Differences in infant feeding practices by mode of conception in a United States cohort

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Objective: To identify associations between fertility treatment use (assisted reproductive technologies, ovulation induction, and artificial insemination) and subsequent infant feeding practices.
Design: The Upstate KIDS population-based cohort enrolled mothers who delivered live births in New York (2008-2010), sampling on fertility treatment and plurality.
Setting: Not applicable.
Patient(s): Data regarding singletons and one randomly selected infant between twins were used.
Intervention(s): Not applicable.
Main Outcome Measure(s): Mothers reported breast feeding and formula feeding practices at 4, 8, and 12 months postpartum. Modified Poisson regression was used to compare risks for feeding practices by mode of conception. Marginal structural models were used to estimate the controlled direct effects of fertility treatment on feeding, independent of preterm birth.
Result(s): Among 4,591 mothers, 1,361 (30%) conceived with the use of fertility treatments. Mothers who used fertility treatments were less likely to breast feed to 12 months after birth and were more likely to provide formula, solids, and juice by 4 months than mothers who did not conceive with treatments. Fertility treatment remained associated with breast feeding cessation and formula feeding in mediation analyses, suggesting that preterm birth does not fully explain these associations.
Conclusion(s): Women who conceived with the use of fertility treatments were less likely to breast feed later in infancy and were more likely to provide formula, solids, and juice earlier in infancy. Our analyses accounted for confounding and preterm birth, but other contributing factors may include difficulties feeding twins or workplace breast feeding accommodations. (Fertil Steril® 2016;105:1014–22. ©2016 by American Society for Reproductive Medicine.)
Key Words: Breast feeding, assisted reproductive techniques, infant nutritional physiologic phenomena, infant food

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There is increasing interest in the growth and development of children conceived with the use of fertility treatments (1). Infant feeding may contribute to both growth and development, yet few studies describe differences in feeding practices according to mode of conception. Differences may stem from the increased risks of preterm birth among those conceived with assisted reproductive technologies (ART) (2)—because this outcome may influence growth or nutritional needs in infancy and, perhaps, subsequent physician advice (3). Alternatively, difficulties breast feeding, socioeconomic factors, or anxieties that may be unique to or more prevalent among parents using fertility treatments may also be associated with infant feeding (4–6).

Current feeding guidelines in the United States (U.S.) recommend exclusive breast feeding in the first 6 months of life and then continued breast

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feeding to 12 months while solid foods and small amounts of juice are added to the infant's diet (7–9). Despite these recommendations, results from the Infant Feeding Practices Study II suggest that almost 40% of mothers in the U.S. introduce solid foods before 4 months; the prevalence was lowest among mothers exclusively breast feeding (24%) compared with those using mixed feeding (50%) (10). Many studies explore the influence of feeding on infant growth, but the inclusion of infants conceived with fertility treatments is seldom addressed, and few studies that examine the growth of these infants comment on feeding (11, 12). Further study of infant feeding practices according to mode of conception is warranted, because feeding is an important mechanism through which infant health and growth is influenced and there is an emerging body of literature reporting that breast feeding differences, in particular, do exist (4, 11,13–15). However, limited inference can be made as to why these differences exist, owing to small sample sizes, incomplete control for confounding by socioeconomic factors, and inappropriate adjustment for potential causal intermediates such as preterm birth.

Therefore, our objective was to compare feeding practices during infancy by mode of conception with the use of data from a U.S. population–based cohort: Upstate KIDS (2008–2010). We hypothesized that differences in feeding exist but may largely be explained by confounding or the higher prevalence of poorer birth outcomes among those conceiving with the use of treatments. By identifying differences in feeding and potential contributing factors, we can better understand if tailoring breast feeding or nutritional counseling for parents who conceived with the use of fertility treatments would be beneficial.

MATERIALS AND METHODS

Upstate KIDS is a population-based birth cohort established to study fertility treatment and child development (16). The cohort included live births from New York State (NY; New York City was excluded) from 2008 to 2010 sampled by fertility treatment exposure. All mothers who conceived with the use of treatments and all mothers of multiples were invited to participate. Singleton live births conceived without treatments were frequency matched on perinatal care region of delivery to a random sample of births conceived with the use of treatments (3:1). Study data were compiled from vital records, hospital discharge data, and written questionnaires completed after birth. Although all mothers of multiples were invited to enroll, analyses included information from mothers of singletons and one randomly selected infant from twin sets, because feeding was presumed to be similar within a set of twins (n = 4,971). We next excluded mothers who did not complete the baseline questionnaire (4 months after birth) in which feeding practices were first queried (n = 380; leaving a final n = 4,591). All participants provided informed consents, and study procedures were approved by the New York State Department of Health and University of Albany Institutional Review Boards (nos. 07-097 and 08-179, respectively).

Our primary exposure was any fertility treatment used in the index pregnancy, compared with no treatments. Treatment information came from questionnaires completed 4 months after birth; birth certificate data were used when this was missing. ART and ovulation induction/medications (OI) with or without additional procedures (e.g., intrauterine insemination [IUI]) were included in the fertility treatment group. Secondary analyses separating ART and OI/IUI were completed. Self-reported ART exposure was concordant with the Society for Assisted Reproductive Technology (SART) Clinical Outcome Reporting System (17).

Our dichotomous outcomes of interest included the following feeding practices during infancy (assessed via paper questionnaires at 4, 8, and 12 months after birth): any breastfeeding at a given time point, the provision of any formula at the time point, and providing solid foods or juices at the time point. Breast feeding questions did not distinguish between physical breast feeding or providing expressed breast milk. Solid food categories included cereal in a bottle, other cereals, fruit or vegetables, finger foods, pureed table food (4 months after birth only), or meat, eggs, cheese, or dairy. Mothers were queried about introducing juice into their baby's diet on each questionnaire, but not the type or amount.

Maternal, paternal, and infant characteristics, as well as feeding behaviors, were compared by mode of conception with the use of chi-square or Fisher exact tests as appropriate. For regression analyses, we used a modified Poisson regression with robust error variances to estimate risk ratios (RRs) and 95% confidence intervals (CIs), as described by Zou (18). Models were run for each time point within each outcome of interest. We also ran several independent regression models in sensitivity analyses: The first models limited our exposed groups to those who used only ART treatments (n = 649) or those who used only OI/IUI (n = 712); the next models added day care initiation to assess residual confounding by maternal return to the workplace and feeding practices of day care providers (all types of providers); we also ran models limiting the population to mothers submitting all questionnaires no later than 2 months after their intended completion dates (n = 843 removed) to assess the ideal scenario that feeding information was obtained near the times specified on questionnaires; and finally, we adjusted for whether or not another pregnancy occurred within the year after enrollment in a model for breast feeding at 12 months after birth.

To address the unique sampling strategy of Upstate KIDS as well as loss to follow-up, we used sampling and missingness weights in our models. We created a stabilized inverse probability weight for missingness for each outcome at each time point. We then multiplied the missingness weight with a sampling weight designed to correct for the study's sampling on region, fertility treatment, and plurality to make our data more representative of New York State during 2008–2010.

By using directed acyclic graphs (DAGs) and our knowledge of the literature, we selected the following potential confounders a priori: maternal age, race/ethnicity, postpregnancy body mass index (BMI), education, morbidities (any diabetes, hypertension, cardiovascular disease, celiac