DIFFERENCES IN FEEDING PRACTICES IN RELATIONSHIP TO ETHNICITY AND INCOME LEVEL

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Abstract

Breastfeeding is linked to numerous health benefits, for both infants and mothers, and is the ideal nutrition for infants until 6 months of age. Failing to follow specific guidelines, such as exclusively breastfeeding for 6 months or waiting until 4-6 months to introduce solids foods, maybe linked to poor health outcomes and higher infant mortality rates. The CDC reports 14.1% of mothers exclusively breastfed their children for six months and 43.5% breastfeed until six months of age. The Non-Hispanic black and lower income populations have the lowest breastfeeding rates and experience higher infant mortality rates. The objective of this study was to gain insight into the common feeding practices of different populations to support targeted interventions to promote adherence to infant feeding guidelines. Data from the 1999-2008 National Health and Nutrition Examination Survey was analyzed using a sample population of 9807 children ages 0 – 6 years. Breast and formula feeding practices were coded into age category (never breastfed, <1 month, 1-3 months, 3-6 months, 6-12months, >1 year). Age introduced to solids as well as age given cow’s milk was also coded into appropriate age categories. Non-Hispanic Blacks and the lowest income group (<100% of the poverty rate) had the lowest adherence to infant feeding recommendations. Hispanics were among the leading groups to meet recommendations, along with the higher income and Non-Hispanic white populations. There were unremarkable differences found when looking at age when solids were introduced and the age cow’s milk was introduced. This study focused on specific areas of infant feeding practices, and may help target which populations are struggling most to meet infant feeding recommendations. It is useful to provide the foundation on which to create unique interventions that can increase compliance with feeding practice guidelines to ultimately decrease infant mortality rate.
Dedication

This document is dedicated to my loving and supportive family
Acknowledgements

A sincere thank you to Dr. Chris Taylor and Dr. Marcia Nahikian-Nelms for their guidance, support and encouragement throughout this past two years
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Introduction:

In the United States, the current infant mortality rate is 5.89% and ranks higher than many other developed countries in the world (1). Infant mortality is considered a measure of overall health of a nation. Even though many factors influence the health of infants, infant feeding practices have a tremendous impact on a child’s growth and future health outcomes. The Academy of Nutrition and Dietetics (AND), World Health Organization (WHO), and the American Association of Pediatrics (AAP) have developed evidence-based guidelines that summarize the current research that will support the optimal development and growth for each infant. These organizations recommend exclusive breast feeding take place for the first six months of life, and the initiation of feeding within 1 hour of birth. A gradual introduction of solids should begin at approximately six months and breast feeding should be continued for 12 months or longer according to these reputable organizations (2,3,4). The greatest effects of breastfeeding are seen when an infant is breast fed exclusively for the first six months of life with continuation of breastfeeding as solid foods are introduced until at least 1 year of age (5).

Problem Statement:

Despite the evidence-based recommendations, the CDC’s most recent breast feeding report shows that only 16.1% of infants are exclusively breastfed for the first six months of life in the United States (6). By 12 months of age only 25.5 % of breastfed infants are still being breast fed. Rates of non-Hispanic black women and those of low-income status are shown to be among the populations least likely to breast feed (6). The AAP states that breastfed infants experienced less hospital stays, fewer health problems and a lower mortality rate during the post neonatal stage than did formula-fed infants. Consequently long term health benefits include lower rates of obesity, and decreased risk for cancer and diabetes (5). By examination of
population data, a stronger picture of infant feeding practices can be described. As these populations are assessed, it may provide the foundation for targeted education, intervention and prevention of infant health issues and consequently their future adult health status.
Related Research:

Breastfeeding provides several medical and developmental advantages which make breast feeding practices a public health issue instead of a lifestyle decision (2). The unique components of breast milk allow for ready absorption of nutrients as compared to infant formulas or cow’s milk (7). Benefits for breastfed infants include a decreased risk of childhood obesity, optimum nutrient balance, enhanced immune function, protection against infectious and noninfectious disease, protection against allergy development and intolerances, improved cognitive function, proper development of the jaw, teeth, and speech, reduced risk for heart disease as well as several benefits for nursing mothers such as reduced risk for breast and ovarian cancers (3,7).

Breast milk is particularly beneficial to an infant’s health during the first year of life and is associated with having a significant impact on decreasing the development of Otitis Media, Necrotizing Enterocolitis, and respiratory disease (8).

The composition of human milk is unique and varies between stages and individuals. The main components include lactose, protein –casein (20%) and whey (80%), and fat of which all are easily digested by a newborn (9). Antibodies and immunoglobulins are major contributions to the health benefits associated with breast milk. Natural human milk has antimicrobial properties and maintains the maternal-fetal immunological link after birth, which is vital to a baby’s development and produces a large amount of antibodies in the first number of days following birth (10,11) The mother creates IgA antibodies in response to pathogens in the environment and are then transferred through breast milk to provide the needed protection for infants in the early, fragile stages of life. (11,12). A mother’s milk goes through several important stages including colostrum (made in first several days after birth), transition milk (7-14 days postpartum) mature milk (2 weeks – 7 months) and extended lactation (7 months to 2 years). Antibodies present in
the milk are highest during colostrum production and slowly decrease through the first three phases. During the first three stages protein content is also slowly declining and fat, lactose and caloric density increase. Once in the extended lactation phase, macronutrient composition is relatively stable, with vitamins and minerals beginning to decrease (8, 11). This pattern is helpful in understanding age recommendations given by AAP and AND for food introduction and milk introduction for infants, as mentioned previously (5).

Many different formula options are available on the market today. Infant formula lacks the antibodies found in breast milk, but is a nutritionally suitable alternative to be used as a complete or partial substitute for breast milk (13, 14). The most commonly used standard infant formula is made with cow’s milk, as formula is typically the primary source of nutrients during the first year of a non-breastfed infants life and must meet nutrient standards of the FDA. It is recommended by AAP that formula be iron fortified given that iron is crucial for cognitive function and development during the first year of life. Nonstandard formula options include soy, hydrolyzed protein, amino acid-based, follow-up and evaporated milk which can be utilized in place of breast milk. Soy formula is a popular choice for babies that do not tolerate cow’s milk (11). The AAP states soy formulas are safe and a good alternative to standard formula but provide no advantages or benefits (13). Standard formula does contain adequate vitamin D unlike human milk which requires supplementation (11). Recommendations for formula fed infants are similar to those who are breast fed in terms of length of time recommended for the introduction of solids (15).
Feeding patterns vary among demographics for different reasons. Patterns can be generally categorized into exclusivity (of breast feeding/formula), duration of breast feeding, time at which solids are introduced, and milk introduction (whole, 2%, 1%, fat free, other).

In the past, rates for any breast feeding have increased to 69% in the hospital and 32.5% at 3 months (6). However, the rates for exclusively breastfeeding at 6 months showed very little change from 1990 – 2005 (6). A systematic review using the Cochrane Database, found significant advantages, including a lower risk of GI infections, for exclusively breast fed infants at 6 months (no foods or other liquids), as compared to those mixed breast fed for 3 -4 months (16, 17). Growth outcomes remain a popular topic when it comes to comparing formula fed to breast fed infants. The Cochrane review found that infants exclusively breast fed for six months showed no deficits in weight gain or length, with larger samples needed to confirm that there is no risk for under-nutrition (16).
A study following 243 children for 3 years which compared formula fed to breast fed infants found differences in metabolic composition and growth patterns. This difference is often attributed to the protein content of formulas. The growth patterns differed for the first year of life, but no significant differences between weight, length, or body composition were seen by age three. There is a lack of long term data to support whether or not different hormonal profiles and growth patterns among formula fed and breastfed infants will play a role in the health outcomes later in life (18). Increasing rates of obesity are also a national concern with over 33% of children considered to be overweight or obese in 2008. Breast feeding is supported by evidence to reduce the risk of childhood obesity (19).

The WHO states that babies at six months of age, should be introduced to complementary foods as they continue to breastfeed in order to meet their growth needs (2). These guidelines are also supported by AAP recommendations. Allergy development is a primary concern when deciding on solid food introduction for infants. There appears to be limited evidence available to support prevention of allergy development in exclusive breast fed infant who delayed the introduction of solids. Research does not support the delayed introduction or prolonged introduction as having negative outcomes related to allergies (20).

Infants should not be fed whole cow’s milk during the first year of life as recommended by the AAP Committee on Nutrition. Breastfeeding infants weaned before 12 months of age, should avoid cow’s milk and be given infant formula with iron fortification. Whole cow’s milk is low in iron and high in nutrients that may inhibit iron absorption from other complimentary foods. Whole milk introduction before the first year is also associated with GI bleeding and could lead to iron deficiency anemia, with the risk subsiding by 12 months of age. Cow’s milk puts stress on a young infant, increasing the renal solute load by 2-3x that of formula fed infants.
Low fat and skim milk is also not recommended by the AAP. Infants require fat as a primary energy source making these milk sources inadequate. Similarly, low fat and skim milk should not be given to infants before the age of two, due to their low nutrient density and the high protein and mineral content causing increased stress on the kidneys (14). Early introduction of cow’s milk is correlated with an increased risk for allergy development to lactose and possibly other foods. These risks decrease as the GI tract matures (11).

Healthy People 2020 has set a goal to increase the percentage of mothers breast feeding at 6 months from 43.5% to 60.6% and exclusive breast feeding for the first 6 months from 14.1% to 25.5% (6). Trends among ethnic groups appear to affect duration and consistency of breast feeding. Research has shown the non-Hispanic black population to have a lower prevalence of breast feeding their children. Black women who are economically and educationally disadvantaged, are still falling behind in breast feeding initiation, while White and Hispanic women have made great strides in breastfeeding initiation to meet the Healthy People 2010 goals (6, 8). Likewise, breastfeeding rates among women participating in the WIC program have been lagging behind other women for the past 25 years (21, 22). A 2003 -2006 CDC report showed a 16 percentage point difference between non-Hispanic blacks and non-Hispanic whites for breastfeeding to six months (23).

<table>
<thead>
<tr>
<th>Healthy People 2020 Breastfeeding Objectives</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICH-21: Increase the proportion of infants who are breastfed</td>
<td></td>
</tr>
<tr>
<td>MICH-21.1  -  Ever</td>
<td>81.9%</td>
</tr>
<tr>
<td>MICH-21.2  At 6 months</td>
<td>60.6%</td>
</tr>
<tr>
<td>MICH-21.3  At 1 year</td>
<td>34.1%</td>
</tr>
<tr>
<td>MICH-21.4 Exclusively through 3 months</td>
<td>46.2%</td>
</tr>
<tr>
<td>MICH-21.5 Exclusively through 6 months</td>
<td>25.5%</td>
</tr>
<tr>
<td>MICH-22: Increase the proportion of employers that have worksite lactation support programs.</td>
<td>38%</td>
</tr>
<tr>
<td>MICH-23: Reduce the proportion of breastfed newborns who receive formula supplementation within the first 2 days of life.</td>
<td>14.2%</td>
</tr>
<tr>
<td>MICH-24: Increase the proportion of live births that occur in facilities that provide recommended care for lactating mothers and their babies.</td>
<td>8.1%</td>
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</tbody>
</table>

Income and poverty level closely correlate to breast feeding prevalence. The higher rate of breastfeeding moms among a higher income population at 74% was noteworthy when compared to the lower income population at 57% from 1999 – 2006 (24). CDC is currently making strides to help narrow these gaps and decrease barriers that may be affecting disadvantaged demographics (7,15, 21). Statistics on non-Hispanic black and/or women with a low income are concerning as infants born to black women of lower socioeconomic status are found to experience higher morbidity and mortality rates (21).

Several barriers indicate possible reasons why women of various ethnicities and socioeconomic classes choose not to breast feed. Unaccommodating work environments, short term maternity leaves and early introduction to child care make it difficult for mothers to produce adequate milk and cause prolonged absence between mother and infant. The intention or need to return to work for financial reasons is associated with decreased initiation of breast feeding. Cost of breast pumps and lack of education also come into play when mothers encounter difficulties breastfeeding, and they often turn to formula as an easier alternative. Advertising and marketing of infant formula is also thought to decrease sustained breast feeding. Attitudes toward breastfeeding, especially among certain socioeconomic groups, have a noticeable impact on breast feeding practices and should be further explored to provide potential interventions (5). Breastfeeding in public is associated with embarrassment and leads to a lower prevalence of breast feeding. Family and spousal support is also found to increase exclusive breast feeding practices. (7, 9,21).

Lack of breastfeeding support and education from hospital staff play a main role in decreased duration and early cessation of breastfeeding. The more a mother knows about breastfeeding and its benefits the more likely she will be to breast feed her baby. A mother’s
doubt regarding benefits, adequacy and feasibility of breast feeding exclusively are shown to have a significant effect on her choice to do so (7, 21). Maternal diseases and circumstances may restrict a mother from breastfeeding such is the case for women with Human Immunodeficiency Virus (HIV) or those undergoing chemotherapy treatments (8, 9).
Methodology

Objective and Purpose:

Infant mortality rates are ranked higher than expected in the United States (1). Rates of breastfeeding show much room for improvement as seen by progress or lack thereof, in meeting Healthy People 2010 goals. Therefore, the purpose of this study is describe current feeding practices in relation to ethnicity and income by looking at the type of milk –breast or formula-fed, the length and duration of feeding, and the age when solid foods and cow’s milk are introduced by addressing the following research questions.

Research Questions:

1. What are the breastfeeding initiation rates in US infants by race/ethnicity and income?
2. What are the differences in the length of breastfeeding by race/ethnicity and income?
3. For infant who were formula fed, how long were they fed formula by race/ethnicity and income?
4. What are the differences in comparing exclusive breastfeeding by race/ethnicity and income?
5. Is there a significant difference in age when infants were introduced to solid foods by race/ethnicity or income?
6. Are there differences in the age in which infants were given regular milk by race/ethnicity or income?
7. When milk was introduced, what type of milk was given by race/ethnicity or income?

Procedures:

To address these research questions analyzed retrospective data from The National Health and Nutrition Survey (NHANES) from 1999-2008. The NHANES program uses a variety
of methods to obtain relevant data on nutrition and health status of children and adults in the United States. Methods such as personal interviews, surveys and physical exams are conducted by trained professionals including physicians, medical technicians, and dietary and health interviewers. Interviews include information on demographics, race/ethnicity, dietary and health while the physical exam conducted by highly trained staff is composed of medical, dental and physiological measurements, in addition to laboratory tests (blood tests are excluded for very young children (25).

In two year rotations, NHANES samples approximately 10,000 people each 2-year cycle and ensures an accurate sample of all ages in the U.S population by over-sampling African American, low-income, Hispanic, and adults over 60. The survey assesses risk factors pertinent to chronic disease development and also provides data on reproductive health and breastfeeding. The NHANES survey uses collected information to determined disease prevalence and associated risk factors. Additionally, findings are used to set national height and weight standards and to provide information to assist in other health science related research and epidemiological studies. As a part of the Center of Disease Control (CDC), NHANES data is used to determine nutritional status and possible disease prevention strategies in conjunction to the development of vital health statistic for the population. Past uses of the surveys include providing data for development of current pediatric growth charts which are used to set growth standards around the world (25).

**Subjects:**

We examined data from NHANES 1999 -2008 on approximately 9,807 children from 0-6 years of age. Information collected on race and ethnicity as well as income level was analyzed, excluding the “other race” category from our sample.
Data Collection:

Demographics

All people in the sample that received an interview had demographics recorded. Information found in the NHANES demographics public release files were taken from Sample Person and Family Demographic questionnaires. Files included data on race/ethnicity, income and age among others. Interviews were conducted with participant’s aged 16 years and older and emancipated minors, using the language selected by subjects (translator used if necessary). Included in the demographics questionnaire are family-level and individual-level data. Several computer assisted interview methods were utilized as were printed hand cards that listed responses or additional information needed for individual questions. Reading assistance was provided as interviewer saw fit.

Data was collected using the following categories: Hispanic-Mexican Americans, Hispanic –Other Hispanic, Non-Hispanic Black, Non-Hispanic White and Other Categories. Other race will be excluded from these analyses due to the small sample size and inability to interpret the findings to a broader audience. Income level was collected as Annual Family Income, Annual Household Income, and ratio of family income to poverty. Subjects self reported race/ethnicity for the questionnaire as well as their total household income and annual family income (both reported in a value range in dollars). A ratio of family income to poverty was also established (25).

Nutrition and Feeding Practices

Interview data collected on diet and nutrition related topics can be found in The Diet Behavior and Nutrition section. These topics include breastfeeding and other childhood feeding
practices at ≤ 6 years and types of milk and current consumption at ≥1 year of age. The sample for this section of the survey varies in age groups, with children under six years of age utilizing proxy respondents. Questions were asked in the home before the physical examination component took place. CAPI (Computer Assisted Personal Interviewing) was used to gather information from respondents, with use of hand cards when needed and interviewer reading the question if appropriate.

Participants were asked several questions to obtain the necessary information on infant feeding practices. Questions included the following:

- Was your child ever breastfed or fed breast milk?
- How old was the child when he/she was first fed something other than breast milk or water?
- How old was your child when he/she completely stopped breastfeeding or being fed breast milk?
- How old was your child when he/she was first fed formula on a daily basis?
- How old was your child when he/she stopped drinking formula?
- How old was your child when he/she was fed milk on a daily basis?
- What type of milk did your child receive on a daily basis?
- Was it whole milk? 1% milk? 2% milk? Fat Free %? Other?
- How old was your child when he/she starting eating solid foods (baby formulas or other non-liquid foods) on a daily basis? (25)

Data Preparation:

Data was classified into more meaningful groups to make it easier to understand and analyze. Race and ethnicity was split into three groups – Non-Hispanic Black, Non-Hispanic White and Hispanic. Income level was assessed by dividing participants into poverty levels of <100%, 100 – 185%, and >185%. These percentages were calculated by comparing the annual household income rate to a PIR (Poverty Income Rate of 1.0 which equals 100% of the poverty rate).
To assess feeding practices, data was presented by feeding duration, type of feeding, exclusivity, introduction of solids, introduction of milk and type of milk introduced. To assess length of breastfeeding compared to recommendations, number of days breastfeeding or formula feeding was reclassified into breastfed for ≤1 week, ≤3 months, >3 months, respectively. Exclusive breastfeeding or exclusive formula feeding was determined by 0 days of either reported by the mother. To examine the timing of introduction of solid foods, age reported giving solid foods was recoded to before or after 6 months. The age of regular provision of milk was classified as before or after 1 year.

**Data Analysis:**

By analyzing data from NHANES, breastfeeding practices are found to be correlated with ethnicity and income level. To examine the rates of meeting specific guideline groups, descriptive analysis was used to compare categorical variables for feeding practices (breastfeeding duration, formula duration, timing of solid foods, timing of milk) across race/ethnicity and income levels.

Our data was organized and recoded using the SPSS 19.0 software and analyzed with SPSS Complex Samples 19.0, to account for age variation and stratification during the sampling selection and to ensure an accurate representation of our population.
Results:

Data obtained from the NHANES data base for the years 1999-2008 was used to answer the research questions outlined for this study. Descriptive statistics describe the current infant feeding practices within income variation and by ethnic group. The actual sample for this study included 6060 subjects.

The initial research question focused on the breastfeeding initiation rates in the United States stratified by income levels. Analysis of the data demonstrated that overall, 66.8% of all children in this sample had been breastfed at sometime in their life. The individuals at the lowest income level (<100 % of poverty rate) had the lowest breast feeding initiation rate resulting in 54.7% breast feeding initiation, while the highest income group (>185% of poverty rate) had a significantly higher rate with a 76.2% breastfeeding initiation. The middle group (100-185% of poverty rate) resulted in a 60.9% initiation.

The same research question of breastfeeding initiation rates among racial/ethnic groups, demonstrated the Non-Hispanic Black population to have the lowest rates at only 45.9% of mothers who have ever breastfed their child.
The Non-Hispanic White individuals in this sample were shown to have a 68.6% initiation rate, while the Hispanic group resulted in slightly higher initiation rates at 73.8% within this population.

Next the relationship between lengths of breastfeeding was analyzed in the context of race/ethnicity and income level. Nearly half (45.8%) of all children in the <100% of poverty rate, group have never been breastfed. While much less, only 24.3% in the highest income group had never been breastfed.

Looking at the length variable, the higher income category (>185% of poverty rate) resulted in the largest percentage of children who were breastfed for greater than one year, at 15.6%. The lowest income level showed 11% of children breastfed beyond one year, with the middle category appropriately placed at 12.7%. It is significant to note that these results show less than a 4% difference across the various income groups in the sample. 38.7% of children in the highest income group had been breastfed until at least 6 months of age while on the opposite end the lowest income group had only 22.7% of children breastfed beyond six months. The middle income group had 28.7% of children who were breastfed after the six month mark.
Data analysis of the same variable of breastfeeding length was similarly compared across ethnic/racial groups. Results demonstrated the Non-Hispanic Black population to have the highest percentage of infants who were never breastfed at 54.4%. Hispanics had the lowest percentage with nearly half that, or 26.6% of infants never breast fed. The Non-Hispanic White population was shown to have 32% of infants who had never been breastfed. Combining the lengths of breastfeeding (variables: 6-12 months and >1 year), Hispanic and Non-Hispanic populations had similar results of babies who were breastfed past six months at 33.9% and 34.4%, respectively. The Non-Hispanic Black group had a lower percentage of infants’ breastfed beyond six months at 20%. Across both demographics, 34.4% of all babies were never breastfed and a total of 22.2% of all babies were breastfed beyond six months of age.

The research question focusing on the relationship between lengths of formula feeding and income level and ethnicity/race were analyzed next. Across both demographics, 14.0% of all infants were never fed formula, nearly half the number of babies who were never fed breast milk (34.4%). The data demonstrates that between 6-12 months, there is a large increase in the number of babies who stop taking formula. For example, in the lowest income group (<100% of poverty rate) only a total of 9.2% of babies stopped receiving formula before six months of age, but between 6-12 months, that percentage jumps to 32.7%. Similar trends exist in each of the other income and race/ethnic groups, with neither group having notably higher or lower percentages when compared to each other. The majority of children stop taking formula after the 1 year mark with 50.9% of all children who stop receiving formula after 12 months, as compared to the 14% of babies fed breast milk beyond one year. Focusing on the individual groups, the individuals with the highest income and the Non-Hispanic White population had the higher
percentage of infants who were never fed formula at 17% and 17.2%. In comparison, 8.5% of babies in the lowest income population and 6.1% of Non-Hispanic black babies were never fed formula.

Data was sorted to analyze the differences in exclusivity in feeding practices across both demographics. In doing so, it was found that 52.2% of all infants in this sample were fed both formula and breast milk, with only 13.8% who were exclusively breastfed and 33.8% who were exclusively formula fed. In examining exclusivity in relation to income, the highest income population had the highest percentage of babies who were exclusively breast fed at 16.7%. The middle income (100-185% of poverty rate) and lowest (<100% of poverty rate) groups followed at 13% and 8.3%, respectively. In turn, the lowest income group had the highest rates of exclusively formula fed babies at 45.5%, followed by the middle income group with 39% and higher income group at 29.1% of babies exclusively formula fed, as would be expected.

The analysis of the same question within the context of race and ethnic group demonstrated that infants in the Non-Hispanic White group were found to have the highest exclusive breast feeding rates at 16.9%, while the Non-Hispanic Black population resulted with only 6% of babies exclusively fed breast milk. Data showed Hispanic children to be in the
middle with 10.6% of babies exclusively given breast milk. Exclusively formula fed children were more frequent among the Non-Hispanic Black population at 54.3%, with a significant decrease among Non-Hispanic White children at 31.6%, and Hispanic at 26.5%

After gaining an understanding of the lengths which children were breastfed or given formula, data was analyzed on the age when solid foods were introduced to the child’s diet in relationship to income level and race/ethnicity. The recommendation from the American Academy of Pediatrics stated that four months is the earliest recommended age to begin introduction of solids. The data indicated that 16.9% of all infants across the two demographics were given solids before four months, with the remaining 83.1% not receiving them until at least 4 months old. The higher the income level, the greater the percentage of infants who did not received solid foods prior to four months of age. 85.8% of infants in the highest income category (>185% of poverty rate), 82.4% of children in the middle category (100-185% of poverty rate), and 79.5% of kids in lowest income level (<100% of poverty rate) were at least 4 months old before receiving solid foods. There is a similar trend that can be observed when looking at data across race/ethnic groups with 83.8% of Non-Hispanic White, 83.5% of Hispanic, and 80.1% Non-Hispanic Black infants who were not given solids until after age four months.
The research question regarding the age when children were first given cow’s milk was addressed next within this data set. The highest income bracket (>185% of poverty rate) and the Hispanic population both showed the lowest percentages of children given cow’s milk before one year of age at 24% and 24.4%, respectively. The highest percentage of children given cow’s milk before one year of age can be found in the lowest income bracket with 31.5%, and Non-Hispanic Black population with 37.9%. When looking at the number of children first given milk between one and two years of age, the data followed similar trends for both income levels and ethnic/racial groups. Forty five percent of Non-Hispanic Black children and 49.6% of children in the lowest income bracket, were first given milk between one and two years of age. In comparison, 56.6% of Hispanics and 58.6% of children in the highest income category were given milk within this time frame. The number of children not fed milk until at least 2 years of age, was fairly consistent with 4 +/- 0.6% for all infants who fell into this category across both income levels and race/ethnic groups. The number of children who had not yet been fed milk was also consistent across all demographics, with an average of 13.9% who had not been given any type of milk.

Finally, the type of milk the children were first fed, among the children who had already been fed milk, was analyzed. Across all categories, whole milk was found to be the primary milk first given to infants, with approximately 70 +/- 2% of babies meeting this standard. The Non-Hispanic White population had the highest percentage of children first given low-fat milk at 16.6%, followed by Non-Hispanic Black at 15.3% and Hispanic at 11.9%. Within the income categories, the middle income category (100-185% poverty rate) had the highest rate of infants given low-fat milk first at 17.1%, followed by 15.6% of children in the highest income level (>185% of poverty rate), and 12.8% of infants in the lowest income bracket.
Discussion and Conclusions:

The main focus of this study was to determine if the infant feeding practices of specific ethnic/racial groups and/or individuals are meeting the national recommendations purposed by accredited organizations including the CDC, WHO, AND, and AAP.

RQ 1: What are the breastfeeding initiation rates in US infants by race/ethnicity and income?

The data shows a higher positive relationship for moms who initiate breastfeeding and their level of income. Results demonstrate the highest initiation rates among the group of individuals who are >185% of the poverty rate. The direct relationship continues as rates decrease as income decreases. The data show that the lower the income level, the less likely it is that a baby will be breastfed. Our data is also consistent with other research, which found that 57% of lower income groups and 74% of higher income groups had breastfed their babies (23). Quite similarly, this study found the lowest income group (<100% of poverty line) to have a 54.7% initiation rate, while the higher income group had 76.2%.

After reviewing the study results for breastfeeding initiation rates among infants in different ethnic groups, Non-Hispanic Black mothers were least likely to breast feed their children. This could be considered consistent with other research related to specific barriers that might affect this particular group of people such as less maternity leave and more time separation between mother and child due to a higher need to work and infants spending more time in daycare. Furthermore, the Hispanic population was 5% more likely to breastfeed their children than Non-Hispanic white mothers. This result was unexpected; however, this study’s research as well as other literature found the Hispanic population to be making great strides towards recommended feeding practices (25). Cultural differences are a possible reason for the higher
initiation rates, but perhaps more pertinent are the policies implemented during the 1980’s and 1990’s in many Latin American countries which promoted breastfeeding (26). Given this knowledge, it is appropriate to conclude that education and awareness should be one of the main focuses as we try to increase breastfeeding and decrease infant mortality in the United States.

*RQ 2: What are the differences in the length of breastfeeding by race/ethnicity and income?*

Once again, a clear relationship was observed, with the lower income group demonstrating a much higher number of children were never breastfed at all at 54.4%. In contrast, the higher income group showed significantly fewer children who had never been breastfed at only 24.3%.

Among all income brackets, an increase in number of children who stopped breastfeeding increased as the age is increased until >12 months, except in the low income group (i.e. <1 mo -7.3%, 1-3 mo-10.3%, 3-6 mo13.9%, 6-12 mo 11.7%). The evaluation of this population demonstrates 13.9% of children who were breastfed until between 3-6 months, and then it drops at the 6 month point to 11.7%. The other two income levels avoid this drop off and continue to increase. The published literature described in the introduction provides evidence that mothers who breastfeed until at least six months of age will provide their babies with optimal nutrition and which will provide all the health benefits offered by breast milk. After looking at the data as a whole, the number of all children who meet this recommendation is less than impressive at only 32.2%, even less than the latest CDC data of 43.5%. The literature also agrees with the findings of this study which show that individuals with a lower income are less likely to breastfeed.
Further supporting this notion, the highest income category jumped from 15.4% of babies breastfed in the 3-6 month age range to 23.1% after 6 months. In the future, it would be worthwhile to determine if individuals within this higher income bracket are more aware of the recommended guidelines or if other factors are present which cause this population to breastfeed longer, such as more support at home and in the workplace or ability to take a longer leave of absence from work. We are unable to draw any conclusions from this descriptive study of why these individuals tend to breastfeed longer.

It is important to note however, that there is only a 4% (12% +/-2%) difference, across all income categories, in the number of babies who are breastfed beyond the one year mark. The current research shows that continuation of breast milk with slow introduction of solids until at least 12 months, is the ideal goal in order to provide best health benefits to an infant (2,3,4). The noted insignificant difference among groups demonstrates that all income levels have room for much improvement when it comes to meeting the above recommendation.

Similar trends exist when comparing length of breastfeeding among the various race/ethnicities. In all three race/ethnic groups, there is an increase in number of children who stopped breast feeding as age increases until the >12 months category, where there is actually a drop in the percentage. For example, the Non-Hispanic Black population demonstrates that at <1 mo, 6.5% of babies had stopped being breastfed and the trend continued at 1-3 mo with 8.5%, 3-6 mo with 10.6%, and 6-12 mo with 13.5% of infants who had stopped
breastfeeding. After one year, the Non-Hispanic Black population had fewer children still breastfeeding with only 6.5%. This group also made up half of all children who had not been breastfed at all. The Hispanic and Non-Hispanic White populations were significantly higher, with approximately 15% of infants who breastfed beyond one year. As expected, fewer infants in these categories had never been breastfed at only 26.6% of Hispanics and 32% of Non-Hispanic white.

Although, there is an obvious trend pointing out the Non-Hispanic White and Hispanic populations as better meeting the recommendations previously mentioned, they are still in need of attention and further intervention to increase the percentage of children breastfed beyond 6 months and especially the percentage of children breastfed until 1 year of age.

**RQ 3: For infants who were formula fed, how long were they fed formula by race/ethnicity and income?**

Although, formula feeding is a preferred source of nutrition for infants, it is second best to breast milk and therefore the recommendations for optimal length of formula feeding is consistent with those of breast feeding (16). After analyzing the data of this study, it is notable that 14% of infants in this sample were never formula fed, while more than twice that number were never given breast milk. One would think logically that given the recommendations, these two numbers would be reversed. Several questions come to mind such as “why do twice the number of mothers choose formula if it is more expensive? Or “is there a negative attitude toward breastfeeding in our society?” Or “Are mother’s in the WIC program less likely to breastfeed their children?” There is obviously room for further research in determining the cause behind such a high percentage of children not meeting the breastfeeding guidelines aforementioned. 17.2% of children in the highest income group and 17% of children in the Non-
Hispanic White population, compared with the 8.5% and 6.1% in the lowest income and Non-Hispanic black populations. Given the higher rate of breast feeding among Non-Hispanic Whites and those of a higher economic class, it is expected that these groups would have a lower number of infants who were formula fed.

*RQ 4: What are the differences in comparing exclusive breastfeeding by race/ethnicity and income?*

Ideally, to receive the greatest benefits, infants should be *exclusively* breastfed for the first six months of life. This data analysis demonstrates that only 13.8% of all children are exclusively breastfed. Keeping in mind our results showed 32.2% of children breastfed until at least six months of age, our data has an even lower rate than the current research of 14.4%. This warrants further investigation and research to help determine reasons for the low rate of breast feeding. It is the goal of Healthy People 2020 to increase exclusive breastfeeding for six months to 25.5% in order to reduce US infant mortality rates. The data in this study helps support the need for such goals.

The Non-Hispanic Black population had the highest number of children who were exclusively formula fed with the Non-Hispanic White and Hispanic populations at nearly half the number of children exclusively formula fed. In turn, the exclusive breast feeding rates among the Non-Hispanic White population had the highest exclusive breast feeding rates, with Non-Hispanic Black individuals having the lowest. In terms of economic status, a trend shows that as the level of income decreases, the rate of exclusive breast feeding also decreases, while the rate of exclusive formula feeding increases. This inverse relationship further points to the need for better education on breastfeeding practices and investing in other resources to pinpoint the barriers to breastfeeding, especially among the low income and Non-Hispanic Black populations.
RQ 5: Is there a significant difference in age when infants were introduced to solid foods by race/ethnicity or income?

Only 16.9% of the sample in this study was found to have received solids before the age of four months. Because the recommendation of the American Academy of Pediatrics which states that solids should not be introduced until between 4-6 months of age, our sample fairs quite well, with 83.1% of children meeting this guideline. A trend is notable as a higher level of income related to a lower number of children who are given solids food before four months old. However, there is only a total of 6% separation between the highest and lowest income groups, making such trends seen by income level appear insignificant. Similarly, the Non-Hispanic White population had the lowest rates of children first given solids before four months at 16.2%, while 19.9% of Non-Hispanic black children were given solids before four months. Again, due to only slight differences between various income levels and race/ethnic categories, it appears that the age at when solids should be introduced is generally well understood and well followed by most populations.

RQ 6: Are there differences in the age in which infants were given regular milk by race/ethnicity or income?

Throughout the study, it was surprising that the Hispanic group often came closer to meeting the standards of breastfeeding and age when children are supposed to be introduced to solids/cow’s milk, than other ethnic groups. They not only had the highest rates of children who had been breastfed at 73.8%, but also the lowest percentage of infants who were given cow’s milk before their first year of life, at only 24.4%. In comparison, the Non-Hispanic Black population was demonstrated to have the highest percentage at 37.9% of infants given milk before one year of age. Looking at the current literature and our comparable results, it is
expected that this population as well as the low income group (demonstrated to have similar at 31.5% of infants given milk before 1 year), to be at higher risk for allergy development and other health problems (11). As expected the highest income group also had the lowest number of children given cow’s milk at 24%.

**RQ 7: When milk was introduced, what type of milk was given by race/ethnicity or income?**

Whole milk was demonstrated to be the primary milk first given to infants at 70% +/- 2% for all income and racial/ethnic groups in this study. A surprising result can be seen in the Non-Hispanic White group, which had the highest number of infants who were first given low-fat milk instead of whole milk, at 16.6%. The Hispanic population once again best met the recommendation among all ethnic groups, having the most children who were first given whole milk and just 11.9% of children first fed low-fat milk. Although only 4.7% less than the Non-Hispanic White group, it is still worth noting in order to observe the trend. As mentioned, Latin American culture and/or policies maybe the explanation for such findings, and further research focused on this specific group of people could prove beneficial for improving feeding practice compliance in the United States.

Other interesting data resulted when focusing on the type of milk introduced and income level. As was mentioned, an infant should receive whole milk between 12-24 months at which point it is appropriate for them to be switched to low fat milk. The lowest income group has, up until this point, been the group least likely to meet the current recommendations in regards to infant feeding practices. However, the data reveals that the lower the income level the higher the number of children who were first given whole milk, while the higher income category had the highest number of children whose first fed milk was low fat. It is important to remember however that the lowest income group also had the highest number of children fed milk before
the recommended one year, which could have affected the interpretation of the results. Likewise, the highest income group had fewer children given milk before one year. Perhaps another explanation for this finding is that this group is also the primary group taking part in the WIC program, which helps direct and encourage proper feeding practices, providing coupons for needed formula and grocery items to promote overall wellness, thereby promoting education and feeding practice recommendations among this group (26).

The data relating to when and what type of milk was given is further evidence that steps need to be taken to determine why the lower income and Non-Hispanic Black populations are consistently falling shorter than other related demographics, of the recommendations that have been provided for ideal infant feeding practices. While it is true that other populations, including those of higher income status and Non-Hispanic White, are also struggling to meet these recommendations, we see repeatedly that Non-Hispanic Black individuals and those with low economic status are significantly further from meeting such guidelines and are therefore suffering more from the health consequences. This can be seen in the African American population who exhibit the highest infant mortality rate at 13.6% as well as the highest mortality rate for many diseases later in life, such as diabetes (27).

As can be observed, there are some definite relationships in feeding practices across different racial/ethnic groups and income levels. Recognizing the significance of the relationships and where they occur will help determine what future research needs to proceed in order to provide the most appropriate interventions focused on the demographics struggling most to meet the infant feeding practices recommendations and subsequently impact the future infant health in the United States.
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