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Home visitation programs: An untapped opportunity for the delivery of early childhood obesity prevention

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Abstract

Background—Extant obesity efforts have had limited impact among low-income underserved children, in part because of limitations inherent to existing programs: 1) short duration and low intensity; 2) late timing of implementation, when children are already overweight or obese; 3) intervention delivery limiting their accessibility and sustainability; and 4) failure to address barriers such as a lack of culturally competent services, poverty and housing instability, which interfere with healthy lifestyle changes.

Objective—This concept paper proposes an innovative model of obesity prevention implemented in infancy and sustained throughout early childhood to address the limitations of current obesity prevention efforts. Specifically, we propose to integrate sustained, weekly, in-home obesity prevention as part of the services already delivered by ongoing Home Visitation Programs, which currently do not target obesity prevention.

Conclusion—The home visiting structure represents an ideal model for impactful obesity prevention as home visitation programs: (1) already provide comprehensive services to diverse low-income infants and families who are most at risk for obesity and poor health due to socio-economic and structural conditions; (2) services are initiated in infancy and sustained throughout critical developmental periods for the formation of healthy/unhealthy behaviors; and (3) have been in place for more than 40 years, with a widespread presence across the United States and nationwide, which is critical for the scalability and sustainability of obesity prevention.

Keywords

Obesity prevention; infancy; early childhood; home visiting programs

Background

In their last report, the World Health Organization (WHO) Commission on Ending Childhood Obesity stressed the importance of addressing obesity risks in the “first 1,000 days” — the period from conception to age 2 years (1). The emphasis on infancy and early

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childhood as “critical periods” for obesity prevention is not surprising considering the mounting evidence supporting the origins of childhood obesity and related disparities in infancy (2). Young children are now experiencing medical conditions that were once diagnosed almost exclusively in adults (3-5), such as Type 2 diabetes (6, 7), cardiovascular disease (8) and hypertension (5, 9-11). Once established, obesity is hard to reverse (12), and rapid weight gain in the first year of life already predicts obesity later in life (13-15). The stability of obesity across the lifespan, and the physical, psychosocial and financial costs related to obesity for the individual and the larger society (16-19) stress the importance of correcting weight trajectories before at-risk children become overweight or obese. Unfortunately, extant childhood obesity prevention efforts have had limited success (20), especially among underserved, low-income children (21, 22).

This concept paper presents a potentially scalable, sustainable, and cost-effective model of obesity prevention delivery, which involves the integration of primary (infants) and secondary (mothers) obesity prevention into the services of ongoing home visitation programs (HVPs). The intent is not to review the literature on infancy and early childhood obesity as this research has been reviewed elsewhere (20-22). Rather, this concept paper outlines the advantages of integrating early obesity prevention as part of the services already provided by home visitation programs nationwide. Over the last three years, our team of researchers, clinicians and stakeholders has integrated key evidence-based nutrition and physical activity components and behavioral strategies into the curriculum and services provided by our HVP partner, the Healthy Families America evidence-based home visiting model. Combining HVP services and obesity prevention circumvents previous barriers encountered in addressing infancy and early childhood obesity prevention among underserved low-income families. On the one hand, HVPs are successful in addressing maternal and infant psychosocial and physical health among at-risk families, but they have not targeted obesity, or comprehensively addressed maternal and infant nutrition and physical activity. On the other hand, as reviewed below, obesity programs have had some level of success with families who can access services (23-26), but the impact of these programs has been limited due to the timing and duration of implementation (2) and because of their delivery modality in outpatient settings (27-29). Embedding maternal and infant nutrition and physical activity into the home visitation comprehensive system of child and maternal health services has several benefits and the potential to overcome the shortcomings of previous efforts.

As applied here, the term “home visitation” refers to home-based parenting support to enhance developmental, health, and safety outcomes in young children. Home visitation programs provide comprehensive services to mothers and infants in the United States (U.S.), Puerto Rico, the Northern Mariana Islands Mexico, Australia, New Zealand, Canada and Europe. The examination of several home visiting curricula and our close collaborations with nationwide HVP directors revealed that, to date, there has been no explicit and enduring effort to target obesity prevention or comprehensive nutrition and physical activity as part of HVPs curricula, possibly because the initial focus of HVPs 40 years ago was to decrease the incidence of low birth weight (30, 31). However, the current prevalence of overweight and obesity among HVPs children (which exceeds rates of 40% in the United States), the mounting evidence that healthy nutrition and physical activity are independent

predictors of chronic diseases such as diabetes, cancer and cardio-vascular diseases, and the recent recommendations from the WHO, the Institute of Medicine (IOM) (32), the United States Department of Agriculture (USDA), and Health and Human Services (DHHS)(33, 34) to address key factors influencing obesity risk in children from birth to 24 months of age, highlight the need to innovatively re-conceptualize the mission and capabilities of HVPs to address obesity prevention for all children.

Below, we briefly review current limitations of existing obesity efforts. These gaps have been systematically reviewed and discussed elsewhere (20-22), and they are summarized here to betoken the underlying premises of the proposed model of delivery. Next, we outline the integration of obesity prevention into an ongoing HVP to reach and engage families. It is important to clarify at the onset that the goal is not to offer “new” obesity prevention components. Consistent with an implementation science framework, this initiative is innovative in extending the mission and capabilities of HVPs to address the increased childhood obesity prevalence in this segment of the population, and intervene in the first 1000 days in a cost-effective, scalable and sustainable way. This model of delivery builds upon the existing HVP infrastructure that successfully addresses multilevel health barriers. Services are initiated during or shortly after pregnancy and sustained through early childhood (2-5 years-of age depending on the model). The in-home delivery of services makes it possible to help families develop ecologically sensitive lifestyle changes and generalize intervention gains to their home environment.

Gaps in Existing Childhood Obesity Interventions and Prevention Programs

Gap 1: Obesity disparities persist among underserved segments of the population

Although a recent nationally representative study found a decline in obesity for children ages 0-5, this was not true for low-income and non-white children (35). In fact, 40% of low-income children enrolled in federally funded programs are overweight or obese by age five (36-39). In Los Angeles (LA) County we have shown a strong association between the prevalence of childhood obesity and increasing economic hardship, with childhood obesity prevalence 7-fold higher in low-income compared to affluent neighborhoods (40). Sadly, even the most successful obesity strategies have had limited impact among economically disadvantaged families, partly because of their failure to address factors which profoundly affect the ability of at-risk families to adhere to lifestyle changes in real-world settings (41, 42). Initiating and maintaining healthy habits is ubiquitously difficult, especially for families who face a multitude of barriers such as a lack of access to linguistically and culturally competent services, poverty, housing instability, and food insecurity (21). These challenges highlight the need to re-conceptualize obesity prevention, by embedding maternal and infant nutrition and physical activity intervention in a comprehensive system of child and maternal health services (1). This is precisely what the integration of a maternal and infant nutrition and physical activity curriculum into the services of HVPs achieves.

Gap 2: The outpatient delivery modalities of obesity efforts restrict the reach and engagement of families who are most at-risk for obesity, and perpetuate health disparities

Much research has been conducted on the advantages of modifying the family environment to “treat” obesity (25). Family-based behavioral interventions provide lifestyle and cognitive-behavioral techniques to improve nutrition, physical activity, and psychosocial health (25, 43-45) to parents (typically mothers) and children. Parents are taught multiple skills such as restructuring the home environment to support healthy behaviors for all family members, supporting children’s healthy behavior changes, modeling healthy behaviors for their children, and problem-solving in the face of challenges (23-26). Despite their emphasis on the role of the home environment in the genesis and maintenance of obesogenic behaviors, however, family-based obesity interventions are usually delivered in outpatient specialized clinics rather than in the families’ homes (see (46, 47) for an exception). Not only does the outpatient model impose considerable burdens on low-income families (e.g., transportation, childcare) and interfere with adherence (27-29), but this modality is arguably not optimal to generalize intervention gains to the families’ natural environment. Furthermore, although family-based programs are efficacious for *weight loss* in both parents and children (48, 49), the ability of this model to “prevent” the development of obesity is not clear (50). Including parents and family members is less common for programs focused on preventing the onset of obesity, with only 40% of childhood obesity prevention programs including a family component and only 5% explicitly targeting behavioral change among multiple family members (51). In fact, most obesity prevention programs are not embedded into existing service delivery systems to promote their accessibility and scalability. Integrating maternal and infant nutrition and physical activity into HVPs makes it possible to deliver the material in the home, in the relevant environment where behaviors occur.

Gap 3: Rapid weight gain in the first months of life is already associated with greater odds of child obesity later in childhood and adolescence (52). Yet, most obesity programs focus on school-aged children, when many youth are already overweight or obese

Very young children are now experiencing medical conditions that were once diagnosed almost exclusively in adults, such as Type 2 diabetes (6, 7), cardiovascular disease (8) and hypertension (5, 9). This is particularly concerning because childhood obesity tracks into adolescence and adulthood (e.g., (13-15)). Child-feeding practices and early nutritional experiences play a key role in shaping children’s health behaviors and weight outcomes (53-56). In a sample of 718 parents of children ages 3-5y, parents with an indulgent feeding style (i.e., parents who make few demands on their children to eat, or demands that are nondirective and non-supportive) had children with a higher BMI (57), a finding that has been replicated in 177 Head Start families (58). Another potential mechanism by which maternal factors might mediate infant outcomes is via breastfeeding. In developed countries, some studies suggest that breastfeeding is protective for childhood obesity (59-62). However, not all studies support this view (63-68). These mixed findings suggest that a range of maternal factors, including mothers’ feeding practices (69-73), mother’s energy intake and diet while breastfeeding, food insecurity (as it relates to energy intake), and physical activity may impact child obesity outcomes (74-82). The integration of obesity prevention into HVPs makes it possible to monitor these factors and intervene during critical developmental periods for the formation of healthy/unhealthy behaviors.

Gap 4: The postpartum period is a pivotal but overlooked time for averting the intergenerational transmission of obesity

Despite the evidence highlighting the interplay between maternal and child obesity, only a few trials have focused on modifying maternal-infant nutrition (83-87). The postpartum period is undoubtedly a pivotal time for secondary prevention in mothers. About 25% of women experience significant weight retention after pregnancy (88-91), and this proportion is even higher for low-income women of color (92-95). Women who are overweight or obese prior to pregnancy are at higher risk of postpartum weight retention (96, 97). Overweight or obese mothers, in turn, may inadvertently expose their children to an obesogenic environment and feeding practices (69-73). Conversely, new mothers may be especially primed for lifestyle and behavior change because of the increased salience and value of adopting healthy behaviors (97-99). Positive changes in mothers' behaviors and in the home environment would not only be beneficial for their own health, but can potentially influence their children's diet, physical activity, and weight trajectories during the critical first 1000 days (100). This has the potential to disrupt the intergenerational transmission of health risk behaviors, obesity, and health disparities. Simultaneously targeting mothers and infants is a more cost-effective use of resources and a potential innovation in terms of targeting pre-conceptual health promotion in the mother before subsequent pregnancies.

Gap 5: The delivery models of obesity prevention and related research limit their clinical impact as well as our understanding of causal, moderating and mediating factors of obesity and treatment effects

A few trials have focused on modifying maternal-infant nutrition (Table 1) with some level of success in decreasing or preventing obesity (83-87). However, the short delivery and low intensity of these interventions greatly decreases their clinical impact. The short intervention delivery is inadequate to cover the critical periods of infancy and early childhood for obesity development (101), and insufficient to consolidate learning of these behaviors for a prolonged period of time. Even when maintenance is directly addressed, or planned as part of the intervention, the maintenance phase rarely (if ever) exceeds a few weekly one-hour sessions, which is insufficient to ensure the mastery of learned skills and their translation into lifelong healthy habits. By contrast, home visitation services typically consist of weekly visits initiated during pregnancy or shortly after birth, and maintained until the child reaches 2-5 years old. This ongoing model of delivery is not only promising in terms of sustainability of healthy lifestyle changes, but it also represents a unique opportunity to study pathways involved in the intergenerational transmission of obesity, and further our understanding of previously neglected causal, moderating and mediating factors of treatment effects (102).

Gap 6: Despite the prominence of complex family and social systems models for obesity, few childhood obesity initiatives have translated these concepts into practice (103, 104)

Although the clustering of obesity in families is partially explained by shared genetics; behavioral and environmental factors undoubtedly contribute to the expression of the obesity phenotype (105-107). Families share exposure to social-ecological constraints (108, 109), and diet and physical activity practices (110), accounting in part, for the intergenerational

transmission of obesity. The efficacy of family-based obesity interventions, among those who can adhere to program recommendations (24, 25, 45, 111, 112), and the strong associations between child and parent weight outcomes (113) further support the power of the family system to impact children's health trajectories. The proximate social networks and community contexts in which families are embedded (i.e., the relationships among family, friends, community members, and organizations) are important in health promotion initiatives because they provide models for healthy or unhealthy practices (114-116), are sources of support, information, and resources (117-121), and can ultimately promote or impede behavior change and maintenance (118, 122-124). Initiatives that holistically target family and community systems to harness factors and relationships that support healthy behavior change have the potential to improve translation by augmenting all stages of the Reach, Effectiveness - Adoption, Implementation, Maintenance framework (RE-AIM) of family-based obesity efforts (124-129).

Home visitation programs: an untapped opportunity to prevent childhood obesity in at-risk children

Annually, over 500 publicly and privately funded models of HVPs (e.g., Nurse-Family Partnership, Healthy Families America, Parents as Teachers, Early Head Start) provide education, training, case management, community linkage, referral, and advocacy to more than 650,000 low-income, underserved mothers and their infants in the U.S. Home visiting services are embedded in a comprehensive system of child and maternal health services that is designed to promote optimal child development and prevent adverse outcomes (130-134). Home visitation programs have been in place for more than 40 years in the U.S., with \$1.5 billion annual investment from the Affordable Care Act (135), which speaks to the sustainability of the services provided. The free and voluntary weekly visits begin during pregnancy or shortly after birth, and typically continue until the child reaches 2-5 years old.

Although there is some variability in the qualification requirements of home visitors across HVP models, they typically share common elements. Home visitors in the Healthy Families America model (our partnering HVP) are Registered Nurses or License Vocational Nurses (under the supervision of Registered Nurses) who are matched to families on cultural background and language (English or Spanish), to provide culturally sensitive services. Home visitors are selected because of their personal characteristics (i.e. non-judgmental, compassionate, ability to establish a trusting relationship, etc.), their experience working with culturally diverse communities and in handling situations they may encounter when working with at-risk families. All visitors receive training in cultural competency, substance abuse, reporting child abuse, domestic violence, drug-exposed infants, and services in their community. Home visiting Staff further receive intensive training specific to their role (i.e., assessment, identifying at-risk families, promoting preventive health care, immunizations, utilizing creative outreach efforts, developing individual family support plans, teaching parent-child interaction, etc.). Staff receive weekly supervision, ongoing developmental training, and have limited caseloads (10-15 families) to meet their families' needs.

The HVP infrastructure is truly unique in providing in-home services, which removes barriers to accessing the program (e.g., transportation, childcare), promotes the generalization of skills to the home environment, and enables ethnically and racially diverse families to access culturally competent health services. In the U.S., HVPs have existing partnerships with Women, Infants and Children (WIC) programs nationwide, and they already address many barriers to healthy lifestyles such as unemployment, family conflict and violence, housing instability, and neighborhood characteristics. The extensive timeframe for service delivery (2 to 5 years post partum) makes it possible for home visitors to transfer and reinforce knowledge, skills and new behaviors, and to help families develop social and community linkages and networks promoting sustainability of health outcomes. The widespread presence of HVPs across the U.S., and their established infrastructures in many urban and rural areas (136-139), lend themselves to the scalability of services across the U.S.

Randomized controlled trials (RCTs) show that high-quality HVPs can effectively improve children's physical and psychosocial health such as birth outcomes, breastfeeding, immunization rates, smoking and overall cognitive and social development (134, 136, 139-157). Although some HVPs provide basic information on infant nutrition, there has been no comprehensive, and sustainable effort to address childhood obesity prevention, nutrition, and physical activity as part of their services, possibly because the initial focus of HVPs, 40 years ago, was to decrease the incidence of low birth weight (30, 31). The current prevalence of overweight and obesity among HVPs children, and the increased emphasis on the importance of intervening in infancy and early childhood from the WHO, the IOM, the USDA and the DHHS, may prompt a new national mandate to address childhood obesity prevention as a part of HVP services.

COPE: Childhood Obesity Prevention @ home / Contrarrestar Obesidad: Programa para niños En casa

Childhood Obesity Prevention @ home / Contrarrestar Obesidad: Programa para niños En casa (COPE) is a collaborative initiative involving researchers, clinicians, HVP stakeholders and families, which emerged in response to the unmet needs and resources voiced by HVPs to address the increasing prevalence of obesity among HVP children. The proposed model does not offer "new" obesity prevention components, but instead proposes a promising model of dissemination, consistent with implementation science, which integrates evidence-based nutrition and physical activity strategies into the curriculum of HVPs to reach and engage an underserved segment of the population. COPE's strategies are shaped by the five stages outlined in the RE-AIM framework (Reach, Efficacy, Adoption, Implementation, and Maintenance) to optimize the scalability and the public health impact of this initiative (158-166) the COPE delivery model deviates from the majority of existing programs in several ways: (1) hands-on/learn-by-doing and experiential pedagogical approaches; (2) in-home delivery to promote ecologically-valid learning and generalization of intervention outcomes; (3) sustained implementation (2-5 years depending on the HVP model) to promote repetition, behavioral rehearsal and mastery and maintenance of learned skills; (4) individualized goal setting and decision-making to help parents modify cues in their home

environment, change unhealthy habits and support alternative health behavior; and (5) linkage with community “healthy” resources and with other families to foster the development of healthy social networks and support for long-term maintenance. This initiative is similar to the Healthy Beginnings Randomized trial (167-169), an early family-focused intervention addressing the prevention of overweight and obesity in early childhood implemented in Sydney, Australia. However, in contrast to Healthy Beginnings, which delivers eight home visits from the antenatal period to 24 months, the COPE module is fully yet incrementally integrated into the weekly home visiting curricula for the entire duration of services (2-5 years depending on the HVP model).

It is also important to note that COPE does not target weight loss, rather our overarching model (Figure 1) promotes maternal healthy behaviors and practices, a healthy home environment, and supportive family and community social networks, as key pathways affecting child outcomes during the important developmental periods of infancy and early childhood (170, 171). Although mothers/infants are the focus of HVPs and COPE, all visits are delivered in the home to the entire families. Fathers and other families members are actively involved whenever possible. This approach is based on the *Ecological Systems Theory*, *Family Systems Perspective* and on the *Life Course Perspective*. These frameworks provide the rationale for targeting the maternal and social mechanisms to initiate, reinforce, and maintain healthy behaviors in infancy/early childhood. The Ecological Systems Theory and Family and Community Systems perspective emphasize the need to consider the impact of individual, family, community, and societal factors on health and social outcomes (172). Social networks, which include parent-child dyads as well as other family, friends, and important individuals and organizations, exert influence on obesity and related behaviors that should be harnessed (173). Finally, the Life Course Perspective underpins our focus on the intergenerational transmission of health behavior and on the importance of intervening during critical life stages. This model also emphasizes how differential exposures to risk / protective factors at key points across the lifespan contribute to health disparities (174-178).

COPE Curriculum Content

Maternal nutrition

Home visitors teach mothers to prepare and store foods they receive from *WIC* and the *Food Bank*, and to gradually build healthier nutrition and activity goals congruent to their cultural practices and ethnic specific food palate: (a) increasing intake of vegetables and fruits (5 servings/day of fruits and vegetables) and integrating nutrient-dense ingredients in their families’ meals/recipes; (b) limiting intake of high-saturated fat and sugar in modifying families’ favorite recipes (the material is adapted to families’ cultural and personal preferences); (c) eliminating sugar-sweetened beverage intake in providing information and activities on sugar content, long-term effects of high sugar consumption, importance of drinking water, and impact of advertising (179-185); (d) teaching healthy portion sizes using different visual activities.

Infants/young children nutrition

The curriculum promotes sustained breastfeeding for the first two years and the gradual integration of complementary feeding (pureed and age-appropriate solid foods) that support healthy eating for infants. Mothers learn about feeding/eating developmental stages and transitions, and healthy feeding (32-34, 186) practices to promote: (a) responsiveness to child hunger and fullness cues; (b) the consumption of nutrient-dense foods (as opposed to energy-dense); (d) the transition to structured schedule for meals/snacks from complementary feeding; and (d) the use of non-food related child soothing techniques. Mothers also learn strategies to address neophobia (187, 188), such as repeated multi-sensory (i.e., smell, touch, taste) exposures to nutrient-dense novel foods (189), gradual texture shaping, parents/caregivers modeling, and involvement of children in food selection and preparation; and strategies to handle meal-related tantrums (e.g., redirection, positive reinforcement of appropriate behaviors) (190, 191).

Maternal/child physical activity

Although there are no unequivocally accepted guidelines for the number of minutes children 0-2yo should be active each day (192), the DHHS has summarized recommendations from the National Association for Sport and Physical Education, the American College of Sports Medicine, and the National Institutes of Health: (a) daily planned physical activities, including tummy time, that safely support the infant's developmental milestones (e.g. head and neck self-support, rolling, floor sitting, kicking, crawling, reaching and grasping for objects, etc.); (b) engage in 30 minutes of supervised but *unstructured* physical activity each day; and (c) avoid being sedentary for more than 60 minutes at a time, except when sleeping. The American Academy of Pediatrics (A.A.P.) Expert Committee further suggests limiting screen time (193). The childhood obesity prevention module is premised on the above guidelines in addition to CDC guidelines for adults (150 minutes of moderate intensity physical activity/week). The curriculum teaches parents to make activity/play a daily habit for their entire family by exploiting lifestyle activities (e.g., taking the stairs, walking to the shop). Home visitors help parents design activities around their local environment, schedule, and preferences, and to optimize their use of safe spaces. Parents are provided with information about resources and free group activities conducive to physical activity (e.g., parks, walking clubs, outings, etc.), and classes they can take with their children and with other HVP families. The curriculum emphasizes the importance of parents co-engaging in activities with their children to set a good example through modeling and to provide opportunities for their children to be physically active.

COPE Delivery Format

Through our formative work and pilot research it became clear that both didactic and experiential approaches were needed to effectively reach, engage and mobilize families.

Didactic Individualized Education

The didactic strategy focuses on in-home individualized coaching to help mothers implement changes in their "natural environment". A strong emphasis is placed on *gradual goal setting* in which mothers set objectives for their own and their children's weekly

activity and diet (e.g., decreasing by “x” the number of sugar-sweetened beverages; trying “x” new vegetables this week) and on *parent modeling* healthy behaviors (i.e., parent co-engaging in healthy behaviors with their children). Parents are also taught behavior management and cognitive-behavioral strategies to change their home environment. For example, mothers receive individual coaching to gradually eliminate high-energy dense foods from the home environment and prevent mindless eating. Parents also work on modifying their home to make it more conducive to making choices that support exercising, such as removing computer and televisions from sleeping areas (193).

Social and Experiential Activities

These activities were developed based on families’ desire to engage in experiential/“hands-on” activities and strategies (e.g., concrete demonstrations, activities and practices) to develop practical skills that generalize to their everyday life. They also requested *social activities* centered on health behaviors. The social and experiential activities that we created (Table 2) are similar to those delivered as part of the National Institute of Food and Agriculture’s Expanded Food and Nutrition Education Program (194). These activities aim to promote group learning, goal setting, and communal coping strategies (195, 196), as well as the development of supportive healthy social networks (197) and communities to reinforce healthy changes and assist long-term sustainability.

Conclusion

In fiscal year 2009–2010, 46 states and the District of Columbia made \$1.4 billion available for early childhood home visitation programs, with most states investing in at least two programs (198). Investment in these services remains strong, with the Affordable Care Act allocating \$1.5 billion for states to invest in home visitation programs (139). Home visitation programs successfully promote child development and reduce risks of negative psychosocial and academic outcomes. However, their application to childhood obesity prevention has never been tested. Successful outcomes would have a major impact on the conceptualization of childhood obesity care. Because of its comprehensiveness, widespread presence across the U.S. and natural partnership with WIC programs, the HVP model is ideal for the scalability of obesity prevention. Developing and testing an initiative that builds on this existing infrastructure greatly improves the potential to translate evidence-based weight-control programs into sustainable policy changes that can be disseminated on a larger scale. COPE was designed with the overarching goal of increasing the program’s generalizability and sustainability without sacrificing effectiveness. These translation efforts are aligned with the RE-AIM framework (158-166) to enhance the quality, speed, and public health impact of prevention programs. The RE-AIM model has been successfully used to disseminate obesity, physical activity and healthy lifestyle programs (199-204), and is viewed as a proactive approach to translate research into communities. Furthermore, in order to continue receiving funding from the Department of Health Resources and Services Administration, Maternal, Infants and Early Childhood Home Visiting program, HVPs are mandated to annually evaluate the effectiveness of their services on targeted benchmark areas (maternal and newborn health, child physical and social development, child abuse and neglect, crime or domestic violence, family economic stability, and maternal depression). This ongoing,

nationwide evaluation infrastructure is ideal to continuously monitor the effectiveness of COPE on infants' nutrition, activity and weight in the real world.

In terms of dissemination, the addition of COPE to different HVPs' curricula will necessitate training of home visitors from different sites. The dissemination will also require the input of local stakeholders and families, as they are best suited to identify the staffing and physical resources available that can be harnessed to promote healthy changes. This said, COPE can easily be adapted to best suit and accommodate the needs of different ethnic and racial populations (e.g., cuisines, lifestyle activities preferences, household composition), and our close collaboration with the Healthy Families America national directors will facilitate the deployment of COPE to other sites nationwide.

Empirical evidence and theoretical frameworks highlight the lifelong consequences of health determinants experienced in infancy and early childhood (174, 205-217), with the family system and their broader social-ecological environment being central to shaping these health outcomes. A healthy home environment is thought to promote healthier nutrition and weight trajectories, while exposure to an obesogenic environment may have long-lasting consequences for child health and weight. The HVP model of obesity prevention has great public health implications to address the intergenerational transmission of obesity, reduce lifelong health struggles for individuals, and reduce the financial burden for the society as a whole.

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Figure 1.

COPE intervenes on mothers' eating/activity, feeding practices, food security, social networks and weight. After accounting for genetic, maternal phenotype and environment are effectors of child outcomes.

Table 1

Treatments and prevention programs targeting obesity in infancy and early childhood.

Treatment vs. prevention	Study name and design	Components and delivery	Sample	Outcomes
Prevention	Healthy Beginnings randomized control trial (164-166)	First-time mothers of newborn babies receive eight home visits from a specially trained research nurse delivering a staged intervention beginning in the antenatal period, and then at one, three, five, eight, 12, 18 and 24 months.	Initial RCT: 667 first time mothers and their infants(166) Longitudinal follow-up: 465 participating mothers consenting to be followed up at 3 years after intervention until their children were age 5 years(165)	Initial RCT: Mean BMI was significantly lower in the intervention group (16.53) than in the control group (16.82), with a difference of 0.29 (95% confidence interval -0.55 to -0.02; P=0.04)(166) Longitudinal follow-up: 369 mothers and their children completed the follow-up study. The differences between the intervention and control groups at age 2 years in children's BMI and BMI z score disappeared over time. No effects of the early intervention on dietary behaviors, quality of life, physical activity, and TV viewing time were detected at age 5 years.(165)
Prevention *	The Melbourne Infant Feeding Activity and Nutrition Trial (InfANT); randomized control trial(83, 85, 100)	Parents received six 2-hour dietitian-delivered sessions over 15 months. Target parental behavioral skills related to infant feeding Parenting skills including aspects of healthy eating behaviors.(85)	542 first-time parents and infants (3.8mos at baseline) Implemented during the first 18 months of infancy	Children in the intervention group consumed fewer grams of sweet snacks and had fewer daily minutes of television. No difference in fruit, vegetable, savory snack, or water consumption; in BMI z-scores or physical activity. Reduction in high-energy snack and processed foods in mothers.
Prevention	The NOURISH randomized control trial with concealed allocation of individual mother-infant dyads(84, 215)	Community-based early feeding intervention. Mother-infant pairs were randomly allocated to 1) self-directed access to usual care or 2) attend educational modules delivered in groups, each delivered over 3 months. Targets anticipatory guidance on early feeding practices.	698 first-time mothers and infants (4-6mo at baseline) randomized to NOURISH (n=352 dyads) or control (n=346 dyads)	2012 study: Lower BMI z-score and less rapid weight gain by age 14mo(84) 2014 study: Intervention effects were evident on mothers' self-report of children's feeding behaviors (satiety responsiveness, fussiness, emotional overeating and food responsiveness Intervention children "liked" more fruits and fewer <i>non-core</i> foods and beverages. Intervention mothers reported greater "autonomy encouragement" feeding styles than control mothers.
Prevention	Penn State University	Tested the independent	Mother-infant pairs	Children receiving the combined

Treatment vs. prevention	Study name and design	Components and delivery	Sample	Outcomes
	Obesity Prevention pilot randomized control trial(86)	and combined effects of two behavioral interventions: "Soothe/Sleep" and "Introduction of Solids" delivered to parents. Two home visits delivered by nurses over a 1-year period.	were randomized to received both interventions (n= 42); the Soothe/Sleep intervention only (n=39), the Introduction Solids only (n= 38), or no intervention (n= 41)	interventions had lower weight-for-length percentile than children receiving only one component.
Prevention	Intervention Nurses Starting Infants Growing on Healthy Trajectories (INSIGHT)(183)	Focuses on responsive parenting and feeding to promote self-regulation and shared parent– child responsibility for feeding, reducing subsequent risk for overeating and overweight. Components framed around four behavior states: Sleeping, Fussy, Alert and Calm, and Drowsy. Nurses deliver interventions to first-time parents and their infants at four home visits in the first year after birth followed by clinical research center visits at ages 1, 2, and 3 years	316 first-time mothers and their full-term newborns randomly assigned to intervention (parenting/INSIGHT) or control (home safety control).	Pending
Prevention	The First steps for mommy and me randomized controlled trial in primary care setting(216)	Promotion of healthful behaviors among 0-6 month old infants and their mothers	60 mother-infants assigned to First Steps for Mommy and Me 24 mother-infant assigned to usual care	At 6 months, fewer infants in the intervention than in the control group had been introduced to solid foods, and intervention infants viewed less TV than controls.
Treatment	The High Five for Kids cluster randomized controlled trial(87)	Clinical practices in the community received primary care restructuring, and families received motivational interviewing by clinicians and educational modules targeting television viewing and fast food and sugar-sweetened beverage intake.	Ten pediatric practices were randomized to the intervention arm or usual care. 445 children aged 2 to 6 years (BMI 95th percentile or between the 85th and the 95th percentile if at least 1 parent was overweight.	Intervention participants had greater decreases in television viewing and fast food and sugar-sweetened beverage intake, compared to children receiving usual care.
Prevention and treatment ^{***}	<i>Creciendo Sanos</i> , pilot randomized controlled trial <i>Instituto Mexicano del Seguro Social</i> clinics(217)	Prevention of obesity in children 2-5 years old	306 pairs of parents and children (2-5 yo) randomized to <i>Creciendo Sanos</i> (n=168) or usual care (n=138)	<i>Creciendo Sanos</i> who adhere to the program (5-6 sessions) decreased snacks and screen time and increased vegetable intake compared to usual care. No effects on other behavioral

Treatment vs. prevention	Study name and design	Components and delivery	Sample	Outcomes
			Children were with WHO BMI z-score between 0 and 3.	outcomes or BMI.

* Labeled “Intervention”, however the InFANT program aims to *prevent* childhood obesity and promote healthy life-style choices, and targets infants’ obesity-risk behaviors and BMI.

** Intervention targets children across a wide range of weight-status.

Table 2

COPE experiential and social activities.

Activities	Description
Communal cooking	These gatherings aim to teach parents how to cook healthy meals with the foods they receive from WIC/food bank, and advance meal preparation to promote healthy home cooking and decrease reliance on fast food. The gatherings are lead by our HVP <i>Culinary Program Coordinator</i> , and take place in the Wellness Homes operated by our local community health partner. These homes were given to AVPH by the city of Lancaster to promote preventive care and education to underserved families. These homes have Wi-Fi and a fully equipped kitchen.
Community gardening	A master gardener teaches children and parents gardening techniques such as soil preparation and irrigation; planting, growing and harvesting fruits and vegetables. The classes include USDA/MyPlate activities targeting healthy meals and snacks. The gardens are located on Wellness Homes' grounds. Families are encouraged to tend the gardens with other local families.
Food management	These classes/tours are designed to improve food resource management practices such as purchasing, selecting, or otherwise obtaining; preparing; and storing foods to increase sustained availability of healthy foods throughout the month. This material is delivered during at local farmers markets and grocery stores.
Mobile food demos	Mobile cooking/food demonstrations hosted in neighborhood farmers markets.
Community lifestyle activities	Home visitors facilitate linkage to neighborhood and community activities, such as walking clubs, mommy and me exercises and parks and recreational activities in their neighborhood. Parents are also encouraged to seek support from their social networks and to exercise with friends, neighbors, relatives and other parents enrolled in HVP.