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ARTICLE

A descriptive study of asthma in young adults conceived by IVF

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Mr Nicholas Sicignano received his Master of Public Health degree, epidemiology track, from the graduate programme in public health at Eastern Virginia Medical School in 2009. He completed a Bachelor of Science degree in the area of health sciences with a Minor in public health from James Madison University in 2003. This manuscript is based on his practicum work in collaboration with the Jones Institute for Reproductive Medicine. Upon graduating, Mr Sicignano was hired as a researcher by Battelle Memorial Institute and has been contracted to work as a clinical epidemiologist at the Navy and Marine Corps Public Health Centre in Portsmouth, Virginia. Author contributions:NS participated in questionnaire design, data management, data analysis and drafted the manuscript. HAB conceived the study, performed data analysis and manuscript write-up. SO, HJ and HR were involved in study design and approval, provided data access and revised the paper for intellectual content.

Abstract Although asthma has been previously associated with preterm delivery and low birthweight, evidence supporting a relationship between IVF and asthma remains inconclusive. The purpose of this study was to characterize asthma experiences in the oldest IVF-conceived generation in the USA. A cross-sectional study was conducted among 173 young adults (age: 18–26 years) conceived by conventional IVF between 1981 and 1990 at a major fertility treatment centre. A self-administered questionnaire was used with standard questions adapted from the 2008 Behavioural Risk Factor Surveillance System to assess asthma characteristics. Sixteen percent of participants reported a lifetime diagnosis of asthma; nearly half of those were no longer experiencing asthma symptoms at the time of the survey. The asthma profile of young adults conceived by IVF appeared to be favourable compared with the general population of the USA. Although few statistically significant results were obtained, low birthweight infants and individuals of a multiple gestation tended to be diagnosed at a later stage and were more likely to be current asthmatics seeking healthcare services than normal-weight infants and individuals of a singleton gestation. Further studies using larger samples and more advanced designs are needed to confirm these preliminary findings.

KEYWORDS: asthma, IVF, low birthweight, multiple birth, preterm delivery

Introduction

Infertility is an important public health issue affecting the lives of many couples in the USA and worldwide. Since 1978, over a million infants have been born to infertile couples as a result of assisted reproduction technology (Klonoff-Cohen, 2005). IVF is a special type of treatment whereby both oocytes and spermatozoa are handled and fertilization occurs in an artificial environment outside of the reproductive system. Multiple steps are taken in an IVF treatment

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cycle; these include ovarian stimulation, oocyte retrieval, fertilization in a liquid medium, embryo selection and embryo transfer into the uterine environment. Scientific evidence remains inconclusive as to whether assisted reproduction is linked to adverse short-term and long-term health effects. Most couples who undergo treatment have pre-existing health problems associated with infertility, and the procedure itself can enhance the risk of birth plurality, which in turn has been linked with preterm delivery and low birthweight infants. While ample evidence linking assisted reproduction technology to preterm deliveries and low birthweight infants exists even in the context of single live births (McDonald et al., 2009), it is unclear whether these birth outcomes are due to parental sub-fertility or characteristics of the procedure itself.

Because assisted reproduction technology is a relatively recent treatment modality for infertility, few studies have evaluated its health effects beyond infancy, childhood and adolescence. Health outcomes that have been evaluated in relation to assisted reproduction technology can be broadly classified as obstetric, perinatal, neonatal, post-neonatal outcomes, chromosomal aberrations, congenital malformations, growth and metabolic disorders and motor, neurological, cognitive and socio-emotional development.

To date, few studies have examined assisted reproduction technology as a putative risk factor for asthma. Asthma is a highly prevalent condition often diagnosed prior to adulthood. Its multi-factorial aetiology has been described elsewhere (Hill and Wood, 2009; Subbarao et al., 2009). In the USA, about 23 million are afflicted with asthma, 6.8 million of whom are children and over half (12 million) have experienced an asthma attack within the last 12 months (NIH, 2009). Preterm delivery and low birthweight have been identified as key risk factors for asthma in a number of studies (Alper et al., 2006; Annesi-Maesano et al., 2001; Linneberg et al., 2006; Metsala et al., 2008; Priftis et al., 2007). The significant relationship between preterm delivery and asthma has been recently established in a meta-analysis of 19 studies (Jaakkola et al., 2006). Because assisted reproduction technology is associated with birth plurality and preterm delivery, it is reasonable to postulate that assisted reproduction technology and asthma may be associated.

The purpose of this descriptive study is to characterize asthma and its associated health outcomes among IVF-conceived young adults. First, the study compared the asthma profile of an IVF population to that of the general population of the USA, using the 2008 Behavioural Risk Factor Surveillance System (BRFSS) as a reference. Second, it examined whether birth plurality and low birthweight played a role in asthma prevalence and associated health outcomes. Given the established link between asthma, preterm delivery and low birthweight, the study postulated that the prevalence of asthma would be increased among IVF-conceived young adults, particularly those who were low birthweight infants or individuals of a multiple gestation. This study was based on a larger cross-sectional survey of young adults (aged 18—26 years) conceived by standard IVF between 1981 and 1990 at a major fertility treatment centre (Beydoun et al., in press).

Materials and methods

Study design and setting

This study conducted a cross-sectional evaluation of the first cohort of young adults conceived by IVF at the Jones Institute for Reproductive Medicine (JIRM), the Division of Reproductive Endocrinology and Infertility at Eastern Virginia Medical School (EVMS) in Norfolk, Virginia. The Institutional Review Board at EVMS approved the study with a waiver of informed consent.

Sampling and eligibility

Young adults conceived by standard, or conventional, IVF were recruited and enrolled into the study through their parents. At the time, neither oocyte nor embryo micromanipulation were applied; however, a limited number were conceived through gamete donation or frozen embryos. Arslan et al. (2005) and Riggs et al. (2010) have published reviews of IVF procedures during the first two decades of experience at the study centre. Diagnostic, treatment and outcome data are routinely collected and recorded in a specialized database for all patients seeking IVF at the JIRM. A list of IVF cycles that resulted in a live birth was created and a sampling frame was generated by reconciling this list against a mailing list. The mailing list contains personal data on former JIRM patients, including their names and home addresses. A contact list was created by applying a set of eligibility criteria to the sampling frame. Former patients were included on the contact list if they sought IVF treatment between 1 January 1981 and 31 December 1990 and delivered at least one live-born infant. Former patients with more than one successful IVF cycle were also included on the contact list. Those who were not willing to be contacted, those who had not disclosed method of conception to their IVF offspring and those who had no surviving offspring conceived by IVF were excluded from the contact list. A total of 417 former patients and 560 young adults (out of 816 presumed alive at the time of the survey) met all eligibility criteria.

Recruitment, enrolment and instrumentation

An initial contact letter and two follow-up letters were mass-mailed to former patients on the contact list, i.e. the parents of the IVF-conceived young adults. These letters described study procedures and asked patients to complete and mail an enclosed form in a self-addressed envelope; the form enquired about their willingness to partake in the study by forwarding survey materials to their eligible offspring. To maintain confidentiality, young adults were instructed to contact a third-party key-holder at the JIRM, on a voluntary basis; this contact person was responsible for assigning each young adult a unique identifier and granting them access to the survey instrument. Whereas the contact person had no access to survey responses, investigators had only access to unidentified survey data. At the closing date of the survey, 209 (50.1%) of the former patients had not replied to initial or follow-up letters, 18 (4.3%) were