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Factors Associated with Abnormal Weights in Infants in the First Year of Life: Results from the 2010 National Ambulatory Medical Care Survey

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2010 National Ambulatory Medical Care Survey

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Abstract

Purpose: To examine the predictors associated with abnormal infant weights for lengths in the first year of life as seen in ambulatory care settings.

Data Sources: A secondary data analysis was conducted using the 2010 National Ambulatory Medical Care Survey (NAMCS), in which practitioners documented single patient visits. World Health Organization (WHO) growth charts and recommendations were used to evaluate infant weight for length. Of the total visits, 603 infants were less than one year old, and 595 infants were within the length range of the WHO growth charts. Of the 595 cases, 13.6% were underweight, 5.5% were overweight, 41.2% had diet and nutrition teaching, and 43.5% had growth and development teaching. Of the case characteristics (sex, ethnicity, race, Medicaid insurance, preventative visit, diet and nutrition teaching, growth and development teaching, and return appointment), no significant predictors were found for weight for length.

Conclusions: Providers may not be identifying overweight and underweight infants, may not be providing the added education, or may not have documented their interventions.

Implications for Practice: By examining and identifying infants either underweight or overweight at primary care visits, potential feeding difficulties or risk for childhood obesity can be corrected allowing for appropriate growth and development.

Introduction

An infant's growth and development is significantly associated with how he or she is fed, and growth and development during infancy provides an important basis for healthy development through later life. The WHO's new child growth standards state that breastfeeding is the "natural standard for physical growth" due to its nutritional, immunological, and growth benefits (2014). The WHO has created growth charts based on the WHO Multicentre Growth Reference Study and the breastfed infant to ensure infants are attaining proper growth from birth to 5 years. Growth during infancy is important because malnutrition followed by an increased consumption of calories can lead to childhood obesity (WHO, 2014). Additionally, BMI growth patterns in the first 2 years of life can increase the likelihood that that child will be obese or severely obese at 5 years old (Gittner, Ludington-Hoe, & Haller, 2014). Identifying these infants at risk for malnutrition or childhood obesity in primary care is critical as health education is necessary to teach parents the nutritional standards for optimal growth and development. The NAMCS is a survey organized by the CDC to collect objective information regarding the use of ambulatory care services in the United States. The purpose of this study was to use the NAMCS to examine the predictors associated with abnormal, underweight, and overweight for length in the first year of life and determine what health teaching, if any, is being done to treat these infants.

In their descriptive study, Pridham, Brown, Sondel, Clark, and Green (2001) strived to explore whether characteristics of term and preterm infants, such as maturity at birth, gender, mother's caregiving, infant's feeding behavior, nutrient intake, and acuity of illness, affected growth rates at 1, 4, 8, and 12 months. The sample consisted of 114 mother-infant pairs; 53 were mothers with term infants (37 to 42 weeks gestational age), and 61 were mothers with premature

infants (32 weeks or less). All mothers were at least 18 years of age and were English speaking. Registered nurses conducted home visits to mothers and infants to weigh the infants, videotape the mothers feeding the infants, and assess the mothers and infants through a variety of instruments. The mothers' caregiving was measured through observational and interview items of the Emotional and Verbal Responsibility subscale of the Home Observation for the Measurement of the Environment Inventory. Mothers' depression was measured by the Center for Epidemiologic Studies Depression scale (CES-D). The Parent-Child Early Relational Assessment (PCERA) was used to analyze mothers' interactive feeding behavior as well as infant response to feeding through a five-minute videotape. Infant's acuity of illness was estimated by frequency of illness episodes and subsequent care received. A four-day food record before each home visit was used to assess dietary intake.

According to linear and quadratic rates of weight gain, variations in weight were significant between assessments at 1, 4, 6, and 12 months of age (Pridham et al, 2001). Premature infants weighed less than term infants, but age had the same influence on growth for both groups. Females weighed an average of 380.5g less than males, but the rate of weight gain slowed down more over time for males than females. Higher education of the mother positively correlated with a higher linear growth rate of premature infants. Maternal depression had a slight negative effect on weight for all infants. Greater dysregulation and irritability in infants correlated with a greater weight but a lower growth rate in female infants. Higher caloric intake was associated with a greater weight in premature infants only, and illness acuity was associated with lower weights overall. This study highlights the importance of promoting growth in both premature and term infants. As suggested by the results, healthcare providers should focus not

only on the biological characteristics of the infant but also health of the mother and mother-infant interactions during feeding to promote infant weight gain.

Wright, Parkinson, and Drewett (2006a) endeavored to determine infant as well as maternal factors that affected weight at 6 weeks, 4, 8, and 12 months of age. These infant characteristics were used to determine affect on weight gain, which was calculated using the thrive index. Of 1029 births between June 1999 and May 2000, 923 consenting mothers of term infants included in the Gateshead Millenium Baby Study comprised the sample for this study. Infant factors such as appetite, oromotor dysfunction, and avoidant eating behavior as well as maternal factors such as feeding anxiety and response to food refusal, were measured using a questionnaire developed by the researchers based on prior research and clinical experience. Weights were collected at birth, 6 weeks, 4, 8, and 12 months, and a research nurse weighed the infants at 13 months.

Appetite at 6 weeks and 12 months, avoidant eating behavior and maternal feeding anxiety at 12 months, and response to food refusal and 8 and 12 months significantly correlated with a low weight at 12 months (Wright et al., 2006a). Although most infants with low appetite did not have a sustained low weight, over half of infants with a sustained low weight did have a low appetite. Thus, problems in infant appetite in the context of a low weight should be investigated and treated to improve infant feeding and increase weight.

Wright, Parkinson, and Drewett (2006b) aimed to determine the effect of maternal socioeconomic and emotional factors on infant weight gain and failure to thrive in the infant's first year of life. This study also examined the data that was collected as a part of the Gateshead Millenium Baby Study. Of 923 infants included in this study, 92 had a slow weight gain at one point in the study. Weights were recorded for infants at birth and at primary care centers at 6

weeks, 4, 8, and 12 months, and weight gain was calculated using the thrive index. Researchers collected demographic information including mothers' and fathers' highest education and zip code in order to gauge socioeconomic status. Mothers were asked to complete the Edinburgh Postnatal Depression Scale (EPDS) and Dutch Eating Behavior Questionnaire (DEBQ).

Wright et al. (2006b) found that demographics did not have an effect on weight gain. Infants of mothers who scored above a 12 on the EPDS, which usually requires intervention, showed slower weight gain from birth to 4 months but had no affect from 4 to 12 months. According to the DEBQ, emotional eating of mothers positively correlated but external eating negatively correlated with infant weight gain to 12 months. Maternal social and emotional factors did not have a significant effect on infant weight gain. According to implications of the results, health care professionals should focus assessments and interventions on infant characteristics and maternal-infant interactions to promote adequate weight gain during the first year of life.

McDougall, Drewett, Hungin, and Wright (2009) used a longitudinal, comparative approach to recognize infants with low weights at the 6-8 week well child visit and examine characteristics such as family circumstances, feeding, and behavior development, that may contribute to a slower weight gain. Out of 1880 infants whose birth weight was available in 18 family practice centers in Northeast England, 74 infants were found to have slow weight gain (below the 5th percentile at the 6-8 week check) and 86 were used as controls. Infants born prematurely, multiples, and those with major syndromes were excluded. Those infants whose 6-week weights were not available and those whose mothers declined to participate did not partake in the study. Each of the 18 practices was visited monthly, and the infant's birth weight, sex, gestational age at birth, and weight at the 6-8 week and 9 month check were recorded. Weights

were converted to SD scores using the 1995 British Growth reference and z scores. When the

infant was 4 months of age, mothers answered a questionnaire regarding family details, feeding,

and infant's health.

The researchers found that infants with failure to thrive more often had slower feedings,

took in smaller quantities of milk, had a weaker suck, and refused breast milk more (McDougall

et al., 2009). Solid foods were introduced an average of almost 2 weeks later in case infants.

Additionally, 36% of case mothers responded that they had difficulties feeding their infant

compared with 9% of control mothers. This study showed that slower weight gain during the first

6-8 weeks is a risk factor for slower weight gain throughout later infancy. Future research should

focus on interventions to prevent this occurrence.

In their study, Hill, Nguyen, and Dickers (2009) aimed to describe the weights of

extremely low birth weight (ELBW) infants after discharge from the NICU. Forty-six infant

hospital charts were reviewed to examine weight, length, and head circumference at birth,

discharge, 6, and 12 months corrected age. An instrument developed for this study called the

"ELBW Infant Chronicle" was used to collect the necessary data as well as demographic

information from the infant charts. Weights of ELBW infants were compared with growth

parameters for full term infants.

The average monthly weight gain was 0.52kg from discharge to 6 months, and 0.33kg

from 6 months to 12 months (Hill et al., 2009). Gestational age and race did not affect weights,

lengths, or head circumference after discharge except length at 6 months. ELBW infants gained

weight slower than full term infants according to growth parameters, but ELBW infants grew in

length significantly faster than full term infants. According to this study, healthcare

professionals, especially nurses, should know growth parameters for ELBW infants and be able

to educate parents on changes to expect in their infant's growth. Additionally, accurate weights and an understanding of ELBW growth parameters can help nurses implement nutritional interventions as appropriate for these patients.

Phelan et al., (2011) strived to determine if maternal characteristics during pregnancy, such as diet, exercise, and psychosocial factors, affected infant weight at birth and 6 months of age. The sample consisted of 341 mother-infant pairs. 132 infants were overweight or obese at 6 months, and 153 were of normal weight. Pregnant women participating in this study filled out a demographics questionnaire, and researchers recorded their height, pregravid weight, and weight at the last clinic visit before delivery. These women were also evaluated for dietary intake, exercise, depression (using the Edinburgh Postnatal Depression Scale), cognitive control of eating (Eating Inventory), stress (perceived stress scale), and sleep (General Sleep Disturbance questionnaire). Infant weight and length at birth as well as 6 months were taken from medical records. For this study, a higher than normal weight for age was considered to be above the 90th percentile. Participants in this study made lifestyle modifications to attempt to decrease excessive gestational weight gain in order to determine the effect of a lower maternal gestational weight on infant weight.

According to the results, the greatest maternal predictor of a high infant weight at birth and 6 months was a high consumption of calories from sweets during early pregnancy (Phelan et al., 2011). Higher consumption of calories from protein during later pregnancy was associated with a higher infant weight at 6 months. Mothers with excessive gestational weight gain were more likely to have an overweight infant at birth and 6 months when compared with mothers of average gestational weight gain. The results of this study provide evidence to support the fact that lifestyle modifications that women implement during their pregnancy can decrease the risk

of having an overweight infant. Healthcare professionals should certainly educate pregnant women about diet, exercise, and the general care of oneself to decrease the risk of their infant being overweight. Lowering the incidence of high infant weights can help prevent possible harmful complications associated with obesity.

Gaffney, Kitsantas, and Cheema (2012) aimed to examine the association between "weight-for-age at 1 year and adherence to four clinical practice guidelines: no bottle-to-bed, minimal juice consumption, breastfeeding throughout the first year of life, and introduction to solid food no earlier than 4-6 months," (p. 234). Of the 691 infant-mother pairs participating in this study, 341 were boys, and 350 were girls. In order to determine if mothers had adhered to the clinical practice guidelines for their infants, ten surveys were administered to mothers throughout their infant's first 12 months. Most recent infant weight-for-age was reported by mothers at the 12-month survey and converted to a weight-for-age z score (WAZ). In terms of infant feeding practices, bottle-to-bed, juice consumption, breastfeeding intensity, and introduction to solid foods were measured by mothers' report of frequency during the seven days before each home visit. Demographics information such as infant birth weight, maternal age at childbirth, maternal pregravid BMI, smoking status, weight gain during pregnancy, race, education, and household income was collected.

According to the results, 36.2% of infants took the bottle to bed, 43.6% consumed more than one juice per two days, 52.1% were breastfed at low intensity during the second half of infancy, and 58.2% were introduced to solid foods between 4 and 6 months (Gaffney et al., 2012). Higher than normal weight for age was associated with more juice consumption, lower intensity breastfeeding during late infancy, and early introduction to solid foods. Infant birth weight was associated with a higher weight-for-age at 12 months, and maternal characteristics

were not associated with any differences in infant weights. This study describes infant dietary

practices that are associated with a higher weight-for-age at 12 months. Findings show the need

for healthcare professionals to continue to educate parents about current clinical practice

guidelines and the effect that inadequate nutrition can have on infants. They should provide

support to parents not only in early infancy but throughout later infancy as well to decrease the

risk of unhealthy weight gain that can lead to childhood obesity.

Watt, Appel, Roberts, Flores, and Morris (2013) intended to determine factors

contributing to obesity in infants up to 12 months of age in a primary care clinic in Southwestern

United States serving primarily low-income Hispanics. A program was developed to determine

success of prenatal nutritional interventions on decreasing childhood obesity. Participants in this

program received nutrition-based services such as, "vouchers for fruits and vegetables from the

farmer's market, educational classes, cooking classes, lactation classes, etc." (Watt et al., 2013,

p. 514). During their pregnancy or their infant's well child check, women were given a

questionnaire regarding characteristics such as "perceived food access, diet, cigarette and alcohol

use, exercise, stress, depression, social support, health conditions, demographics, and infant

feeding practices" (Watt et al., 2013, p. 514). Infant weight for length was obtained by the clinic

staff or infant's medical record at 2, 6, and 12 months of age.

The 152 mothers recruited for the study were predominantly Hispanic (98%), Spanish

speaking (82%), uninsured (57%) or insured by Medicaid or CHIP (43%), and on WIC support

and/or receiving food stamps (Watt et al., 2013). Sixty-six infants were found to have a weight-

for-length greater than the 85th percentile. A majority of the mothers (76.3%) reported a diet that

did not match recommendations of health care professionals for pregnant or breastfeeding

women. Particularly, maternal consumption of sweets or sugar-sweetened beverages and mothers

who received food stamps/SNAP were more likely to have an overweight infant. Sixteen percent

screened positive for depression according to a two-item depression screener, but in terms of

psychosocial risk factors only maternal stress levels as measured by the Cohen Perceived Stress

Scale were associated with an overweight infant. Majority of women breastfed or fed their

infants according to pediatrician recommendations. Fifty-five percent of infants were in the 85th

percentile (overweight) and 30% were included in the 95th percentile (obese) in terms of weight

for length measurement. Since low-income Hispanics are at significant risk for childhood

obesity, early maternal and infant nutritional intervention in clinical practice is necessary with

this population. Additionally, since social factors have an effect on infant obesity, interventions

should also target stress management and nutrition provided by SNAP/food stamps.

The purpose of the study by Wisner et al. (2013) was to compare weights of infants born

to depressed mothers who were taking SSRIs to weights of infants born to nondepressed,

nonmedicated mothers. The sample consisted of 238 mother-infant pairs. Of these, 71 infants had

SSRI exposure in utero, 36 infants had mothers who were depressed but were not taking SSRIs,

and 131 infants had mothers who were neither depressed nor taking SSRIs. Mothers were

evaluated for depression and SSRI use at 20, 30, and 36 weeks gestation. Infants were evaluated

for weight, length, and head circumference at 2, 12, 26, and 52 weeks postpartum.

Wisner et al. (2013) found that maternal depression and SSRI use did not affect infant

weight, length, or head circumference throughout the first year of life. The results and

implications of this study support the idea that SSRIs are safe for women to take during

pregnancy as use of the medication did not correlate with an effect on infant growth. However,

further research in a larger sample size is necessary to add strength to this statement.

Previous research has identified various maternal and infant characteristics that put an

infant at risk for having an abnormally low or high weight-for-length. To highlight the most important findings of the current literature, poor infant feeding behaviors, higher illness acuity, prematurity, low birth weight, and maternal anxiety and depression correlated with an abnormally low infant weight (Hill et al., 2009; McDougal et al., 2009; Pridham et al., 2001; Wright et al., 2006a; Wright et al., 2006b). In terms of maternal characteristics and behaviors, participation in food stamps/SNAP, increased stress levels, Hispanic ethnicity, high caloric intake during pregnancy, and excessive gestational weight gain correlated with an abnormally high infant weight (Phelan et al., 2011; Watt et al., 2013). When examining infant characteristics, high birth weight, increased juice consumption, less breastfeeding, and early introduction to solid foods correlated with an overweight infant (Gaffney et al., 2012). Higher education of the mother and infant high caloric intake correlated with a healthy increased infant weight gain for underweight or normal weight infants (Pridham et al., 2001). Based on the results of these research studies, providers should focus on screening infants for an abnormally low or high weight, the presence of maternal or infant characteristics that put the infant at high risk for weight abnormalities, and feeding difficulties displayed by the infant.

Research Questions

1. What association does sex, ethnicity, race, source of payment, major reason for visit (preventive or problem), and visit disposition (return appointment) have with abnormal weights (both high and low) in infants in the first year of life?

2. What health education and interventions were documented by primary care providers for infants with abnormal weights?

Methods

Design

A secondary analysis was conducted using the National Ambulatory Medical Care Survey (NAMCS) 2010 data set. The NAMCS is a national survey put forth by the Centers for Disease Control and Prevention in order to collect objective, reliable information regarding the use of ambulatory medical care services in the United States (CDC, 2014).

Sample

All NAMCS cases of infants age up to 365 days were included in the sample.

Procedure

Each infant case was determined to have an abnormally low, normal, or abnormally high weight-for-length in relation to the expected growth for the infant's particular length and sex based on references provided by the World Health Organization (World Health Organization, 2014). Weight was converted from pounds to kilograms, and length was converted from inches to centimeters. Length was rounded to the closest value (within 0.05cm) when interpreting each case as underweight, normal, or overweight according to the World Health Organization (WHO) growth chart. As per WHO, a separate growth chart was used for males and females. Below two standard deviations was considered to be an abnormally low weight-for-length, and above two standard deviations was considered to be an abnormally high weight-for-length. Infants were considered to have a normal weight-for-length if it was within two standard deviations above or below the mean. Infants with a length less than 45cm were excluded from the sample, as they were outside the range provided by WHO's growth chart. Cases of infants with very high or very low weight-for-lengths were included in the sample due to the numerous possible conditions

infants may have that alter their growth. These cases seeming to be outliers were all found to be

possible for an infant and most likely were not incorrectly imputed data.

Analyses

Through the NAMCS data, records of primary care visits of infants were analyzed for

factors associated with abnormally low or high weights as predictors of nutritional status in the

first year of life. Such characteristics were sex, ethnicity (Hispanic or Non-Hispanic), race

(White versus other), payment with Medicaid, and major reason for visit (preventative care

versus problem). Primary care interventions used to treat those with abnormal weights were

examined. Specific documented treatments noted were diet/nutrition education,

growth/development education, and the presence of a return appointment. Frequencies were used

to describe underweight, overweight, and normal weight infants. Three logistic regressions were

used to respectively predict abnormal, underweight, and overweight for length. Predictors

included ethnicity, race, gender, preventative versus problem, Medicaid versus other insurance,

diet teaching, growth and development teaching, and return appointment. Pearson correlations

were computed to examine the association between health education for diet/nutrition and

growth/development, with normal/abnormal infant weight-for-length.

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Results

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Out of the total number of cases comprising the NAMCS 2010 data set, 603 were found

to be between 0 and 365 days of age. After manually deleting the cases that were greater than

one year of age, two cases were accidentally deleted, leaving 601 total cases. Six cases were

excluded from the sample, as they had a length less than 45cm and were not within the frame of

reference on the WHO growth charts. There were 595 total cases comprising the final sample.

Four hundred eighty-one were considered normal weight, 81 were underweight, and 33 were

overweight. Table 1 contains demographic characteristics for the full sample, normal weight, underweight, and overweight infant records.

The three logistic regressions examined normal versus abnormal weight, underweight versus not underweight, and overweight versus not overweight with predictor variables ethnicity, race, gender, preventative versus problem visit, Medicaid versus other insurance, diet teaching, growth and development teaching, and return appointment. A greater percentage of overweight infants were seen for new or chronic problems (36.4%) rather than preventative treatment when compared with the full sample (22.5%), but this was not statistically significant in the results. None of the predictors were statistically significant in correlating with an abnormal weight, underweight, or overweight infant. Abnormal weight was not correlated with documented diet and nutrition education or with growth and development education, $r(595) = -.08$, $p = .06$; and $r(595) = -.05$, $p = .24$, respectively. In fact, both underweight and overweight infants had less diet and nutrition education (33.3% each) when compared with the full sample (41.2%), and overweight infants had much less growth and development education (27.3%) than the full sample (43.5%). Of those cases receiving diet/nutrition education, it was statistically significant that growth/development education was also documented, however, $r(595) = .44$, $p = .001$.

Discussion

According to the results and subsequent analysis, 13.6% of the infants were underweight, 5.5% were overweight, and of the predictors tested, none of the patient demographics were significantly correlated with an abnormality in infant weights. More overweight infants were seen for a new or chronic problem when compared to the full sample. Although this was not statistically significant, it is clinically important to note that an abnormally high infant weight may be associated with a greater likelihood for health problems. Results from Dietz et al. (2013)

support this idea as they found that small for gestational age (SGA) and large for gestational age (LGA) infants had greater healthcare utilization in the first year of life, with greatest utilization from LGA infants. Shibli, Rubins, Akons, and Shaoul (2008) conversely found in their study of 2,139 infants less than two years old who were hospitalized in Israel that overweight infants between the 85th and 94th weight-for-length percentile had less hospitalizations than expected, but infants 95th percentile or greater had more hospitalizations and repeat admissions than expected. A higher birth weight or the maternal health affecting the baby's weight may impact the baby's health causing him or her to require additional care.

This study used the WHO guidelines for identifying underweight and overweight infants. In clinical practice, these infants should be identified for their weight abnormality and should receive necessary interventions to correct their weight. Providers may not be identifying these infants in need of further treatment based on their weights, may not be providing the added education or further evaluation, or simply may not have documented the associated interventions. In a study assessing primary care pediatricians on their identification of infants at risk for child obesity, many risk factors and predictors for obesity were missing in the infant's chart or scattered therefore potentially limiting their usefulness (Trapp, Ryan, Ariza, Garcia, & Brinns, 2008). Identifying infants with an abnormal weight is the first step to treating them and ensuring optimal growth and development and good health through childhood and the rest of life. Even if data is collected regarding risk factors, weights, lengths, and feeding behaviors, if this information is not organized, analyzed, or brought to the attention of the practitioner, the health history and physical exam will not benefit the infant in terms of education and treatments aimed at correcting abnormal weights. Implications described by Trapp et al. (2008) can help explain

and add support to the results of the NAMCS data where infants with abnormal weights did not always receive diet and growth/development teaching.

There is a potential issue that primary care providers are having difficulty with identifying and treating infants with weight abnormalities. The possible absence of this care can be due to a lack of publicized guidelines explaining how to identify infants with weight abnormalities and the education and treatments necessary to correct them. Another possibility is lack of time to diagnose and treat this condition as a result of other assessments or issues being deemed of a higher priority or simply a shortage of primary care providers available to care for these patients. If infants are truly not receiving the attention and care they require, more disseminated education is needed to ensure infants at risk for further nutrition and developmental problems receive the necessary treatments and benefits from health teaching. In their study testing the effect of increased nutritional education in a poor community in Peru, Penny et al. (2005) found that infants and children who received the increased nutritional education had greater adherence to dietary recommendations, fewer problems with energy, fewer deficiencies in iron and zinc, less likelihood of stunted growth, better weight gain, and better length gain. According to these results, nutritional education can provide a major benefit to infants' growth and ability to maintain a healthy weight especially when performed early in life. Nutrition and growth recommendations should be discussed at every infant's primary care visit, especially if there is the potential to correct an infant's abnormal weight and lead to healthy growth.

According to the WHO guidelines (2014), healthcare providers should be seeking to identify any weight abnormalities in infancy that can potentially affect that individual later on in life. If infants' weights' are above or below two standard deviations from the mean, they should be further assessed to determine potential reasons for difficulties gaining or maintaining a

healthy weight. If education, treatments, or referrals were provided to the patient, such

interventions would be beneficial to have documented for the purposes of continuity of care for

these patients. In providing continuity of care, practitioners should work collaboratively with

their patients to promote their health and wellness. Parents must first be educated that their

infant's weight is abnormal and be taught based on recommended diet/nutrition and

growth/development guidelines how to properly feed their infant and promote a healthy weight.

In order to further improve clinical practice, future research should be focused on

duplicating the results of this study with a larger data set to yield a larger sample size of

abnormal weight infants. A longitudinal approach would allow for a more comprehensive view

of the weight and nutritional status of the infants. By examining the weight for length and health

teaching performed at multiple primary care visits, one would be able to determine if that infant

had a low or high weight at one particular visit or had more of a chronic problem. Data that

includes a description of known feeding intolerances or symptoms of potential feeding

difficulties would be beneficial in gathering more information about the infant's nutritional

status. Additionally, an inclusion of a corrected age of prematurity or diagnosis of a disorder that

may affect the infant's weight or length would provide a more accurate sense of the infant's

nutritional status. Based on the current literature describing infant nutrition and weight

abnormalities, important predictors of infant weight and nutrition stem from maternal prenatal

behaviors such as prenatal care, maternal eating habits, and tobacco/alcohol use (Wright et al.,

2006b; Phelan et al., 2011; Pogodina, Huber, Racine, & Platonova, 2009; Pridham et al., 2001;

Truong, Reifsnider, Mayorga, & Spitler, 2013; Watt et al., 2013). Lastly, a follow up of the

efficacy of diet/nutrition and growth/development teaching and the effect on correcting feeding

difficulties and abnormal infant weights should be investigated to determine the interventions necessary for treating abnormal weights for length leading to optimal growth and development.

Although relevant information was unveiled through the analysis of the NAMCS 2010 data set, certain limitations exist affecting the generalizability of these results. This study was a secondary data analysis, so the data available for each of the cases was limited to what had already been collected. Specifically, there was missing data for ethnicity and race for many cases, so when determining frequencies and performing regressions, the full sample size could not be utilized. Another limitation of performing a secondary data analysis is that one is not able to determine whether certain interventions, such as health teaching, were not done during the visit or simply were not documented for that case. The data does not correct weight and length for prematurity, and many disorders and conditions affecting growth may be present but undocumented. The WHO child growth standards are based on breastfed infants from the Multicenter Growth Reference Study, so formula fed infants may be categorized as overweight at that visit but may be following another growth pattern (2014). Breastfed babies tend to be leaner babies and follow a different growth curve than formula fed babies, especially during the first six months when growth is usually rapid (WHO, 2014). Although breastfeeding is still the best nutritional standard, an abnormally high weight during infancy, especially during this period of rapid growth, may be documented for a formula fed infant who can grow to be a healthy child similar to a breastfed infant.

As this was a secondary data analysis, the data collected for each case was limited to one visit, so there is no definitive way of knowing whether a weight abnormality represents an abnormal period of growth leading up to that visit or a chronic nutritional problem. This is crucial because that information would determine how the infant would be treated or if any

treatment would be required outside of reinforced education. In the NAMCS, there was not any further information able to be collected on any patient, and information from other visits was not included in the survey. Pertinent diagnoses and other assessment information were only included if recorded under "reason for visit" or "diagnoses" on the NAMCS survey. Another important piece that would have added value to the existing data is to know how each infant is feeding. In the NAMCS, one would not be able to discern general feeding practices or feeding difficulties unless otherwise noted in the reason for visit section. Although the interpretations of the results are important considerations for future practice, one would not be able to make definitive implications based on these results alone to guide future practice.

Assessing infants' weights at primary care visits and identifying those who are underweight and overweight is crucial to bring attention to potential feeding difficulties and risk for nutritional problems. Proper nutrition is critical for growth and development during the first few months and years of life to lead to ideal health (WHO, 2014). Results from the 2010 NAMCS suggest that primary care practitioners may not be identifying infants with abnormal weights, may not be performing health teaching to correct these weights and potential nutritional problems, or may not be documenting their interventions. Further research is needed to determine if providers are in fact not adequately assessing and treating infants with abnormal weights. Increased disseminated education and support for primary care providers on identifying and educating parents of infants with abnormal weights may help to ensure guidelines on optimal nutrition during infancy are followed and that this benefits this vulnerable population.

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Table 1

Patient Characteristics of Infants at Primary Care Visits

Variables	Full	Normal	Underweight	Overweight
	n = 595	n = 481	n = 81	n = 33
	n (%)	n (%)	n (%)	n (%)
Female	295 (49.6)	249 (51.8)	35 (43.2)	11 (33.3)
Hispanic or Latino	165 (36.0)	133 (35.8)	20 (32.8)	12 (46.2)
Race				
White only	323 (78.6)	263 (78.3)	42 (77.8)	18 (85.7)
Other races	88 (21.4)	73 (21.7)	12 (22.2)	3 (14.3)
Medicaid	307 (51.6)	251 (52.2)	37 (45.7)	19 (57.6)
Preventative care	461 (77.7)	371 (77.5)	69 (85.2)	21 (63.6)
Diet/nutrition education	245 (41.2)	207 (43.0)	27 (33.3)	11 (33.3)
Growth/development education	259 (43.5)	215 (44.7)	35 (43.2)	9 (27.3)
Return appointment	479 (80.5)	387 (80.5)	67 (82.7)	25 (75.8)