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Concept Analysis: Prenatal Obesity, A Psychoneuroimmunology Perspective

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Abstract

Purpose—To analyze the concept of prenatal obesity within a psychoneuroimmunology framework.

Conclusion—By considering the psychosocial, neurological, endocrine, and immunological contributions, a psychoneuroimmunology framework maintains a holistic focus. Identifying the multidirectional mechanisms linking these systems will provide valuable insight into the mechanisms by which prenatal obesity increases the rate of adverse pregnancy outcomes.

Practice Implications—Utilization of the concept of prenatal obesity within a psychoneuroimmunology framework will facilitate multidisciplinary research to identify underlying mechanisms by which prenatal obesity leads to adverse pregnancy outcomes as well as the development of interventions to treat obesity before, during, and after pregnancy.

Keywords

concept analysis; obesity; prenatal; psychoneuroimmunology; inflammation; psychological stress

Introduction

Concepts represent a mental image of a phenomenon of interest. Behavioral concepts are particularly complex in their representation of actions, emotions, and phenomena that may not be readily apparent (Morse, Mitcham, Hupcey, & Tason, 1996). In addition, concepts provide a common language to define these complex phenomena. Clarification of these common definitions allows for their measurement and utilization in research and practice, thereby producing a foundation for nursing theory (Morse, Mitcham, Hupcey, & Tason, 1996). Concept analysis is a formal and rigorous process utilized to examine the structure and function of a concept. (Walker & Avant, 2011) The aim of this paper is analysis of the concept prenatal obesity within a psychoneuroimmune (PNI) framework. This analysis will be achieved utilizing the eight step framework proposed by Walker and Avant (2011).

Walker and Avant (2011) state concept analysis is useful in clarifying ambiguous or vague concepts. The results of the concept analysis provide the investigator with a thorough understanding of the defining attributes associated with the concept. According to Walker and Avant (2011), this clarity is essential if the researcher is to construct hypotheses that accurately reflect relationships among concepts. The steps involved are: select a concept;

determine the aim of the analysis; identify uses of the concept; determine defining attributes; identify model case; identify borderline, related, contrary, invented, and illegitimate cases; identify antecedents and consequences; define empirical referents.

Purpose

Obesity is internationally defined utilizing a classification system established by the World Health Organization (WHO). In women of childbearing age, the population of focus in this analysis, obesity has been described as an epidemic with far reaching public health implications (Azarbad & Gonder-Frederick, 2010; Baeten, Bukusi, & Lambe, 2001; Chu, Kim, & Bish, 2009; Moore, 2004; Siega-Riz & Laraia, 2006). The impact of obesity on pregnancy outcomes has been extensively detailed in the literature. However, investigation into the causative factors of these complications is just beginning. New and exciting investigations involving obesity, inflammation, and pregnancy complications are beginning to emerge. For the purposes of this paper, *prenatal obesity* will be analyzed utilizing the method as outlined by Walker and Avant through the lens of a PNI framework.

The term psychoneuroimmunology was first coined by Dr. Robert Ader in 1980. Psychoneuroimmunology is the study of the interactions among behavior, the endocrine and neural systems, and the immune system (Ader, 2000). A key component of this model is the premise that each system functions in direct relation to the other systems. Therefore, *psychological* phenomenon influence the *immune* system via pathways in the *neuroendocrine* system, and conversely the *immune* system influences the *neuroendocrine* system via immune molecules (Zeller, McCain, & Swanson, 1996).

The use of a PNI framework for nursing research facilitates development of models which integrate *psychological*, *neural*, *endocrine*, and *immune* variables to promote over-all physical and mental well-being in individuals at risk for low grade inflammation and the subsequent impact on health (Zeller, et al., 1996). Applying this framework to the analysis of the concept *prenatal obesity* serves to ensure a holistic approach to the process taking into consideration psychosocial, behavioral, environmental, and biological factors. In addition, this novel approach to the definition of the concept *prenatal obesity* facilitates a mind-body approach to future research utilizing this concept to investigate pregnancy outcomes. Represented in Figure 1 is a model of the PNI framework.

Data Sources

Literature selected for the analysis was located through the use of the PUBMED, CINAHL, and PsycINFO data base search engines. Key words used for the search were 'concept analysis', 'obesity', 'prenatal', 'psychoneuroimmunology', 'inflammation', and 'psychological stress'. The search period was designated as 1980 and forward due to the emergence of the term psychoneuroimmunology at that time. Data searches were limited to articles that were peer-reviewed and written in the English language. Through review of article abstracts, article selection was narrowed based on relation to the key search terms obesity, prenatal, and psychoneuroimmunology. Full-text articles were then read in detail focusing on content appropriate for definitions, attributes, antecedents, and consequences of prenatal obesity through the lens of a PNI framework. Those articles which were not congruent with aspects of the PNI framework were discarded. Reference lists from selected articles were also reviewed for other relevant articles. A total of 49 sources were chosen for the concept analysis.

Literature Review

As stated earlier, obesity is a public health problem now reaching epidemic proportions (Azarbad & Gonder-Frederick, 2010; Baeten, et al., 2001; Chu, et al., 2009; Moore, 2004; Siega-Riz & Laraia, 2006). Obesity can be defined as “a condition characterized by the excess accumulation and storage of fat in the body” (“Merriam-Webster online,” 2011). Synonyms for obesity include: adiposity, chubbiness, corpulency, fat, fatness, fleshiness, plumpness, portliness, pudginess, and rotundity. The Center for Disease Control and Prevention (CDC) states obesity is a label for a range of weight associated with a given height that is greater than is considered healthy. Several authors describe obesity as an imbalance between energy intake and energy output (Olson & Blackwell, 2011; Siega-Riz & Laraia, 2006; Vickers, 1993).

A review of the literature reveals an internationally utilized categorization of obesity based on the classification system developed by the WHO. This system is based on body mass index (BMI). BMI is a generally accepted measurement secondary to the fact that for most people it correlates well with amount of body fat. While obesity and overweight are closely related, the category of obesity was chosen for this concept analysis after review of literature revealed the preponderance of extant literature utilizes this category in research involving non-pregnant women.

BMI is defined as an individual's weight in kilograms divided by the square of the height in meters (Greenberg & Obin, 2006). According to the WHO classification system, obesity is defined as a BMI of greater than or equal to 30. It is estimated by the WHO (2010) that 28.4% of women age 20-34 are obese and 36.1% of women age 35-44 are obese (“WHO Global Infobase Data for Saving Lives,” 2010). Azarbad and Gonder-Frederick (2010) estimate that if this trajectory continues 50.3% of reproductive age American women will be obese by the year 2020 with a subsequent 58% by the year 2030.

In women, obesity is a complex problem (Hayword, et al., 2000; Robinson & Butler, 2011). Behavioral, psychological, physiological, social, and economic variables as well as childbearing have all been posited as contributing factors (Robinson & Butler, 2011). Strong evidence exists to link obesity in women with increased morbidity and mortality. Significant health problems include increased risk of hypertension, insulin resistance, metabolic syndrome, dyslipidemia, cardiovascular disease, stroke, cancer, and mood disorders (Azarbad & Gonder-Frederick, 2010; Faeh, Braun, Tarnutzer, & Bopp, 2011; Farag, et al., 2008a; Greenberg & Obin, 2006; Heilbronn & Campbell, 2008; Moore, 2004; Robinson & Butler, 2011; Visser, Bouter, McQuillan, Wener, & Harris, 1999). In addition, obese women are more likely to experience weight related discrimination and poor self image (Azarbad & Gonder-Frederick, 2010). As many women will retain weight gained during pregnancy, these health problems may persist in the period following pregnancy (Walker, Sterling, & Timmerman, 2005).

It is estimated that a full 45% of women will enter pregnancy either overweight or obese (Gunderson, 2009). In addition, gestational weight gain is on the rise with 43% of pregnant women gaining more than the recommended amount for their height and pre-pregnancy weight (Gunderson, 2009). A literature review reveals obesity in pregnancy is also classified utilizing BMI, typically prenatal BMI, while weight gain across gestation also may be recorded and considered as above or below recommendations (Denison, Roberts, Barr, & Norman, 2010; Gunderson, 2009; Madan, et al., 2009; Roberts, et al., 2011; Sarwer, Allison, Gibbons, Markowitz, & Nelson, 2006; Siega-Riz & Laraia, 2006).

There is a general consensus in the literature regarding prenatal obesity as a high risk pregnancy state. Prenatal obesity increases the risk for potential complications in pregnancy

including: miscarriage, fetal anomalies, gestational diabetes, preeclampsia, thromboembolism, preterm labor, dysfunctional labor, cesarean section, postpartum hemorrhage, wound infections, anesthetic complications, depression, stillbirth, and neonatal death (Chu, et al., 2009; Corwin, 2010; Gunderson, 2009; Morin, 1998; Olson & Blackwell, 2011; Reece, 2008; Sarwer, et al., 2006; Siega-Riz & Laraia, 2006; Stothard, Tennant, Bell, & Rankin, 2009). While there is a preponderance of information regarding the occurrence of these adverse outcomes in pregnancies complicated by obesity, little is known as to the exact mechanisms by which prenatal obesity contributes to these outcomes (Denison, et al., 2010; Roberts, et al., 2011; Siega-Riz & Laraia, 2006; Wolf, et al., 2001). Once a common definition of prenatal obesity which is inclusive of the mind-body interactions inherent in the PNI framework is established, subsequent use of the concept in research designs may provide a unique understanding of potential underlying mechanisms in relation to the whole individual. This understanding of underlying mechanisms may also guide prevention and treatment strategies.

The framework of PNI focuses on interactions among the behavioral, neural, endocrine, and immune systems and the subsequent implications for human health (Ader, 2000). This perspective is foundationally holistic providing a basis for nursing research which allows for theoretical and empirical knowledge advancement in the study of psychological, neural, endocrine, and immunological processes that contribute to human health (McCain, Gray, Walter, & Robins, 2005). In this sense, the PNI framework serves to maintain the holistic focus of the discipline of nursing (McCain, et al., 2005; Starkweather, Witek-Janusek, & Mathews, 2005; Zeller, et al., 1996).

The PNI of Obesity

Psychological

Extant literature supports a link between an environment of stress and obesity (Benson, et al., 2009; DeVriendt, Moreno, & DeHennauw, 2009; Laria, Dole, Siega-Riz, & London, 2009; Spencer & Tilbrook, 2011). Stressors may be intrinsic or extrinsic and may be physical, biological, chemical, or psychological (DeVriendt, Moreno, & DeHennauw, 2009). Psychological stress is frequently secondary to society's stereotypical perception of obese individuals (Puhl & Heuer, 2010). These harmful perceptions depict the obese person as non-compliant, lazy, unsuccessful, unintelligent individuals lacking in discipline and will-power (Rogge, Greenwald, & Golden, 2004). These perceptions result in stigma and discrimination in the home, the workplace, educational institutions, and the media (Puhl & Heuer, 2010; Rogge, et al., 2004). This subsequent stigma and discrimination leads to both psychological and physical health consequences.

While psychological stress is positively correlated with obesity, obesity itself is likewise linked to an exaggerated stress response (Benson, et al., 2009; Farag, et al., 2008b; Spencer & Tilbrook, 2011). The exact mechanism by which this occurs has not been established. However, a link between psychological stress and a hyperactive hypothalamic-pituitary-adrenal (HPA) axis has been established (Charmandari, Tsigos, & Chrousos, 2005; Chrousos & Gold, 1992; Spencer & Tilbrook, 2011).

Neuroendocrine

The HPA axis is the primary endocrine system responsible for mediating the body's response to stress (Spencer & Tilbrook, 2011). When an individual is exposed to either acute or chronic stress, cells in the hypothalamus are stimulated to release corticotropin-releasing hormone (CRH). CRH in turn stimulates the anterior pituitary to release adrenocorticotropin releasing hormone (ACTH). Subsequently ACTH stimulates the adrenal glands to release the glucocorticoid cortisol (Spencer & Tilbrook, 2011). One function of cortisol is the

control of appetite. Individuals exposed to chronic stress exhibit elevated levels of cortisol which produce a chronically stimulated appetite contributing to obesity (Spencer & Tilbrook, 2011). In addition, prolonged exposure to glucocorticoids can lead to dysregulation of the immune system (Chrousos, 1995; Corwin & Pajer, 2008; Dantzer, O'Connor, Freund, Johnson, & Kelley, 2008; Miller, Maletic, & Raison, 2009).

Immunological

It was once believed that adipose tissue was simply a storage unit for fat. Emergent research now supports the role of adipose tissue as a highly active endocrine organ (Denison, et al., 2010; Greenberg & Obin, 2006; Heilbronn & Campbell, 2008; Visser, et al., 1999). As an endocrine organ, adipose cells secrete pro-inflammatory cytokines (Denison, et al., 2010; Greenberg & Obin, 2006; Heilbronn & Campbell, 2008; Ramsay, et al., 2002; Roberts, et al., 2011; Schmatz, Madan, Marino, & Davis, 2010; Visser, et al., 1999; Walsh, 2007). With increasing BMI, and thus increasing number of adipose cells, levels of these pro-inflammatory molecules increase inducing a state of low grade and potentially chronic inflammation. Research utilizing C-reactive protein (CRP), a reliable indicator of inflammation, also supports a correlation between inflammation and obesity (Visser, et al., 1999; Wolf, et al., 2001).

To date the preponderance of research on obesity and inflammation has been conducted with non-pregnant women and men. This research supports the premise that a state of low grade inflammation is linked to several chronic disease states associated with obesity including metabolic syndrome, insulin resistance, hypertension, dyslipidemia, cardiovascular disease, stroke and cancer (Greenberg & Obin, 2006; Heilbronn & Campbell, 2008; Visser, et al., 1999). Studies have suggested that this low grade inflammatory state in women may also be a factor in adverse pregnancy outcomes (Denison, et al., 2010; Madan, et al., 2009; Ramsay, et al., 2002; Retnakaran, et al., 2003; Roberts, et al., 2011; Schmatz, et al., 2010; Walsh, 2007; Wolf, et al., 2001). A few investigators have demonstrated elevated levels of pro-inflammatory cytokines in obese pregnant women (Ramsay, et al., 2002; Retnakaran, et al., 2003; Wolf, et al., 2001). In addition, these elevated levels have been correlated with adverse pregnancy outcomes such as hypertension, preeclampsia, and gestational diabetes (Madan, et al., 2009; Ramsay, et al., 2002; Retnakaran, et al., 2003; Wolf, et al., 2001).

With little advancement of the knowledge base regarding the complex mechanisms by which obesity impacts pregnancy, clarification of the concept prenatal obesity within a PNI framework will lay the groundwork for future investigations. Utilization of the model to guide future inquiry into the sequelae associated with prenatal obesity will allow for a comprehensive and holistic approach.

Results

Defining Attributes

Identifying the defining attributes of a concept is the most crucial step in concept analysis (Walker & Avant, 2011). These attributes allow an individual to discriminate between a particular concept and borderline or related concepts (Morse, et al., 1996). Review of the literature associated with prenatal obesity through a PNI lens elucidates unique attributes which distinguish this concept from a more generic perspective of obesity.

A review of the literature reveals these defining attributes:

- *Anthropomorphic Measurement.* In both non-pregnant and pregnant women, obesity is defined utilizing the classification system developed by the WHO. Review of the literature reveals the common trend of utilization of this system

when defining the phenomenon of interest. According to the WHO (2010) obesity is classified as a BMI greater than or equal to 30 according to the following equation: weight in kilograms divided by the square of the height in meters.

- *Marginalization.* Psychological stress is positively correlated with obesity (Benson, et al., 2009; DeVriendt, et al., 2009; Spencer & Tilbrook, 2011). This psychological stress is a direct result of perceptions permeated by society. Society views obese individuals as lazy, weak, and lacking in will-power and motivation to conform to societal norms of acceptable behavior (Allan, 1994; Dworkin & Wachs, 2004; Rogge, et al., 2004). Obese women are viewed as noncompliant with conventional medical recommendations. Subsequently, these women experience discrimination in the home, work environment, educational arena, healthcare environment and the media (Puhl & Heuer, 2010; Rogge, et al., 2004). This psychological stress has both behavioral and physical consequences (Allan, 1994; Dworkin & Wachs, 2004; Rogge, et al., 2004).
- *Mind-body stress response.* There is a link between the mind and the body as evidenced by a hyperactive HPA axis response prompted by psychological stress. This response leads to increased levels of circulating cortisol (Benson, et al., 2009; Charmandari, et al., 2005; Chrousos & Gold, 1992; Farag, et al., 2008b; Spencer & Tilbrook, 2011). Cortisol plays a major role in appetite regulation. Chronically elevated levels lead to a chronic increase in appetite (Spencer & Tilbrook, 2011). In addition prolonged exposure to elevated levels of cortisol may play a role in immune system dysfunction (Chrousos, 1995; Corwin & Pajer, 2008; Dantzer, et al., 2008; Miller, et al., 2009).
- *Functionally active adipose cells.* Use of the PNI framework expands on the definition of adipose tissue. Adipose tissue from the PNI perspective is no longer simply a storage cell for fat. The adipose cell becomes a functionally active endocrine organ secreting pro-inflammatory cytokines (Denison, et al., 2010; Greenberg & Obin, 2006; Heilbronn & Campbell, 2008; Madan, et al., 2009; Ramsay, et al., 2002; Roberts, et al., 2011; Schmatz, et al., 2010; Visser, et al., 1999; Walsh, 2007).
- *State of low-grade inflammation.* With the expanded knowledge the lens of the PNI framework provides, the active adipose cell is seen as inducing a state of low grade and potentially chronic inflammation. This state of inflammation is linked to chronic disease states and potential pregnancy complications (Greenberg & Obin, 2006; Heilbronn & Campbell, 2008; Madan, et al., 2009; Ramsay, et al., 2002; Roberts, et al., 2011; Schmatz, et al., 2010; Visser, et al., 1999; Walsh, 2007).

While these attributes were chosen due to the repetitive mention within the literature, it must be acknowledged that knowledge is dynamic. As research is conducted within this field further clarification of the concept may be necessary.

Cases

Walker and Avant (2011) utilize constructed cases to bring clarity to the concept, allowing us to paint an image in our mind and the minds of others of what the concept is and is not. Cases may stem from everyday experience or originate within the literature. Walker and Avant (2011) propose several case examples within their framework. These include model, borderline, related, contrary, invented, and illegitimate. Model, related, borderline, and contrary, cases are utilized in this analysis.

Model case

A model case contains all of the defining attributes of the concept, thereby leaving no question in the mind of the reader that this is indeed representative of the concept (Walker & Avant, 2011).

Ms. A is a 27 year old female presenting for her first pregnancy. Her medical history is significant for a height of 5'10", a weight of 265 pounds, and a BMI of 38. She is a Type 2 diabetic. Ms. A is recently divorced from her husband. She has been unable to find work and she attributes this to discrimination secondary to her weight. She is currently living with her parents in a two bedroom apartment. She reports high levels of stress, depression, and anxiety necessitating referral to a counselor. Throughout the pregnancy, Ms. A is carefully monitored for complications due to her high-risk status. At 37 weeks of pregnancy, Ms. A develops preeclampsia necessitating induction of labor. Ms. A. is subsequently delivered via cesarean section secondary to failure to progress in labor. At her postpartum visit Ms. A is diagnosed with postpartum depression.

This model case demonstrates both the psychological and biological critical attributes identified for the concept prenatal obesity. Ms. A has a BMI of 38 which is classified as obese according to the WHO. She also has a preexisting condition of Type 2 diabetes. Type 2 diabetes is a chronic disease state associated with obesity and is linked to a state of low grade inflammation stemming from excess adipose tissue and altered metabolic function. In addition, Ms. A develops preeclampsia and also requires a cesarean section. She subsequently is diagnosed with postpartum depression. These adverse pregnancy outcomes have been correlated with prenatal obesity (Corwin, 2010; LaCoursiere, Barrett-Connor, O'Hara, Hutton, & Varner, 2010).

Borderline case

According to Walker and Avant (2011), a borderline case contains some of the defining attributes of the concept but not all. These cases are in some aspect inconsistent with the concept.

Ms. B is a 27 year old female presenting for her first pregnancy. Her medical history is significant for a height of 5'6", weight of 190 pounds, BMI of 30, WHO classification obese. She is otherwise healthy. Ms. B's prenatal course is uncomplicated. She proceeds to begin labor at 38 weeks of pregnancy, subsequently giving birth via cesarean section secondary to fetal distress.

While Ms. B does demonstrate the defining characteristic of obesity according to the WHO classification system, this case is inconsistent with the concept. There is no evidence of other defining characteristics associated with the concept, and while Ms. B does deliver via cesarean section, this is secondary to fetal complications as opposed to maternal complications.

Related case

A related case is one that is similar to the concept being studied. However, related cases do not contain the defining attributes of the concept being addressed.

Ms. C is a 27 year old female presenting for her first pregnancy. Her medical history is significant for a height of 5'10", weight of 190 pounds, BMI 28, WHO classification of overweight. She proceeds to give birth vaginally to a seven pound male infant without complications.

Ms. C does not meet any of the defining attributes for prenatal obesity. However she is classified as overweight according to the WHO classification. While the classification of overweight is similar to obesity it is a separate category by itself.

Contrary case

Contrary cases are those that are clearly not an example of the concept (Walker & Avant, 2011).

Ms. D is a 27 year old female presenting for her first pregnancy. Her medical history is significant for a height of 5'6", a weight of 110 pounds, a BMI of 17, WHO classification of underweight. The course of her pregnancy, labor, and birth are uneventful.

Ms D. is a clear example of the opposite end of the spectrum of weight classifications. She is underweight according to the WHO classification system.

Antecedents and Consequences

Antecedents are those events that must occur or be in place prior to the occurrence of the concept (Walker & Avant, 2011). For prenatal obesity to exist, there must be a physiological imbalance between energy intake and energy output. This imbalance leads to excessive amounts of adipose cells (Olson & Blackwell, 2011; Siega-Riz & Laraia, 2006; Vickers, 1993). Psychological antecedents stem from the woman's deviation from societal norms regarding acceptable body weight thereby producing acute and chronic stress (Allan, 1994; Puhl & Heuer, 2010; Rogge, et al., 2004).

Consequences associated with the concept are those events that occur as a result of the concept (Walker & Avant, 2011). Consequences include the outward phenotypic expression of obesity. As a result of this outward appearance, discrimination and stigmatization occur with resultant psychological and physical health implications (Puhl & Heuer, 2010). Secondary to the mind-body response associated with obesity, a hyperactive HPA response occurs producing increased appetite, perpetuating a state of obesity, as well as immune system dysfunction (Benson, et al., 2009; Farag, et al., 2008b; Spencer & Tilbrook, 2011). Increased levels of pro-inflammatory cytokines produced by adipose cells lead to a state of low-grade inflammation that may be associated with adverse pregnancy outcomes. These adverse outcomes may include: miscarriage, fetal anomalies, gestational diabetes, preeclampsia, venous thromboembolism, preterm labor, dysfunctional labor, cesarean section, postpartum hemorrhage, wound infections, anesthetic complications, depression, stillbirth, and neonatal death (Chu, et al., 2009; Gunderson, 2009; Morin, 1998; Olson & Blackwell, 2011; Reece, 2008; Sarwer, et al., 2006; Siega-Riz & Laraia, 2006). Table 1 represents the relationship between the defining attributes, antecedents, and consequences of prenatal obesity.

Empirical Referents

Empirical referents are those observable instances that provide clear evidence of the existence of the concept (Walker & Avant, 2011). Empirical referents may be identical to the defining attributes of the concept. Walker and Avant state empirical referents "are the means by which you can recognize or measure the defining characteristics or attributes" (p. 168).

As evidenced consistently throughout the literature, BMI is an empirical referent of maternal obesity. BMI is a relatively easily measured construct. It is also a standardized measurement classified by the WHO. This standardization allows for valid measurement.

A second empirical referent of prenatal obesity from a PNI perspective is assessment of biological variables. Cortisol levels are easily measured in individuals as are levels of pro-inflammatory cytokines. Increasingly researchers are utilizing measurements of these biological variables not only to document a state of inflammation but also to correlate increased levels with adverse health outcomes (Corwin & Pajer, 2008; Heilbronn & Campbell, 2008; Madan, et al., 2009; Ramsay, et al., 2002; Retnakaran, et al., 2003; Roberts, et al., 2011; Visser, et al., 1999; Wolf, et al., 2001).

Third, use of psychometric instruments can be utilized to measure psychological empirical referents. For example, symptoms of postpartum depression can be assessed through administration of the Edinburgh Postnatal Depression scale, self-esteem can be measured through administration of the Rosenberg Self-Esteem Inventory, and anxiety can be assessed by administering the State-Trait Anxiety Inventory (Bieling, Antony, & Swinson, 1998; Cox, Holden, & Sagovsky, 1987; Sinclair, et al., 2010). Lastly, retrospective chart review can be conducted in order to assess for adverse pregnancy outcomes. Through this chart review the empirical referents of prenatal complications, complications during labor and birth, and neonatal complications can be assessed.

Discussion

Limitations

While the Walker and Avant concept analysis model is a systematic and thorough method, limitations are present. Knowledge is never stagnant, constantly evolving. As such, as investigation into this phenomenon continues revisions to the concept may be warranted (Walker & Avant, 2011). Concept analysis presents the current state of the science revealed in the literature and it is the first step in advancing the knowledge base of the discipline (Hupcey & Penrod, 2005).

The intent of this analysis was to present a concept analysis of prenatal obesity through a PNI framework. However, the available literature presented limitations secondary to minimal data regarding obesity in pregnancy. The preponderance of data available to date is related to individuals not currently pregnant. Because of this, information in this analysis may not be generalizable to the pregnant population.

Theoretical Framework

By considering psychosocial, endocrine, neurological, and immunological contributions, a PNI framework serves to maintain the necessary holistic focus of human health mandated within the nursing paradigm. Focusing on the multidirectional mechanisms linking these systems will provide valuable insight into the mechanisms by which prenatal obesity increases the rate of adverse pregnancy outcomes. Future studies designed to investigate the effect prenatal obesity exerts on the function of the biological systems, correlated with pregnancy outcomes, will continue to shed light on the mechanisms by which prenatal obesity leads to adverse pregnancy outcomes.

The PNI framework also provides a lens for investigation into psychological and behavioral issues associated with prenatal obesity. As stated earlier, the PNI framework emphasizes the interaction between all systems and the subsequent impact on health. For example, little is known surrounding the relationship between obesity and postpartum depression (Corwin, 2010; Sarwer, et al., 2006). Use of the PNI framework to guide future research investigating relationships between these concepts may provide valuable insight into underlying mechanisms as well as effective interventions.

In addition to providing information on the mechanisms by which prenatal obesity leads to adverse pregnancy outcomes, the PNI framework is also useful to design studies aimed at developing interventions to treat obesity prior to, during, and after pregnancy. New methodologies aimed at treating this complex, chronic disease must be multidisciplinary in order to be effective. The PNI framework provides a vehicle for this multidisciplinary approach. Many times complications arising in pregnancy are unpredictable and unpreventable. Prenatal obesity, and the associated morbidity and mortality for mother and infant, is an area where risks are predictable and in which effective interventions can modify the risk profile.

The PNI framework is congruent with nursing's emphasis on appreciation of the individual as a whole as well as the emphasis on mind-body interactions (McCain, et al., 2005). Use of this model as a basis for research aimed at uncovering the mechanisms by which prenatal obesity impacts pregnancy outcomes will generate knowledge based in theory. This will in turn provide the subsequent foundation for interventional research aimed at preventing and treating this complex condition. These subsequent interventions, based on a theoretical framework congruent with a holistic view of the individual, will translate well to the patient care arena as clinicians take in to consideration the unique aspects of the individual.

Conclusion

Concepts provide a common language identifying complex phenomena enabling their measurement and utilization in research (Morse, et al., 1996). This paper has presented an analysis of the concept prenatal obesity from a PNI framework. Through the identification of defining attributes, and associated antecedents and consequences, clarity of the concept has been established enabling usage of the concept in future research.

Prenatal obesity has been described as a public health problem reaching epidemic proportions. Utilization of the concept prenatal obesity within a PNI framework will facilitate future research to identify the underlying mechanisms by which prenatal obesity leads to adverse pregnancy outcomes. In addition, situating this concept within a PNI framework facilitates multidisciplinary research aimed at developing interventions to reduce the rate of morbidity and mortality associated with prenatal obesity as well as developing interventions to treat obesity before, during and after pregnancy.

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Figure 1.
Psychoneuroimmunology Model of Prenatal Obesity

Table 1

Defining attributes, antecedents, and consequences of prenatal obesity

Anthropomorphic Measurement	<ul style="list-style-type: none"> •Antecedent: Imbalance between energy intake and energy expenditure •Consequence: Phenotypic expression of obesity
Marginalization	<ul style="list-style-type: none"> •Antecedent: Diversion from societal norm in regards to acceptable body weight •Consequence: Discrimination, stigma, psychological health impact, physical health impact
Mind-body Stress Response	<ul style="list-style-type: none"> •Antecedent: Chronic or acute psychological or physical stress secondary to deviation from acceptable societal norms in relation to body weight •Consequence: Hyperactive HPA axis response, increased appetite, dysregulation of the immune system
Functionally Active Adipose Cells	<ul style="list-style-type: none"> •Antecedent: Imbalance between energy intake and energy output, excess number of adipose cells, BMI > 30 •Consequence: Increased levels of proinflammatory molecules, low-grade chronic inflammation
State of Low-Grade Inflammation	<ul style="list-style-type: none"> •Antecedent: Imbalance between energy intake and energy output, excess number of adipose cells, BMI > 30 •Consequence: Potential adverse pregnancy outcomes