



Editorial

Invisible seams: Preventing childhood obesity through an improved obstetrics-pediatrics care continuum

1. Introduction

Obesity is an “unrelenting” challenge (Zylke and Bauchner, 2016). Yet if recent signs of progress among young children tell us anything, they reinforce the public health maxim that an ounce of prevention is worth a pound of cure. Recent analyses of National Health and Nutrition Examination Survey (NHANES) data between 1999 and 2014 show sustained increases in obesity prevalence among older children and adolescents (Skinner et al., 2016). Indeed, weight status often persists throughout childhood and into adulthood. However, similar analyses show the majority of significant declines in overweight and obesity prevalence have been among children under the age of five (Ogden et al., 2016).

These observed improvements raise a critical question: Are we too late in our attempts to curb obesity? Should public health and healthcare efforts focus more on health trajectory take-offs and less on mid-flight course corrections? Evidence continues to mount connecting prenatal and early childhood factors with subsequent health and disease risk, and even potentially overpowering some health behaviors later in life.

In this commentary we explore selected prenatal and early childhood factors that predispose children to excess fat accumulation and present a case for closer collaboration between Obstetric and Pediatric health care delivery as a means to prevent obesity.

2. Prenatal and early childhood factors influencing obesity

Obesity's etiology is a unique interaction between genetics, socioeconomic factors, and environmental conditions. Researchers and practitioners are rightly affording the early origins of obesity more attention and demonstrating important roles for epigenetics and the gut microbiome (National Academy of Medicine, 2015). A clearer picture is emerging tracing health's origins to factors before conception and during early childhood, particularly during the first 1000 days of life (Taveras, 2016). Many of them, such as a mother's pre-pregnancy health status, antibiotic and endocrine disruptor exposure, mode of delivery, breastfeeding, and sleep patterns during infancy, are posited to even override subsequent health behaviors, such as diet and physical activity.

2.1. Mother's health status

Maternal weight status and weight gain during pregnancy are both strong predictors of subsequent obesity risk in the child. In fact, some

posit genetics to account for more than 50% of observed obesity in childhood, in part, through the gut microbiome (Llewellyn et al., 2013). A 2014 study found a linkage between maternal obesity status and etiology and her offspring's microbiome composition, which played a role in shaping diet preferences and metabolism (Galley et al., 2014).

2.2. Antibiotic exposure

Studies have consistently identified associations between frequent antibiotic use early in life and subsequent obesity risk, likely from changes and lost diversity in the child's gut microbiome (Schwartz et al., 2016). This link may even extend into pregnancy. A 2015 study found that antibiotic exposure during the second or third trimester increased obesity risk in children by 84% (Mueller et al., 2015). Further, protective measures against obesity, such as breastfeeding, may not be able to overcome the significant microbiome alterations associated with early life antibiotic exposure (Korpela et al., 2016). Unfortunately, an estimated one in every three antibiotic prescriptions each year for adults and children is unnecessary (Fleming-Dutra et al., 2016).

2.3. Endocrine disruptors

Exposure to endocrine-disrupting compounds at critical points during development can result in permanent alterations to normal tissue development and influence health outcomes. Such compounds have been linked to a broad range of diseases in animals and humans, including metabolic syndrome and obesity. In the case of obesity, numerous studies have linked prenatal exposure to endocrine disrupting compounds and obesity in early childhood (Agay-Shay et al., 2015).

2.4. Breastfeeding

Breastfeeding and early childhood nutrition are critical for healthy development. A 2016 review found that longer periods of breastfeeding were associated with a 26% reduction in odds of developing overweight and obesity, and a 35% reduction in type 2 diabetes incidence (Victora et al., 2016). Longer breastfeeding duration also appears to particularly benefit higher-risk infants, including offspring of mothers with a high body mass index (BMI), lower education and socioeconomic status, and who smoked during pregnancy. Though exclusive breastfeeding rates in the United States have increased from 14% in 2007–09, they still fall well-short of the recommended 6-month duration (Centers for Disease Control and Prevention, 2014).

2.5. Mode of delivery

The mode of childbirth, whether vaginal or cesarean section, influences the colonization and composition of an infant's microbiome, shaping future health. Research to date has found a strong link between mode of delivery and the development of immune system function and disease (Neu and Rushing, 2011). Further evidence suggests an influence on long-term health. A recent review found a strong association between cesarean section and increased BMI, overweight, and obesity (Darmasseelane et al., 2014). However, caesarian section deliveries in the United States increased 60% between 1996 and 2009, and in 2014, one in three deliveries was by cesarean section.

2.6. Sleep patterns

Millions of American children lack sufficient sleep, influencing health, well-being, and cognitive function. Sleep duration and timing have been consistently linked to obesity risk, particularly among younger age groups. A 2015 review found children and adolescents with short sleep duration had twice the risk of overweight and obesity compared to those who slept for longer periods (Fatima et al., 2015). Other reviews have found similar results, suggesting an important role for pediatricians.

3. Healthcare reimaged for mothers and young children

Improved continuity across obstetrics and pediatrics could remedy a patchwork of services and provide a more coherent approach to addressing obesity's prenatal and early childhood origins. Often, obstetricians and pediatricians operate independently, applying differing skill sets to different clinical outcomes. However, as in the case of breastfeeding support, when providers assume an aspect of care is the responsibility of another provider, and communication between them is absent, significant gaps in care can emerge (Garner et al., 2016). This delegation of responsibility stems in part from inadequacies and inconsistencies in knowledge and skills across provider specialties related to obesity prevention. For example, less than half of PCPs report providing specific guidance on diet, physical activity, or weight control, the result of varying degrees of knowledge about current physical activity and healthy eating guidelines among providers, particularly those treating children (Wilder Smith et al., 2011) (Pronk et al., 2012). This knowledge gap translates into message and care inconsistencies, such as the thirty percentage point difference observed between pediatricians and OB-GYN physicians when it comes to providing comprehensive obesity prevention care (Klabunde et al., 2014).

Patient surveys of new mothers tell a similar story, who report receiving inadequate, inconsistent, and conflicting messages about breastfeeding within and across healthcare institutions (Cross-Barnet et al., 2012). Rushed visits, limited personalization of care and information, substandard information, a lack of peer support, and poor communication by providers are also common complaints by pregnant women (Lucas et al., 2014) (Novick, 2009). As a result, as has been observed in communications research, exposure to conflicting health messages increases confusion and doubt among message recipients, subsequently undermining the effectiveness of future health messages (Nagler, 2014), thereby influencing whether a pregnant woman, often the primary healthcare decision maker for families, will seek future care from the same healthcare system for herself and her family.

Remedying this type of discontinuity is a critical step to achieving improved population health and patient experience, and curtailing future health costs attributed to obesity, which are estimated to surpass \$60 billion annually in the United States by 2030 (Wang et al., 2011). The World Health Organization's Commission on Ending Childhood Obesity and the American Academy of Pediatrics have both endorsed a more intense focus on prenatal care, and stronger collaboration and integration between obstetrics and pediatrics as critical to preventing

obesity and other chronic conditions. Regarding breastfeeding, new guidelines from the U.S. Preventive Services Task Force specifically point to the discontinuity in breastfeeding support across obstetrics and pediatrics as a primary reason why women stop breastfeeding too soon (US Preventive Services Task Force, 2016). The Task Force goes on to suggest interventions focused on support and education during pregnancy and continuing through early childhood as important clinical considerations.

Greater continuity can be achieved through two critical improvements: provider training and use of community health workers (CHWs). As already alluded to, though recommended for pediatric obesity management, clinical practice to support health behavior adoption or modification varies considerably across providers (Daniels et al., 2015). A majority of physicians receive minimal formal education on lifestyle topics, such as nutrition, or accompanying training in counseling or motivation interviewing, skills in which they are increasingly recommended to deploy to treat patients who are overweight or obese. As a result, weight stigma and bias are common in healthcare, hampering quality of care and outcomes for patients (Phelan et al., 2015). Continuing education and training for healthcare professionals will be critical, which have already been shown to enhance clinical practice, such as improving breastfeeding counseling (Shen and Rudesill, 2016). Secondly, CHWs have been consistently found to effectively bridge between healthcare and communities, especially in the context of improving access and outcomes in underserved communities (Viswanathan et al., 2009). Several states, including Minnesota, have taken steps to establish Medicaid reimbursement for CHW activities, creating new opportunities for expanded care teams, and a means to leverage CHWs as facilitators of greater continuity across obstetrics and pediatrics (Rosenthal et al., 2010).

The synapse between obstetrics and pediatrics is a seam, and as entrepreneur and business writer Seth Godin describes it, seams are either visible or invisible (Godin, 2016). When seamless, "You can't tell where one part of the railing ends and the other begins." On the contrary, we often observe seams, and this discontinuity affects the quality of services and patient outcomes. Godin challenges, "...the problematic area is where you try to hide a seam, and you fail. Seams are a promise, an opportunity, a fresh start. Own them or make them invisible." Can we make the Obstetrics-Pediatrics seam invisible?

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References

- Agay-Shay, K., Martinez, D., Valvi, D., et al., 2015. Exposure to endocrine-disrupting chemicals during pregnancy and weight at 7 years of age: a multi-pollutant approach. *Environ. Health Perspect.* 123:1030–1037. <http://dx.doi.org/10.1289/ehp.1409049>.
- Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 2014r. Breastfeeding Report Card: United States. <http://www.cdc.gov/breastfeeding/pdf/2014breastfeedingreportcard.pdf> (Published 2014. Accessed April 22, 2016).
- Cross-Barnet, C., Augustyn, M., Gross, S., Resnik, A., Paige, D., 2012. Long-term breastfeeding support: failing mothers in need. *Matern. Child Health J.* 16:1926. <http://dx.doi.org/10.1007/s10995-011-0939-x>.
- Daniels, S., Hassink, S., Committee on Nutrition, 2015. The role of the pediatrician in primary prevention of obesity. *Pediatrics* 136 (1). <http://dx.doi.org/10.1542/peds.2015-1558>.
- Darmasseelane, K., Hyde, M.J., Santhakumaran, S., Gale, C., Modi, N., 2014. Mode of delivery and offspring body mass index, overweight and obesity in adult life: a systematic review and meta-analysis. *PLoS One* 9 (2), e87896. <http://dx.doi.org/10.1371/journal.pone.0087896>.
- Fatima, Y., Doi, S.A., Mamun, A.A., 2015. Longitudinal impact of sleep on overweight and obesity in children and adolescents: a systematic review and bias-adjusted meta-analysis. *Obes. Rev.* 16 (2):137–149. <http://dx.doi.org/10.1111/obr.12245>.

- Fleming-Dutra, K.E., Hersh, A.L., Shapiro, D.J., et al., 2016. Prevalence of inappropriate antibiotic prescriptions among US ambulatory care visits, 2010–2011. *JAMA* 315 (17): 1864–1873. <http://dx.doi.org/10.1001/jama.2016.4151>.
- Galley, J.D., Bailey, M., Kamp Dush, C., Schoppe-Sullivan, S., Christian, L.M., 2014. Maternal obesity is associated with alterations in the gut microbiome in toddlers. *PLoS One* 9 (11), e113026. <http://dx.doi.org/10.1371/journal.pone.0113026>.
- Garner, C., Ratcliff, S., Thornburg, L., Wethington, E., Howard, C., Rasmussen, K., 2016. Discontinuity of breastfeeding care: “There’s no captain of the ship.”. *Breastfeed. Med.* 11 (1):32–39. <http://dx.doi.org/10.1089/bfm.2015.0142>.
- Godin, S., February 13, 2016. How to Deal With Seams. Accessed February 14, 2016. http://sethgodin.typepad.com/seths_blog/2016/02/how-to-deal-with-seams.html.
- Klabunde, C.N., Clauser, S.B., Liu, B., et al., 2014. Organization of primary care practice for providing energy balance care. *Am. J. Health Promot.* 28 (3):e67–e80. <http://dx.doi.org/10.4278/ajhp.121219-QUAN-626>.
- Korpela, K., Salanen, A., Virta, L.J., Kekkonen, R.A., de Vos, W.M., 2016. Association of early-life antibiotic use and protective effects of breastfeeding: role of the intestinal microbiota. *JAMA Pediatr.* 170 (8):750–757. <http://dx.doi.org/10.1001/jamapediatrics.2016.0585>.
- Llewellyn, C.H., Trzaskowski, M., Plomin, R., Wardle, J., 2013. Finding the missing heritability in pediatric obesity: the contribution of genome-wide complex trait analysis. *Int. J. Obes.* 37:1506–1509. <http://dx.doi.org/10.1038/ijo.2013.30>.
- Lucas, C., Charlton, K.E., Yeatman, H., 2014. Nutrition advice during pregnancy: do women receive it and can health professionals provide it? *Matern. Child Health J.* 18 (10): 2465–2478. <http://dx.doi.org/10.1007/s10995-014-1485-0>.
- Mueller, N.T., Whyatt, R., Hoepner, L., et al., 2015. Prenatal exposure to antibiotics, cesarean section and risk of childhood obesity. *Int. J. Obes.* 39 (4):665–670. <http://dx.doi.org/10.1038/ijo.2014.180>.
- Nagler, R., 2014. Adverse outcomes associated with media exposure to contradictory nutrition messages. *J. Health Commun.* 19 (1):24–40. <http://dx.doi.org/10.1080/10810730.2013.798384>.
- National Academy of Medicine, 2015. Examining a Developmental Approach to Childhood Obesity: The Fetal and Early Childhood Years Workshop Summary. <http://www.nationalacademies.org/hmd/Reports/2015/Examining-a-Developmental-Approach-to-Childhood-Obesity.aspx> (Published March 2015. Accessed May 27, 2016).
- Neu, J., Rushing, J., 2011. Cesarean versus vaginal delivery: long term infant outcomes and the hygiene hypothesis. *Clin. Perinatol.* 38 (2):321–331. <http://dx.doi.org/10.1016/j.clp.2011.03.008>.
- Novick, G., 2009. Women’s experience of prenatal care: an integrative review. *J. Midwifery Womens Health* 54 (3):226–237. <http://dx.doi.org/10.1016/j.jmwh.2009.02.003>.
- Ogden, C.L., Carroll, M.D., Lawman, H.G., et al., 2016. Trends in obesity prevalence among children and adolescents in the United States, 1988–1994 through 2013–2014. *JAMA* 315 (21):2292–2299. <http://dx.doi.org/10.1001/jama.2016.6361>.
- Phelan, S., Burgess, D., Yeazel, M., et al., 2015. Impact of weight bias and stigma on quality of care and outcomes for patients with obesity. *Obes. Rev.* 16 (4):319–326. <http://dx.doi.org/10.1111/obr.12266>.
- Pronk, N.P., Krebs-Smith, S.M., Galuska, D.A., et al., 2012. Knowledge of energy balance guidelines and associated clinical care practices: the U.S. national survey of energy balance related care among primary care physicians. *Prev. Med.* 55:28–33. <http://dx.doi.org/10.1016/j.ypmed.2012.05.005>.
- Rosenthal E, Brownstein J, Rush C, et al. Community health workers: part of the solution. *Health Aff.* 2010;29(7):1338–1342. [10.1377/hlthaff.2010.0081](http://dx.doi.org/10.1377/hlthaff.2010.0081).
- Schwartz, B.S., Pollack, J., Bailey-Davis, L., Hirsch, A.G., Cosgrove, S.E., 2016. Antibiotic use and childhood body mass index trajectory. *Int. J. Obes.* 40 (4):615–621. <http://dx.doi.org/10.1038/ijo.2015.218>.
- Shen, Y., Rudesill, R., 2016. Impact of an educational intervention on breastfeeding counseling behavior of OB/GYN residents. *Breastfeed. Med.* 11 (6):293–296. <http://dx.doi.org/10.1089/bfm.2015.0191>.
- Skinner, A.C., Perrin, E.M., Skelton, J.A., 2016. Prevalence of obesity and severe obesity in US children, 1999–2014. *Obesity (Silver Spring)* 24 (5):1116–1123. <http://dx.doi.org/10.1002/oby.21497>.
- Taveras, E.M., 2016. Childhood obesity risk and prevention: shining a lens on the first 1000 days. *Childhood Obes.* 12 (3):159–161. <http://dx.doi.org/10.1089/chi.2016.0088>.
- US Preventive Services Task Force, 2016. Primary care interventions to support breastfeeding: US Preventive Services Task Force Recommendation Statement. *JAMA* 316 (16):1688–1693. <http://dx.doi.org/10.1001/jama.2016.14697>.
- Victora, C.G., Bahl, R., Barros, A.J., et al., 2016. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet* 387 (10017):475–490. [http://dx.doi.org/10.1016/S0140-6736\(15\)01024-7](http://dx.doi.org/10.1016/S0140-6736(15)01024-7).
- Viswanathan, M., Kraschnewski, J., Nishikawa, B., et al., 2009. Outcomes of community health worker interventions. Evidence Report/Technology Assessment Number 181. Agency for Healthcare Research and Quality, Rockville. <http://www.ahrq.gov/sites/default/files/wysiwyg/research/findings/evidence-based-reports/comhwork-evidence-report.pdf>.
- Wang, C.Y., McPherson, K., Marsh, T., Gortmaker, S., Brown, M., 2011. Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet* 378:815–825. [http://dx.doi.org/10.1016/S0140-6736\(11\)60814-3](http://dx.doi.org/10.1016/S0140-6736(11)60814-3).
- Wilder Smith, A., Borowski, L.A., Liu, B., et al., 2011. U.S primary care physicians’ diet-, physical activity-, and weight-related care of adult patients. *Am. J. Prev. Med.* 41 (1):33–42. <http://dx.doi.org/10.1016/j.amepre.2011.03.017>.
- Zylke, J.W., Bauchner, H., 2016. The unrelenting challenge of obesity. *JAMA* 315 (21): 2277–2278. <http://dx.doi.org/10.1001/jama.2016.6190>.

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