

## **Secondhand tobacco smoke exposure is associated with increased risk of failed implantation and reduced IVF success** *Hum. Reprod.* (2011) 26 (9): 2525-2531.

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**BACKGROUND** Infertility and early pregnancy loss are prevalent as is exposure to secondhand tobacco smoke (STS). Previous research has suggested a relationship between STS exposure and early pregnancy loss, but studies have been limited by small study sizes and/or imprecise methods for exposure estimation. IVF allows for the collection of follicular fluid (FF), the fluid surrounding the pre-ovulatory oocyte, which may be a more biologically relevant sample media than urine or serum in studies of early reproduction.

**METHODS** In a retrospective analysis of a prospective cohort study, we measured cotinine in FF collected during 3270 IVF treatment cycles from 1909 non-smoking women between 1994 and 2003 to examine the relationship between STS exposure and implantation failure.

**RESULTS** In adjusted models, we found a significant increase in the risk of implantation failure among women exposed to STS compared with those unexposed [odds ratio (OR) = 1.52; 95% confidence interval (CI) = 1.20–1.92; risk ratio (RR) = 1.17; 95% CI = 1.10–1.25]. We also found a significant decrease in the odds for a live birth among STS-exposed women (OR = 0.75; 95% CI = 0.57–0.99; RR = 0.81; 95% CI = 0.66–0.99).

**CONCLUSIONS** Female STS exposure, estimated through the measurement of cotinine in FF, is associated with an increased risk of implantation failure and reduced odds of a live birth.

## **Sidestream smoking is equally as damaging as mainstream smoking on IVF**

**outcomes** *Hum. Reprod.* (September 2005) 20 (9): 2531-2535. Centre for Reproductive Care, Hamilton Health Sciences, 690 Main Street West, Hamilton, Ontario, Canada, L8S 1A4. Email: [nealm@hhsc.ca](mailto:nealm@hhsc.ca)

**BACKGROUND:** Cigarette smoking (CS) is a widely recognized health hazard, yet it remains prevalent in society and the effects of environmental tobacco smoke exposure on fertility are unknown. Our objective was to measure the effects of CS on the fertility of mainstream (MS) or sidestream (SS) smoke-exposed women compared to their non-smoking (NS) counterparts.

**METHODS:** This retrospective study investigated 225 female patients undergoing IVF ( $n=97$ ) or ICSI ( $n=128$ ). Patients were grouped based on their smoking status for comparison. This included: 39 MS (18 IVF and 21 ICSI); 40 SS (16 IVF and 24 ICSI); and 146 NS (63 IVF and 83 ICSI) women. Fertility treatment outcomes including embryo quality, implantation and pregnancy rate were measured.

**RESULTS:** No difference in embryo quality between the three groups was observed. However, there was a significant difference in implantation rate (MS=12.0%, SS=12.6%, and NS=25.0%) and pregnancy rate (MS=19.4%, SS=20.0%, and NS=48.3%) per embryo transfer. **CONCLUSIONS:** Despite similar embryo quality there was a striking difference in implantation and pregnancy rates of MS and SS smokers when compared with NS. Our data demonstrate that the effects of SS smoking are equally as damaging as MS smoke on fertility.

## **Effects of cigarette smoking on reproduction** *Hum. Reprod. Update* (2011) 17 (1): 76-95.

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**BACKGROUND** Cigarette smoking is associated with lower fecundity rates, adverse reproductive outcomes and a higher risk of IVF failures. Over the last few decades, prevalence of smoking among women of reproductive age has increased. This review focuses on current knowledge of the potential effects of smoke toxicants on all reproductive stages and the consequences of smoke exposure on reproductive functions.

**METHODS** We conducted a systematic review of the scientific literature on the impact of cigarette smoking and smoke constituents on the different stages of reproductive function, including epidemiological, clinical and experimental studies. We attempted to create hypotheses and find explanations for the deleterious effects of cigarette smoke observed in experimental studies.

**RESULTS** Cigarette smoke contains several thousand components (e.g. nicotine, polycyclic aromatic hydrocarbons and cadmium) with diverse effects. Each stage of reproductive function, **folliculogenesis, steroidogenesis, embryo transport, endometrial receptivity, endometrial angiogenesis, uterine blood flow and uterine myometrium** is a target for cigarette smoke components. The effects of cigarette smoke are dose-dependent and are influenced by the presence of other toxic substances and hormonal status. Individual sensitivity, dose, time and type of exposure also play a role in the impact of smoke constituents on human fertility.

**CONCLUSIONS** All stages of reproductive functions are targets of cigarette smoke toxicants. Further studies are necessary to better understand the deleterious effects of cigarette smoke compounds on the reproductive system in order to improve health care, help to reduce cigarette smoking and provide a better knowledge of the molecular mechanisms involved in reproductive toxicology.