USDA-HHS Birth to 24 Months (B-24) Topic Identification Project

Topic Briefs for Potential Systematic Reviews

Period of Transitional Feeding, 12–24 months

The B-24 expert Work Group 3 identified important nutrition topics relevant to dietary guidance for children 12–24 months of age (the period of transitional feeding) to facilitate exploration of the evidence base. Below is a brief description of each topic identified, including the rationale, potential systematic review questions, data needs, research priorities, and key references.

1. What are the specific energy needs of infants and children aged 12–24 months to promote health and prevent disease?

Rationale: Alarming patterns of overweight and obesity occurring in early life (<4 years of age) continue in the US (Ogden, 2012). Although many factors may contribute to this pattern (Flores, 2013), it is clear that the energy requirements of toddlers are critical components to be considered. Of particular interest is the relationship of energy intake to growth velocity, which decelerates after one year of age (Butte, 2000; Jordan, 2008), and to physical activity levels of toddlers in today's society. The key question is: How should dietary guidance reflect these changes?

PICO:

Population: Toddlers, aged 12–24 months.
Intervention/Exposure: Energy intake and energy expenditure.
Comparator: Excess or inadequate energy intake and energy expenditure.
Outcomes: Growth and physical development.

Systematic Review Questions:

- What are the energy requirements for toddlers, aged 12–24 months, to promote optimal growth and physical development?

Data and Research Needs:

- Data on food consumption patterns in infants/toddlers in the US including:
  - Total calories and contributions of specific food groups
  - Demographic/cultural/ethnic determinants
  - Impact of foods consumed in home versus out of home, including childcare facilities
- Factors contributing to "unhealthy" body composition, e.g., differences between parental attitudes, beliefs and habits, and those of other caregivers
- Determination of the optimal mathematical model to estimate EER in toddlers from knowledge of energy expenditure, growth, and physical activity level.

Supporting Documents:

- Flores G, Lin H. Factors predicting overweight in US kindergartners. *Am J Clin Nutr.* 2013 Jun;97(6):1178-87. doi: 10.3945/ajcn.112.052019. Epub 2013 Apr 3. PubMed PMID: 23553169.
- Jordan PN, Hall KD. Dynamic coordination of macronutrient balance during infant growth: insights from a mathematical model. *Am J Clin Nutr.* 2008 Mar;87(3):692-703. PubMed PMID: 18326609; PubMed Central PMCID: PMC2562789.
- Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999-2010. *JAMA.* 2012 Feb 1;307(5):483-90. doi: 10.1001/jama.2012.40. Epub 2012 Jan 17. PubMed PMID:22253364.
- Butte NF, Wong WW, Hopkinson JM, Heinz CJ, Mehta NR, Smith EO. Energy requirements derived from total energy expenditure and energy deposition during the first 2 y of life. *Am J Clin Nutr.* 2000 Dec;72(6):1558-69. PubMed PMID:11101486.

2. What is the optimal type and amount of physical activity to promote health of infants and toddlers 6–24 months of age?

Rationale: As noted by Work Group 2, the National Association of Sports and Physical Education (NASPE) has developed specific guidelines for the physical activity of children from birth to age 5 that address the developing child's unique characteristics (NASPE, 2013). These guidelines reflect the current evidence with regard to motor development, movement and exercise, and the physical activity needs of young children during the first years of life. Because of the importance of physical activity for growth and physical development, energy balance, and bone development in infants and toddlers, its measurement is critical for the evaluation of its impact on energy needs, and ultimately, the ability to develop evidence-based guidance for infants and toddlers. Limited information is available to determine what types and amounts of physical activity optimize the health and development of infants and toddlers. In addition, a need exists to better understand what types of opportunities for physical activity, including indoor and outdoor activities, should be recommended.

PICO:

Population: Infants and toddlers aged 6–24 months; pregnant and lactating women.
Intervention/Exposure: Physical activity: Types, amount (duration and frequency).
Comparator: Different types, duration, or frequency of physical activity; inactivity.
Outcomes: 1) Growth and physical development, 2) bone development and health, and 3) overweight/obesity.

Systematic Review Questions:

- What types of physical activity during ages 6–24 months are associated with 1) optimal growth and physical development, 2) optimal bone development, and 3) reduced risk of overweight/obesity?
- What amount (i.e., duration, frequency, and number of daily occasions) of physical activity from ages 6–24 months is associated with 1) optimal growth and physical development, 2) optimal bone development, and 3) reduced risk of overweight/obesity?

Data and Research Needs:

- Prevalence data are needed for US children with regard to types and amounts of physical activity.
- Most common and available settings to be physically active and relative value to the child's health and development: At home and outside the home.

Supporting Documents:

- The National Association of Sports and Physical Education. Active start: A statement of physical activity guidelines for children from birth to age 5. 2nd edition. 2013. Internet: Active Start .

3. Micronutrients and other dietary constituents of concern for infants/toddlers 12–24 months of age

Rationale: Limited information is available on consumption of specific nutrients in infants aged 12–14 months and their adequacy relative to existing recommendations (Butte, 2010). New data is needed with regard to their adequacy in the diet in relation to current Dietary Reference Intakes (DRIs, estimated average requirements or EARs, and tolerable upper intake level or ULs), and the association of the individual nutrients with specific health outcomes. Nutrients noted to be of special concern include: Sub-optimal intakes of iron, zinc, vitamin E, vitamin D, fiber, and potassium; excessive intakes of energy, protein, sodium, vitamin A, synthetic folate, saturated fat, water, and fluoride (Butte, 2010). A particular need is further guidance with regard to folate, fiber, vitamin, and the percentage of milk fat (e.g., skim, 2%, or whole milk) recommended for 12- to 24-month-olds to ensure proper neurodevelopment, while minimizing obesity and cardiovascular risk.

PICO:

Population: Toddlers, aged 12–24 months.
Intervention/Exposure: Average nutrient intakes versus recommended intakes (i.e., fiber, vitamin A, and synthetic folate).
Comparator: Sub-optimal or excessive intakes of nutrients.
Outcomes: 1) Markers of growth in relation to WHO reference growth standards and 2) biomarkers of adequacy.

Systematic Review Questions:

- What is the relationship between observed intakes of fiber, vitamin A, and folate and the EARs and ULs for toddlers 12–24 months of age?
- What is the relationship between fiber, vitamin A, and folate and 1) markers of growth in relation to WHO reference growth standards, or 2) biomarkers of adequacy?

Data and Research Priorities:

- Knowledge of the average consumption of food intake by food groups in infants aged 12–24 months in relation to body mass index (BMI) and overweight at two years.
- Knowledge of the average nutrient intakes, including the contribution of dietary supplements (i.e., iron, zinc, vitamin E, vitamin D, fiber, potassium, energy, protein, sodium, vitamin A, synthetic folate, saturated fat, water, and fluoride) of toddlers and how intakes compare to the current DRIs (EARs and ULs).
- Improved understanding of the relationship between vitamin D, fluoride, and calcium intake in pregnancy and in infants up to two years of age and bone health outcomes in young children.
- Improved understanding of the relationship between intake of fiber in toddlers and functional outcomes such as bowel motility/function.
- Improved understanding of the relationship between sodium and potassium intake in toddlers and outcomes of blood pressure.
- Improved understanding of the relationship between total and saturated fat intake in toddlers and outcomes of blood triglycerides, high-density lipoprotein-cholesterol, and low-density lipoprotein-cholesterol.
- Knowledge of the optimal Adequate Macronutrient Distribution Range (AMDR) for infants 12–14 months of age including sugars versus starches to optimize growth, body composition, and functional outcomes, such as bowel motility cognition (related to sugars), food behavior, hyperactivity, and glucose tolerance.

Supporting Documents:

- Butte NF, Fox MK, Briefel RR, Siega-Riz AM, Dwyer JT, Deming DM, Reidy KC. Nutrient intakes of US infants, toddlers, and preschoolers meet or exceed dietary reference intakes. *J Am Diet Assoc.* 2010 Dec;110(12 Suppl):S27-37. doi:10.1016/j.jada.2010.09.004. PubMed PMID: 21092766.

4. Impact of different approaches weaning off the breast or bottle on infant/toddler health

Rationale: Delayed weaning from (or inappropriate use of) bottle feeding may lead to dental caries (Smith, 1998) or anemia. Limited evidence implicates early weaning with increased calorie intake and overweight/obesity (Sloan, 2008; Huh, 2011), but available literature is scant and the results of extant studies are inconsistent (Moorcroft, 2011). Because of changes in nutrient composition of mature human milk over time, delayed weaning from the breast may affect growth and development. Thus a need exists to better understand how the timing of weaning affects consumption of other foods and how this may influence diet quality, the development of eating behaviors and growth and development, including the prevalence of overweight and obesity. It is important to understand whether there are differences between breastfeeding and bottle feeding of expressed human milk.

PICO:

Population: Toddlers, ages 12–24 months.

Intervention/Exposure: Later weaning from the breast or bottle (including formula and human milk).

Comparator: Earlier weaning from the breast or bottle (including formula and human milk).

Outcomes: Toddler 1) dietary intake, 2) eating behaviors, and 3) growth and development, including risk of overweight/obesity.

Systematic Review Questions:

- What is the relationship between delayed weaning from the breast on toddlers' 1) dietary intake (including energy and iron intake), 2) eating behaviors, 3) growth and development, including risk of overweight/obesity, 4) oral health, and 5) anemia?
- What is the relationship between delayed weaning from the bottle or inappropriate use (including formula, human milk, and juice) of a bottle on toddlers': 1) dietary intake (including energy and iron intake), 2) eating behaviors, 3) growth and development, including risk of overweight/obesity, 4) oral health, and 5) anemia? An example of "inappropriate" use might include either use that is inconsistent with current guidance (e.g., off the bottle by 18 months) or use of food to manage behavior: Soothe, quiet, redirect, or control a non-hungry infant/toddler.

Data and Research Priorities:

- Are there differences between delayed weaning from human milk in a bottle versus formula in a bottle? Potential differences of interest between human milk- and formula-fed infants might include: 1) nutrient intake, 2) health outcomes, including body composition, 3) how weaning is accomplished, and 4) caregiver behavior/demographics.

Supporting Documents:

- Huh SY, Rifas-Shiman SL, Taveras EM, Oken E, Gillman MW. Timing of solid food introduction and risk of obesity in preschool-aged children. *Pediatrics.* 2011 Mar;127(3):e544-51. doi: 10.1542/peds.2010-0740. Epub 2011 Feb 7. PubMed PMID:21300681; PubMed Central PMCID: PMC3065143.
- Moorcroft KE, Marshall JL, McCormick FM. Association between timing of introducing solid foods and obesity in infancy and childhood: a systematic review. *Matern Child Nutr.* 2011 Jan;7(1):3-26. doi:10.1111/j.1740-8709.2010.00284.x. Review. PubMed PMID: 21143583.
- Sloan S, Gildea A, Stewart M, Sneddon H, Iwaniec D. Early weaning is related to weight and rate of weight gain in infancy. *Child Care Health Dev.* 2008 Jan;34(1):59-64. doi: 10.1111/j.1365-2214.2007.00771.x. PubMed PMID: 18171445.
- Smith PJ, Moffatt ME. Baby-bottle tooth decay: are we on the right track? *Int J Circumpolar Health.* 1998;57 Suppl 1:155-62. Review. PubMed PMID: 10093266.

5. Implication of consumption of different types of post-weaning beverages in infant/toddler growth, development and health

Rationale: In addition to complementary foods, the period from 6–24 months involves the introduction of several complementary beverages, including juice, sweetened beverages, water, and milk (cow's milk or other alternative milks such as soy, rice, almond, and coconut; Fox, 2010). Because the 12–24 month period also usually involves the discontinuation of human milk or infant formulas, the replacement fluids provide an important (but diminishing) source of essential nutrients. Consumption of many of these types of beverages may have adverse health effects, including increased risk for obesity (O'Connor, 2006), cardiovascular disease (Kosova, 2013), anemia (Maguire, 2013), and others. Excess quantities of these fluids can displace the appetite for healthful solid foods and certain beverages may be associated with such adverse outcomes as irritable bowel syndrome and diarrhea. Consequently, guidance is needed to specify a maximum recommended intake of these beverages. Guidance is also needed about the percentage of milk fat recommended for 12- to 24-month-olds to ensure proper neurodevelopment, while minimizing obesity and cardiovascular risk. Recent guidance from the American Academy of Pediatrics suggests reduced fat milk for 12- to 24-month-olds who are felt to be at risk for obesity or cardiovascular risk. Similarly, with a rise in prevalence of allergies, the past 20 years has seen a rise in the types of milk-alternative beverages offered (e.g., soy, rice, almond, and coconut). The effect of these types of alternative milks versus human or cow's milk on young children's nutritional status, nutrient intake, risk of allergies, and cardiovascular risk is unclear.

PICO:

Population: Infants and toddlers, aged 6–24 months.

Intervention/Exposure: Appropriate amount of milk or juice intake; "milk alternative" beverages.

Comparator: Excess milk or juice intake, inadequate milk intake; human milk or cow's milk.

Outcomes: Anemia, energy intake, cognitive and neurological development, obesity, cardiovascular disease, nutritional status and nutrient intake (vitamin D and calcium), and risk of allergy.

Systematic Review Questions:

- Is there a level (minimum and maximum) of cow's milk consumption that is ideal for infants/toddlers aged 12–24 months to support:
  - Physical growth and development
  - Cognitive/behavioral development
  - Prevent increased risk for such non-communicable conditions as anemia, obesity, and cardiovascular disease
- What is the effect of different milk fat percentages (e.g., whole, reduced, and skim) on 12- to 24-month-olds': 1) energy intake, 2) neurological development, 3) obesity, and 4) cardiovascular disease risk?
- What are the effects of "milk alternative" beverages (e.g., soy, rice, almond, and coconut beverages) as compared to human or cow's milk on children's: 1) nutritional status, 2) nutrient intake (e.g., effect on vitamin D and calcium status), 3) risk of allergy, and 4) cardiovascular disease risk?
- What is the effect of juice consumption in this age-group on: 1) risk of diarrhea, 2) growth and development (decreased risk of obesity or poor weight gain), and 3) diet quality (i.e., displacement of other foods in diet)?
- What amount of free water is recommended for children aged 12–24 months to promote optimal growth and development, adequate hydration, and limits displacement of other foods in the diet?

Data and Research Priorities:

- What are the consequences (both positive and negative), related to optimal growth and development, of the provision of human milk to toddlers

5. Implication of consumption of different types of post-weaning beverages in infant/toddler growth, development and health

over 12 months of age?

Supporting Documents:

- Fox MK, Condon E, Briefel RR, Reidy KC, Deming DM. Food consumption patterns of young preschoolers: are they starting off on the right path? *J Am Diet Assoc.* 2010 Dec;110(12 Suppl):S52-9. doi: 10.1016/j.jada.2010.09.002. PubMed PMID:21092769.
- Kosova EC, Auinger P, Bremer AA. The relationships between sugar-sweetened beverage intake and cardiometabolic markers in young children. *J Acad Nutr Diet.* 2013 Feb;113(2):219-27. doi: 10.1016/j.jand.2012.10.020. PubMed PMID: 23351625.
- Maguire JL, Lebovic G, Kandasamy S, Khovratovich M, Mamdani M, Birken CS, Parkin PC; TARGet Kids!; Collaboration. The relationship between cow's milk and stores of vitamin D and iron in early childhood. *Pediatrics.* 2013 Jan;131(1):e144-51. doi: 10.1542/peds.2012-1793. Epub 2012 Dec 17. PubMed PMID:23248224.
- O'Connor TM, Yang SJ, Nicklas TA. Beverage intake among preschool children and its effect on weight status. *Pediatrics.* 2006 Oct;118(4):e1010-8. PubMed PMID:17015497.

6. Implications of sleep patterns for infant/toddler nutrition, growth, and health

Rationale: Short sleep duration and its relationship with obesity risk, appetite, and dietary quality is an emerging area of inquiry (Taylor, 2011). Most studies have been performed in adults and older children (Dattilo, 2012), but there are also some cohort studies of infants and toddlers that have illustrated a link between shortened sleep duration (<12 hours in a 24-hour period) and increased BMI z-score, subscapular and triceps skinfold thicknesses and odds of overweight among infants aged 0–24 months (Taveras, 2008). Moreover, short sleep duration is highly prevalent, particularly among minority ethnic groups (Nevarez, 2010; Crosby, 2005), and tend to persist into later childhood (Kataria, 1987). Understanding the mechanisms for the observed relationship between sleep and obesity comes primarily from the adult literature, where sleep restriction has been associated with reduced leptin levels, increased ghrelin levels and increased appetite. Through these studies, it is apparent that sleep plays an important role in appetite, dietary quality, and subsequent obesity risk.

PICO:

Population: Infants and toddlers, aged 0–24 months.
Intervention/Exposure: Short sleep duration (<12 hours in a 24-hour period).
Comparator: Long sleep duration (>12 hours in a 24-hour period).
Outcomes: 1) Overweight/obesity, 2) appetite, and 3) diet quality.

Systematic Review Questions:

- What is the effect of short sleep duration on obesity risk among infants aged 0–24 months?
- What is the effect of short sleep duration on appetite and dietary quality among children consuming complementary foods?

Data and Research Priorities:

- If ideal duration of sleep is 12 hours in a 24-hour period, is there an ideal duration of sleeping episodes, i.e., is 12 continuous hours better than three sessions of four hours or some other combination?
- What is the impact of sleep periodicity on dietary intake patterns?
- What are the predictors of documented differences in sleep patterns/practices among different racial/ethnic groups?
- How does composition (i.e., quantity and quality) of the diet affect sleep patterns?
- How do eating patterns (regular meals, on-demand feeding, etc.) affect sleep patterns?

Supporting Documents:

- Dattilo AM, Birch L, Krebs NF, Lake A, Taveras EM, Saavedra JM. Need for early interventions in the prevention of pediatric overweight: a review and upcoming directions. *J Obes.* 2012;2012:123023. doi: 10.1155/2012/123023. Epub 2012 May 17. PubMed PMID: 22675610; PubMed Central PMCID: PMC3362946.
- Taveras EM, Rifas-Shiman SL, Oken E, Gunderson EP, Gillman MW. Short sleep duration in infancy and risk of childhood overweight. *Arch Pediatr Adolesc Med.* 2008 Apr;162(4):305-11. doi: 10.1001/archpedi.162.4.305. PubMed PMID: 18391138; PubMed Central PMCID: PMC2650815.
- Taylor BJ, Heath AL, Galland BC, Gray AR, Lawrence JA, Sayers RM, Dale K,Coppell KJ, Taylor RW. Prevention of Overweight in Infancy (POI.nz) study: a randomised controlled trial of sleep, food and activity interventions for preventing overweight from birth. *BMC Public Health*. 2011 Dec 19;11:942. doi:10.1186/1471-2458-11-942. PubMed PMID: 22182309; PubMed Central PMCID:PMC3293097.
- Nevarez MD, Rifas-Shiman SL, Kleinman KP, Gillman MW, Taveras EM. Associationsof early life risk factors with infant sleep duration. *Acad Pediatr*. 2010 May-Jun;10(3):187-93. doi: 10.1016/j.acap.2010.01.007. Epub 2010 Mar 27. PubMed PMID: 20347414; PubMed Central PMCID: PMC2866807.
- Crosby B, LeBourgeois MK, Harsh J. Racial differences in reported napping and nocturnal sleep in 2- to 8-year-old children. *Pediatrics.* 2005 Jan;115(1Suppl):225-32. PubMed PMID: 15866856; PubMed Central PMCID: PMC2987587.
- Kataria S, Swanson MS, Trevathan GE. Persistence of sleep disturbances in preschool children. *J Pediatr.* 1987 Apr;110(4):642-6. PubMed PMID: 3559818.

7. "Micro-environmental" effects on the transition to the adult diet. How do inborn responses to basic tastes and learning and experience with food and eating influence the transition to the adult diet during the period of 6–24 months of age?

Rationale: From birth to 24 months, feeding occasions include the interaction of the child, caregiver and the food. Each has a set of unique characteristics that affect the nature and impact of this interaction (Fisher, 2009; Ventura, 2009). For example, child factors might include inborn taste preferences, ability to learn, developmental level, and temperament; while the caregiver factors might include eating habits or eating style. The interactions between child and caregiver include feeding practices and parenting style. Finally, the food contributes via flavors, portion size and energy/nutrient content. How these myriad factors affect feeding from 12 to 24 months needs to be better understood.

PICO:

Population: Infants and toddlers, aged 6–24 months.

Intervention/Exposure: "Micro-environmental" effects on the transition to the adult diet:

- Children's inborn ability to learn food likes and dislikes (through familiarization, observational learning, and associative learning), predispositions for basic tastes and individual differences (for example, temperament, prior experience with food in the first year of life)
- Parent/caregiver feeding practices, such as foods, flavors, and portion sizes made available; systematic introduction of new foods to promote acceptance; responsiveness to child cues; parenting styles (e.g., authoritative, authoritarian, permissive) parent/caregiver eating habits; other parent/caregiver characteristics
- Food characteristics, such as taste/flavor characteristics, portion size, energy, nutrient density, and novelty of the flavor
- Factors that increase picky eating; more pickiness.

Comparator: See above.

Outcomes: Transition to the "adult idea" (i.e., dietary intake, diet quality, and food preferences).

Systematic Review Questions:

- How do children's 1) inborn ability to learn food likes and dislikes (i.e., the ability to learn to like or dislike foods and other things via familiarization, and associative learning processes), 2) predispositions for basic tastes (i.e., the species' general unlearned liking to sweet, salty, and umami and rejection of sour, bitter tastes) and 3) individual differences contribute to: a) making the transition to consuming the foods of the adult diet (food preferences and dietary intake), b) growth and development, and c) risk of overweight/obesity?
- How do parent/caregiver feeding practices impact 1) the transition to the adult diet (food preferences and dietary intake; development of reactivity, self-regulation of food intake), 2) growth and development, and 3) risk of overweight/obesity?
- What food characteristics (e.g., taste/flavor characteristics, portion size, energy, nutrient density, novel, or familiar) impact the development of food preferences and dietary intake?
- What factors (either from the child or the parent/caregiver) precipitate or exacerbate "picky eating"?
- What is the relationship between picky eating and dietary intake, long-term eating behaviors, and other health outcomes, such as growth and development and risk of overweight/obesity?
- What factors contribute to the ability to self-regulate energy intake?
- Can changes in infant/toddler feeding patterns or environmental characteristics impact the ability to self-regulate energy intake?

7. "Micro-environmental" effects on the transition to the adult diet. How do inborn responses to basic tastes and learning and experience with food and eating influence the transition to the adult diet during the period of 6–24 months of age?

Data and Research Priorities:

- Evidence for how children learn food likes and dislikes (through familiarization, observational learning, and associative learning).
- How do children's predispositions for basic tastes and individual differences (e.g., temperament and prior experience with food in the first year of life) contribute to making the transition to consuming the foods of the adult diet?
- Evidence for food (energy) intake regulation in toddlers.
- Examine the age at which the ability to self-regulate energy intake begins to deteriorate.
- What factors (e.g., feeding practices, palatability, schedule/routine, and social context) contribute to this deterioration?
- Can changes in infant/toddler feeding patterns or environmental characteristics prevent or reduce the deterioration?
- Evidence for parent/caregiver effects on the transition to the adult diet (food preferences, intake patterns): Feeding practices; foods, flavors, portion sizes made available.
  - Are new foods introduced systematically to promote acceptance?
  - Is feeding responsive to child cues?
  - Are there differences in general parenting style (e.g., authoritative, authoritarian, or permissive), parent/caregivers' own eating habits or other characteristics which might impact a child's food likes, dislikes, reactivity, and regulatory ability affecting what foods are consumed and how much is consumed?
- Evidence for the effects of food characteristics on liking and intake: Taste/flavor characteristics, portion size, and energy/nutrient density. Novel or familiar?
- Etiology of "picky eating" (including food refusal and food jags) and consequences on dietary intake and eating behaviors. What factors precipitate or exacerbate "picky eating" and how does picky eating affect dietary intake, long-term eating behaviors, and other outcomes?

Supporting Documents:

- Fisher JO, Sinton MM, Birch LL. 2009. Early experience with food and eating: Influencing risk for the development of disordered eating and problems of energy balance. In J. Kevin Thompson, L. Smolak (Eds.), *Body Image, Eating Disorders, and Obesity in Youth: Assessment, Prevention, and Treatment*. 2nd Edition Washington, DC: American Psychological Association.
- Ventura A, Johnson SL, Birch LL. 2009. Children's Eating: The Development of Food-Acceptance Patterns. *Development and Education: Research Reviews from Young Children*. Washington, DC: National Association for the Education of Young Children. Available at: Children's Eating.

8. Factors affecting exposure to and impact of media in infants/toddlers

Rationale: Television viewing has been systematically associated with increased risk of adverse dietary outcomes, including obesity risk (Ford, 2012). Advertising and other marketing strategies to promote foods contribute to obesity and exposure to television may represent the earliest exposure to a screen from birth to 24 months. Efforts to control exposure to ads that promote food may contribute to obesity prevention. In addition, foods marketed to children are often high in sources of fat and added sugars, so reduced consumption of foods advertised on television may help reduce the risk of later heart disease. Parents and other caretakers model and control TV time. Advertising and other marketing strategies to promote foods contribute to obesity (Zimmerman, 2011) and exposure to television may represent the earliest exposure to a screen from birth to 24 months. Efforts to control exposure to ads that promote food may contribute to obesity prevention. In addition, foods marketed to children are often high in sources of fat and added sugars (Slining, 2013), so reduced consumption of foods advertised on television may help reduce the risk of later heart disease.

PICO:

Population: Infants and toddlers, aged 6–24 months, caregivers, and child care providers.
Intervention/Exposure: Screen time (e.g., television viewing, cell phones, PDAs).
Comparator: Varying levels of screen time.
Outcomes: 1) Growth and physical development, 2) overweight/obesity, and 3) cognitive, behavioral, or neuromotor development.

Systematic Review Questions:

- What are the impacts of exposure to advertising on food choice, food intake, and weight status?
- What is the relationship between screen time and 1) growth and physical development, 2) overweight/obesity, and 3) cognitive, behavioral, or neuromuscular development in infants and toddlers?

Data and Research Priorities:

- What types and amounts of advertising are infants and toddlers exposed to?
- What are the impacts of exposure to advertising on food intake and weight status?
- What is the relationship between screen time and 1) growth and physical development, 2) overweight/obesity, and 3) cognitive, behavioral, or neuromuscular development in infants and toddlers?
- Are there critical periods/milestones in cognitive development that play a role in "receptivity" to the influence of specific types of media?
- What impact do caregivers and child care providers have on infant and toddler screen time?

Supporting Documents:

- Ford C, Ward D, White M. Television viewing associated with adverse dietary outcomes in children ages 2-6. *Obes Rev.* 2012 Dec;13(12):1139-47. doi:10.1111/j.1467-789X.2012.01028.x. Epub 2012 Sep 10. Review. PubMed PMID:22958789.
- Slining MM, Popkin BM. Trends in intakes and sources of solid fats and added sugars among U.S. children and adolescents: 1994-2010. *Pediatr Obes.* 2013 Aug;8(4):307-24. doi: 10.1111/j.2047-6310.2013.00156.x. Epub 2013 Apr 2. PubMed PMID: 23554397; PubMed Central PMCID: PMC3713091.
- Zimmerman FJ. Using marketing muscle to sell fat: the rise of obesity in the modern economy. *Annu Rev Public Health.* 2011;32:285-306. doi:10.1146/annurev-publhealth-090810-182502. Review. PubMed PMID: 21219166.

9. Impact of food insecurity on infant/toddler health and development

Rationale: Household food insecurity (lack of access to an available and nutritious diet) remains a major public health problem, affecting an estimated 21.8% of US households with children under six years of age. Rates may be as high as 49.9% for low-income female-headed households with children (Coleman-Jensen, 2011). Toddlers in food-insecure households are at risk for numerous adverse health outcomes, including iron deficiency, increased hospitalizations, and poor perceived health and developmental delays (Cook, 2004; Skalicky, 2006; Rose-Jacobs, 2008; Zaslow, 2009). National nutritional programs [e.g., WIC and the Supplemental Nutrition Assistance Program (SNAP)] reduce food insecurity. Further guidance is needed with regard to the impact of food insecurity and programs designed to address it on infant and toddler diet and health relationships.

PICO:

Population: Toddlers, aged 12–24 months.
Intervention/Exposure: Food insecurity.
Comparator: Food security.
Outcomes: 1) Cognitive, behavioral, or neuromotor development, 2) dietary intake, 3) poor perceived health, and 4) risk of iron deficiency/anemia.

Systematic Review Questions:

- What is the relationship between food insecurity in infants/toddlers and: 1) Cognitive, behavioral, or neuromotor development, 2) dietary intake/diet quality, 3) poor perceived health, 4) risk of iron deficiency/anemia, and 5) weight status?

Data and Research Priorities:

- Prevalence of food insecurity in the United States by demographic/race/ethnicity.
- Quality of dietary intakes of infants living in food insecure environments.
- Primary sources of food for families living in food insecure environments.
- Role of the household versus other childcare settings in food insecure settings.
- Impact of the community on dietary quantity and quality for food insecure infants/toddlers including:
  - National food assistance programs
  - Community based/charitable organizations
  - Impact of episodic (e.g., monthly or seasonal) versus chronic food insecurity on infant/toddler growth, health, and development
  - Implications of the reduction of WIC benefits after the first year of life on WIC participation and its impact on infant/toddler food security, nutrition, and health.

Supporting Documents:

- Coleman-Jensen A, Nord M, Andrews M, Carlson S. Household food security in the United States in 2010. U.S. Dept. of Agriculture. Available at: Household Food Security. Published September 2011. Accessed February 23, 2012.
- Skalicky A, Meyers AF, Adams WG, Yang Z, Cook JT, Frank DA. Child food insecurity and iron deficiency anemia in low-income infants and toddlers in the United States. *Matern Child Health J.* 2006 Mar;10(2):177-85. PubMed PMID:16328705.
- Cook JT, Frank DA, Berkowitz C, Black MM, Casey PH, Cutts DB, Meyers AF, Zaldivar N, Skalicky A, Levenson S, Heeren T, Nord M. Food insecurity is associated with adverse health outcomes among human infants and toddlers. *J Nutr.* 2004 Jun;134(6):1432-8. PubMed PMID: 15173408.
- Rose-Jacobs R, Black MM, Casey PH, Cook JT, Cutts DB, Chilton M, Heeren T, Levenson SM, Meyers AF, Frank DA. Household food insecurity: associations with at-risk infant and toddler development. *Pediatrics.* 2008 Jan;121(1):65-72. doi:10.1542/peds.2006-3717. PubMed PMID: 18166558.

9. Impact of food insecurity on infant/toddler health and development

- Zaslow M, Bronte-Tinkew J, Capps R, Horowitz A, Moore KA, Weinstein D. Food security during infancy: implications for attachment and mental proficiency in toddlerhood. *Matern Child Health J.* 2009 Jan;13(1):66-80. doi:10.1007/s10995-008-0329-1. Epub 2008 Mar 4. PubMed PMID: 18317892.

10. Specific food safety concerns for this population, such as exposure to lead and mercury and potential choking risks associated with food (e.g., texture, shape, etc.)

Rationale: Because infants and toddlers increase their exposure to things within their environment as a result of increasing mobility and independent movement, they are at increasing risk of choking (Altkorn, 2008; Cyr, 2012) and exposure to potential toxic materials/substances in their food and environment (Piccinelli, 2010). Guidance is needed to limit exposure to toxic/unsafe materials in the environment of infants and toddlers.

PICO:

Population: Infants and toddlers, aged 0–24 months.

Intervention/Exposure: Dietary behaviors that increase exposure to lead or mercury (i.e., from fish intake/human milk); choking risks associated with food (e.g., texture, shape, etc.).

Comparator: Dietary behaviors that decrease exposure to lead or mercury; food characteristics that decrease choking risk (e.g., texture, shape, etc.).

Outcomes: Food safety (including lead poisoning, mercury exposure, and choking).

Systematic Review Questions:

- What dietary behaviors increase the risk of lead poisoning among infants and toddlers?
- What dietary behaviors increase a toddler's risk of exposure to mercury among infants and toddlers?
- What food characteristics (i.e., texture, shape) are associated with increased risk of choking among infants and toddlers?

Data and Research Priorities:

- What is the role of nutritional status (e.g., general nutrition, calcium/vitamin D, thiamine, etc.) both as a predictor and an outcome of heavy metal exposure?
- What is the role of body composition in heavy metal exposure toxicity?
- What is the role of the caregiver? Are there parenting "style" issues that might contribute to increased exposure to either toxic or choking risk?
- Are there differences in incidence of choking at home versus day-care?

Supporting Documents:

- Cyr C; Canadian Paediatric Society, Injury Prevention Committee. Preventing choking and suffocation in children. *Paediatr Child Health.* 2012 Feb;17(2):91-4. English, French. PubMed PMID: 23372401; PubMed Central PMCID: PMC3299355.
- Altkorn R, Chen X, Milkovich S, Stool D, Rider G, Bailey CM, Haas A, Riding KH, Pransky SM, Reilly JS. Fatal and non-fatal food injuries among children (aged 0-14 years). *Int J Pediatr Otorhinolaryngol.* 2008 Jul;72(7):1041-6. doi:10.1016/j.ijporl.2008.03.010. Epub 2008 May 2. PubMed PMID: 18455807.
- Piccinelli R, Pandelova M, Le Donne C, Ferrari M, Schramm KW, Leclercq C. Design and preparation of market baskets of European Union commercial baby foods for the assessment of infant exposure to food chemicals and to their effects. *Food Addit Contam Part A Chem Anal Control Expo Risk Assess.* 2010 Oct;27(10):1337-51. doi: 10.1080/19440049.2010.489913. PubMed PMID: 20635267.

11. General food preparation, handling, and storage issues related to this population

Rationale: Specific concerns related to toddler feeding include issues related to food preparation, "the 5-second rule" and the parental habit of carrying food for children for long periods without refrigeration (Turck, 2012).

PICO:

Population: Toddlers, aged 12–24 months.

Intervention/Exposure: General food preparation, handling, and storage issues, specifically consuming food that has dropped on the floor and consuming food that hasn't been refrigerated properly.

Comparator: Consuming food that hasn't dropped on the floor and consuming food that has been refrigerated properly.

Outcomes: Risk of foodborne illness.

Systematic Review Questions:

- What is the risk of foodborne illness associated with consuming food that has been mishandled?
- What is the risk of foodborne illness associated with consuming food that hasn't been refrigerated properly?

Data and Research Priorities:

- Who is the source of greatest risk (child/caregiver characteristics)?
- Race, gender, father versus mother, versus other caregivers.
- Are there nutritional risks/consequences?

Supporting Documents:

- Turck D. Safety aspects in preparation and handling of infant food. *Ann Nutr Metab*. 2012;60(3):211-4. doi: 10.1159/000338215. Epub 2012 Jun 6. PubMed PMID:22699771.