children and adolescents, clinicians and patients alike will benefit from an approach to care that includes a more comprehensive and inclusive framework.

## Author contribution (CRediT authorship contribution statement)

All authors were involved in the conception of the article, contributed to the literature searches and identification of pertinent articles, critically reviewed the manuscript, and had final approval of the submitted version.

## Ethical review

This submission represents the original work of the authors supported by appropriately cited professional literature. This work did not involve human subjects.

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## Declarations of competing interest

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.obpill.2022.100040>.

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