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Predictors of Pregnancy and Live Birth in Couples with Unexplained or Male-factor Infertility after Insemination

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Abstract

Objective—To identify risk factors for pregnancy outcomes in couples treated with intracervical or intrauterine insemination, with or without superovulation for unexplained or male-factor infertility. The treatment continued for four cycles unless pregnancy was achieved.

Design—Secondary analysis of data from a randomized superovulation and intrauterine insemination trial.

Setting—Academic medical centers.

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Intervention(s)—None.

Patients—Out of 932 couples randomized to four treatment groups, 664 couples who had completed the lifestyle questionnaires were assessed for occurrence of pregnancy and live birth.

Main outcome measure(s)—pregnancy and live birth.

Results—The pregnancy and live birth rates were significantly higher in couples in which the female partners reported that they had consumed coffee or tea in the past or drank alcoholic beverages in the past (past users) when compared to those who had never consumed coffee or tea (4.0, 1.6–10.2 for pregnancy; 3.1, 1.2–8.1 for live birth) or alcoholic beverages (1.9, 1.1–3.3 for pregnancy; 2.1, 1.2–3.7 for live birth) (data are adjusted odds ratio and 95% confidence interval). Past users also had significantly higher pregnancy and live birth rates than those who were currently consuming coffee or tea or alcoholic beverages. Demographic, occupational exposures and other lifestyle factors were not significant.

Conclusion(s)—Couples in which the female partners drank coffee, tea, or alcoholic beverages in the past had higher pregnancy and live birth rates when compared to never or current users. When discontinuing these habits, they might have made other lifestyle changes to improve the pregnancy outcome.

Keywords

Infertility; lifestyle; pregnancy; live birth; insemination; superovulation

INTRODUCTION

Infertility, defined as the inability to conceive after 12 months of unprotected intercourse, is a major public health problem affecting up to 15% of all couples (1, 2). Lifestyle factors, including smoking, caffeine use, alcoholic beverage drinking and obesity have been associated with subfertility and an increase in early pregnancy loss in some investigations (3, 4, 5, 6, 7, 8, 9). A variety of occupational exposures have also been linked to impaired natural fertility (10, 11). However, the effect of lifestyle factors and occupational exposures on natural fertility is not consistent from study to study (10, 12). In addition, many studies have been too small to detect an effect or have relied on retrospective information, which is subject to recall bias (13, 14, 15, 16).

Multiple studies have investigated the impact of lifestyle factors on outcomes of in vitro fertilization (IVF). Both tobacco use and high body-mass-index (BMI) have been associated with a negative impact on IVF pregnancy rates (17, 18). Additionally, alcohol use has been associated with a reduction in IVF pregnancy rate (19). The relationship between caffeine use and IVF outcomes is less clear; however, a decrease in good quality embryos has been reported in high-caffeine users compared to moderate users (20).

Little is known regarding the relationship between lifestyle factors and pregnancy outcomes following less-aggressive infertility treatments such as controlled ovarian stimulation (COS), intrauterine insemination (IUI), or a combination of both. Given that many couples undergo such treatment cycles in order to achieve a pregnancy, a better understanding of the relationship between lifestyle factors and outcomes is important in order to appropriately counsel patients.

To address these questions, we examined the relationship between lifestyle factors, occupational exposures and treatment outcomes in a large multicenter randomized clinical trial (21) evaluating the effectiveness of different treatments (intracervical insemination (ICI), COS with ICI, natural cycle IUI, and COS with IUI) for unexplained infertility.

SUBJECTS AND METHODS

Study design

From 1991 to 1997, 932 infertile couples with unexplained infertility were recruited from university-based infertility and gynecology clinics (21, 22). The couples were randomly assigned to receive ICI, IUI, COS-ICI, or COS-IUI. Treatment continued for four cycles unless pregnancy was achieved. Inclusion criteria consisted of at least 12 months of infertility, a detailed fertility evaluation with normal results and the presence of motile sperm upon semen analysis for male partners. Exclusion criteria included previous infertility treatment, a history of chemotherapy or radiation therapy, previous surgery (tubal surgery, myomectomy, ovarian cystectomy, or unilateral oophorectomy for women; vasovasostomy, varicocelectomy within 6 months before study, or pelvic-node dissection for men), or a medical condition related to infertility. The primary outcome studied was the establishment of pregnancy. Pregnancy was determined by an increase in the serum β-human chorionic gonadotropin (β-hCG) concentration between luteal days 15 and 17 (21). Live birth was also recorded for the study and was defined as the delivery of a viable infant. Pregnancy loss included miscarriage, abortion, still birth and non-viable infant. The institutional review board at each center approved the protocol, and all couples gave written informed consent.

Lifestyle factors and occupational exposure assessment

Enrolled subjects completed extensive self-report questionnaires prior to undergoing treatment. The influence of subjects' baseline characteristics, lifestyle habits and occupational exposures of the female partner on pregnancy outcome was evaluated. We selected the following 25 putative risk factors from a long list of variables: treatment group, age, BMI, race, education, pregnancy history, infertility length, history of smoking, coffee, tea, soda, or alcohol use, use of marijuana or cocaine, solvents, lead, paint, pesticide, metal fumes, anesthetic gases, chemotherapeutic drugs, excess heat, vibration, and radiation exposure during the past month. For smoking, "never" refers to those who had never smoked regularly or had smoked less than one cigarette a day; "current" refers to those who smoked regularly, at least one cigarette a day, within past month; "past" refers to those who had smoked regularly, at least one cigarette a day, more than one month ago. For coffee or tea drinking, "never" refers to those who had never drank or drank less than one 8-ounce cup of coffee or tea a week; "current" refers to those who drank at least one cup of coffee or tea a week, within past month; "past" refers to those who had drank at least one cup of coffee or tea a week, more than one month ago. For alcoholic beverage drinking (including beer, wine and liquor), "never" refers to those who had never drank or drank less than one alcoholic beverage a week; "current" refers to those who drank at least one alcoholic beverage a week, within past month; "past" refers to those who had drank at least one alcoholic beverage a week, more than one month ago. Alcoholic beverages include beer, wine and liquor. One glass of beer equals to 12 ounces; one glass of wine equals to 4 ounces; one shot of liquor equals to 1 ounce. The putative risk factors were selected by a combination of our knowledge and intuition. Our approach is not entirely hypothesis driven to allow us the flexibility to utilize the collected data; in the meantime, we limited the number to 25 to avoid being overly exploratory.

Data analysis

The study sample in this analysis was used in a previous analysis looking at the efficacy of superovulation and intrauterine insemination in the treatment of infertility (21). Of the 932 infertile couples recruited for that study, 268 (29 percent) did not complete the lifestyle or occupational exposure questionnaire. Those subjects were excluded from the present analysis, leaving 664 couples. All data management and analyses were performed using SAS (9.1) (SAS Institute Inc., Cary, NC).

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Baseline characteristics of the couples were compared among different treatment groups. Next, bivariate analyses were performed to determine the association between pregnancy outcome and the different factors based on a priori hypotheses. For live birth analysis, the live birth rate was the ratio of the total number of patients who delivered a live birth to the total patients in the groups, regardless of their pregnancy status. Pearson chi-square test was used for categorical data. Multivariable logistic regression analyses were then performed by applying the backward and stepwise procedures on the predictors introduced above (p-value <0.1 to enter and p-value <0.05 to stay), leading to the same final model. When the final model was obtained, the adjusted odds ratios and 95% confidence intervals (CIs) were computed with respect to the corresponding reference groups. We further performed an analysis on a subset of the data by including only the couples who underwent IUI (IUI and COS-IUI groups), to evaluate whether the results were changed. A two-tailed p value less than 0.05 was considered statistically significant. The reported p-values were not adjusted for multiple comparisons.

RESULTS

Baseline characteristics

First, baseline characteristics of the 664 couples included in the following analysis are listed in Table 1. They are similar to those reported previously for the entire cohort (21). Second, among the 664 remaining couples, there were 170 subjects in the ICI group, 171 in the natural cycle IUI group, 159 in the COS-ICI group and 164 in the COS-IUI group. There were no statistically significant differences in the baseline characteristics among the four treatment groups (Table 1). In addition, there was no significant difference in pregnancy rate or live birth rate between the patients included in the current analysis and those excluded (Supplemental Table 1). Therefore, not completing lifestyle or occupational exposure questionnaire seemed to have occurred randomly with respect to the baseline characteristics, treatment assignments, and the primary outcomes and the patients in the current study remained representative of the population and selection bias was not apparent.

Bivariate analyses

The association between the individual factors and pregnancy outcome is shown in Table 2. Besides the different treatment effects, as also reported in the previous study (21), women who reported that they had consumed coffee, tea or alcoholic beverages in the past (more than one month) had significantly higher rates of pregnancy and live birth when compared to never users (Table 2). For the subjects who drank coffee or tea or alcoholic beverages in the past, the duration since they stopped drinking is shown in Supplemental Table 2. There was no significant association between pregnancy or live birth and the duration since the subjects stopped drinking coffee or tea (Supplemental Table 2), nor between pregnancy or live birth and the length of years the subjects drank coffee or tea or alcoholic beverages in the past (data not shown, p>0.1). There was a significantly negative association between pregnancy or live birth and the duration since the subjects stopped drinking alcoholic beverage beer and liquor, but not wine (Supplemental Table 2). The amount of coffee or tea or alcoholic beverages consumed by the subjects is shown in Supplemental Table 2. There was no significant association between pregnancy or live birth rate and the amount of coffee or tea or alcoholic beverages consumed by the subjects before the subjects stopped drinking coffee or tea or alcoholic beverages (Supplemental Table 2). In addition, for subjects who drank coffee or tea or alcoholic beverage in the past, there was no significant difference in the pregnancy rate and live birth rate between those who stopped drinking coffee or tea or alcoholic beverages because they were trying to conceive and those who stopped drinking coffee or tea or alcoholic beverages for other reasons (Supplemental Table 3).

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No significant association was found between pregnancy and live birth rates and the other lifestyle factors evaluated, including age, BMI (15 to 44), race, education, female infertility duration, smoking, and all occupational exposures (Table 2). For smoking, the "current" smokers had smoked regularly, at least one cigarette a day, for 12.4 ± 4.8 years (n=78); the "past" smokers had smoked regularly, at least one cigarette a day, for 6.8 ± 4.7 years (n=126), with a duration of 79.8 ± 60.5 months since they stopping smoking, and before they stopped smoking regularly, they smoked 11.8 ± 8.7 cigarette a day. While these variables were not significant, we assessed whether they might confound the significant associations reported above and found that they had little effect.

The pregnancy loss rate was not significantly different between the subjects with regard to their smoking, coffee or tea drinking, alcoholic beverage drinking, cocaine trying, marijuana trying status and different occupational exposure history (data not shown).

Multivariable analyses

The results of the multivariable analyses with pregnant vs. not pregnant or live birth vs. non live birth status as the outcome are presented in Table 3. After backward selection, variables for women of coffee, tea, and alcohol drinking were included the final model (variable for exposure to pesticide also included when the outcome is pregnancy). In particular, women who drank coffee or tea, or alcoholic beverages in the past, but not current users, had a higher rate of pregnancy and live birth when compared to never users. When compared to the current users, women who reported that they had consumed coffee, tea or alcoholic beverages in the past also had significantly higher rates of pregnancy (adjusted odds ratio: 3.3, 95% CI: 1.6 – 6.7, p<0.001 for tea or coffee drinking; adjusted odds ratio: 1.7, 95% CI: 1.1 – 2.9, p=0.035 for alcoholic beverage drinking) and live birth (adjusted odds ratio: 3.3, 95% CI: 1.6 – 6.8, p=0.002 for tea or coffee drinking; adjusted odds ratio: 2.3, 95% CI: 1.3 – 4.0, p=0.004 for alcoholic beverage drinking).

Sub-group analyses

When we repeated the main data analyses including only the couples who underwent IUI treatments (IUI and COS-IUI groups), similar results were again obtained; past use of coffee, tea or alcohol was associated with significantly greater pregnancy and live birth rates compared to never or current users (Table 4). No significant association was identified between pregnancy or live birth rates and self-reported exposure to pesticide.

Coffee or tea drinking and smoking may interact with each other (3, 12, 23, 24). Thus, we also stratified our analyses according to female partner's smoking. In couples in which the female had never smoked regularly, past alcoholic beverage drinking was still significantly associated with pregnancy and live birth rate, but past coffee or tea drinking had no significant association with pregnancy outcomes (Supplemental Table 4). In smokers (including both current and past smokers), however, coffee or tea drinking was significantly associated with pregnancy outcomes (Supplemental Table 4).

DISCUSSION

In this investigation, we have examined the relationship between lifestyle factors/ occupational exposures and pregnancy outcomes resulting from treatments for unexplained infertility in a large, prospective multicenter trial. Supplemental Table 5 provides a summary of our findings. Given the high prevalence of exposure to these factors in modern society, it is imperative to have a better understanding of the relationship between these factors and outcomes in order to better counsel women regarding lifestyle modifications that may improve the chances of conception while undergoing treatment. Of the lifestyle factors and exposures evaluated in this investigation, only coffee, tea, or alcohol use was significantly associated with pregnancy and live-birth outcomes. Specifically, past users of coffee, tea, or alcohol had significantly higher chances of conception and live-birth compared to never and current users. Other factors that have been related to impaired natural fertility in previous investigations such as smoking, high BMI, illicit drug use, and exposure to environmental toxins (25, 26, 27, 28) were not significantly associated with the outcomes of fertility treatments. These findings were consistent in both the bivariate and the logistic regression analyses. Any relationship between illicit drug use and pregnancy outcomes would have been difficult to ascertain in this investigation, as the variables related to illicit drug use ("women marijuana trying" and "women cocaine trying") only captured any use of marijuana and cocaine rather than specified current or past use, or the use of any other substance. Moreover, because both of these drugs are illegal, actual use may be underreported. With regard to age, we found that the live birth rates were lower in the 30–40 year old women as compared to women in the 20–29 year-old age group (13.9% vs. 18.3%, p=0.167, Table 2). One explanation for the lack of significant difference in pregnancy or live birth rates among different age groups is that this is a preselected group of women with 'unexplained' infertility. It is possible that the younger women have subclinical reduced ovarian reserve or some other unmeasured variable that makes them similar to the older women resulting in infertility; thus, the younger women behave similarly to the older women with respect to pregnancy and delivery (29).

The effect of alcohol use on natural fertility in women has not been clearly established. In a prospective study of 7,393 women, Eggert and colleagues identified an increased risk of infertility (relative risk = 1.6; 95% CI: 1.1–2.3) in high consumers of alcohol (≥ 2 drinks/day) relative to moderate consumers (30). Conversely, other investigations have not identified a significant relationship between alcohol use in women and fecundability (3, 4, 5), but have shown an increase in first trimester pregnancy loss (8). Within the context of infertility treatments such as COS-IUI, we are unaware of prior studies investigating the relationship between alcohol use and outcomes; however, consumption of at least four drinks per week was associated with a decrease in the IVF live-birth rate in one investigation (19).

As with alcohol use, we are unaware of previous investigations evaluating the impact of coffee or tea drinking on outcomes following infertility treatments such as COS-IUI. Given that both coffee and tea contain significant amounts of caffeine, it seems likely that the relevant exposure is caffeine. We identified no significant relationship between soda drinking and either pregnancy or live-birth rates; however, soda contains significantly less caffeine than either coffee or tea. High caffeine use (> 5–7 cups/day) has been associated with decreased natural fertility in some investigations (3, 31), an effect which may be dose-related (32). However, others have failed to identify a significant relationship (4). It has been shown in some studies that moderate to heavy caffeine use increased the rate of pregnancy loss (33, 34). One may hypothesize that the higher pregnancy and live birth rates observed in the "past" users of coffee or tea may be due to higher pregnancy loss rates in the "current" users. However, this is not supported by our data. In fact, the pregnancy loss rate in the "past" users was the highest among the three groups ("past" at 6.7%, "current" at 5.4%, and "never" at 2.7%).

Given that previous investigations have generally shown a negative impact of female smoking and obesity on the time to spontaneous conception (25, 26) and outcomes following IVF treatment (17, 18), we were surprised that no significant relationship was identified between these variables and either pregnancy or live-birth rates. Consistent with our findings, Farhi and colleagues did not identify significant differences in pregnancy rate between smokers and nonsmokers (16.3% and 15.8%, respectively) in a retrospective review of 885 couples undergoing COS-IUI, although a higher dose of gonadotropins was required in smokers (35). Similarly, a retrospective review of the outcomes of 333 ovulatory women undergoing COS-IUI identified no significant difference in cycle fecundity among different BMI groups ranging from underweight to obese (36). It is possible that the observation of impaired natural fertility in obese women is partially related to ovulatory dysfunction.

Our observation of increased pregnancy and live-birth rates in past users of coffee, tea or alcohol relative to current and never users requires further evaluation and validation. Although we did not have a prior knowledge for this finding nor did we have an external dataset to validate it, there are reasons to believe its validity. If these exposures had long-lasting negative effects on conception, one would expect to observe a similar negative impact on outcomes in both current and past users compared to never users. Alternatively, if exposure to these factors resulted in only short-term effects, then one would expect past and never users to have similar pregnancy rates, both of which would be superior to current users. However, neither of these outcomes was observed. It is possible that women who discontinue drinking coffee, tea or alcohol in anticipation of attempting conception possess characteristics that are associated with positive health outcomes, such as an internal locus of control (i.e. a belief that their ability to conceive can be self-managed and controlled), as it is generally considered that consumption of caffeine containing beverages and alcohol are not healthy habits prior to conception. Perhaps women who have recently discontinued the use of coffee, tea, or alcohol in an attempt to improve their chances of achieving a pregnancy are also making other lifestyle changes that were not measured or not fully adjusted for in this investigation. Since the discontinuation of coffee or tea or alcohol increase both the pregnancy and live birth rate, the possible undetected positive lifestyle changes along with the discontinuation of these habits may have beneficial effects on both pregnancy and live birth (37). One of the factors is smoking status. Smoking has been shown to increase or decrease the effect of coffee or tea drinking on pregnancy outcome (23, 24). The lack of effect of coffee or tea drinking on pregnancy outcome among patients who never smoked in this study suggests that smoking and coffee or tea drinking have an interacting relationship with conception and live birth rates. Another possibility is that never users of coffee, tea, or alcohol are simply different in their ability to conceive at baseline than are current and past users. In other words, if exposure to these factors causes a temporary and reversible negative impact on fecundability, then one would expect past users to experience higher pregnancy rates than current users. Never users that would have been susceptible to the negative effects of coffee, tea, or alcohol could have already achieved a pregnancy prior to enrollment. Thus, the remaining “never” users have different underlying etiologies for their infertility. Previous studies have investigated the relationship between social class status and pregnancy outcome, and lower level of social class may have a lower pregnancy rate and higher rate of adverse birth outcome (38, 39). The lack of significant association between coffee, tea or alcoholic beverage drinking and male or female education level (data not shown), one of the main social class factors, suggests that baseline social class status may not be a potential explanation for the difference in pregnancy and live birth rate observed in this study. Regardless of the mechanism, the magnitude of the effects observed in this investigation (adjusted odds ratio 4.0 for past users of coffee or tea; 1.9 for past users of alcohol) is considerable. Therefore, further prospective investigations are needed to confirm and extend the finding of improved pregnancy and live-birth rates following the recent discontinuation of alcohol, coffee and tea.

Limitations of the current investigation should be noted. First, all data regarding lifestyle factors were self-reported, and it is possible that subjects may have underreported exposures. Particularly this may be true with regards to smoking and alcohol use behaviors. Second, the association between greater pregnancy and live-birth rates noted in past users of coffee, tea, and alcohol compared to current and never users does not necessarily imply a causal relationship between these factors and outcomes. The data do not contain information to infer this causal relationship.

In summary, in a large, prospective multicenter trial investigating the effectiveness of treatments for unexplained infertility, we identified past use of alcohol, coffee and tea as being significantly associated with increased odds of conception and live-birth. Other lifestyle factors and exposures, including smoking, BMI, ever use of illicit drug, and exposure to environmental toxins were not significantly related to outcomes. Additional prospective investigations are necessary to confirm the finding of improved fecundity following the recent discontinuation of alcohol, coffee and tea.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Baseline characteristics of 664 subjects

Characteristic	ICI (n=170)	IUI (n=171)	COS-ICI (n=159)	COS-IUI (n=164)	p value#
Age, mean ± SD					
Women	32 ± 4*	32 ± 4	32 ± 4	32 ± 4	0.743
Men	35 ± 5	34 ± 4	34 ± 5	35 ± 5	0.711
Body mass index (kg/m^2), mean ± SD (women)	24 ± 5	23 ± 4	23 ± 4	23 ± 4	0.669
Bachelor's degree (%)					
Women	32	38	43	44	0.089
Men	36	33	36	42	0.406
White race (%)					
Women	88	88	88	89	0.968
Men	88	88	89	89	0.924
Nulliparous (women) (%)	62	62	60	58	0.838
Duration of infertility (mo), mean ± SD	44 ± 33	45 ± 32	42 ± 30	40 ± 24	0.466

ICI, intracervical insemination.

IUI, intrauterine insemination.

COS-ICI, controlled ovarian stimulation and intracervical insemination.

COS-IUI, controlled ovarian stimulation and intrauterine insemination.

#The Chi-square test was used for categorical variables, and the F statistic from an analysis of variance was used for continuous variables.

Table 2

Bivariate analyses of risk factors for pregnancy outcome (pregnant vs. non pregnant; live birth vs. non live birth)

Characteristic	N	Pregnancy rate per couple %	p value	Live birth rate per couple %*	p value
Treatment					
ICI	170	8.2	<0.001	5.9	<0.001
IUI	171	17.5		15.2	
COS-ICI	159	21.4		16.4	
COS-IUI	164	34.2		23.2	
Sociodemographics					
Women age (years)					
20–29	169	21.9	0.734	18.3	0.379
30–34	306	19.0		13.7	
35–40	189	20.6		14.3	
Men Age (years)					
20–29	95	23.2	0.696	17.9	0.666
30–39	508	19.9		14.8	
40–55	61	18.0		13.1	
Women race					
White	601	19.6	0.316	14.6	0.806
Black	19	36.8		21.1	
Asian	32	21.9		18.8	
Other	12	16.7		16.7	
Men race					
White	606	19.0	0.105	14.4	0.431
Black	18	38.9		22.2	
Asian	30	30.0		23.3	
Other	10	30.0		20.0	
Women Body mass index (kg/m^2)					
<=25	450	19.1	0.318	14.4	0.620
25–30	95	23.2		17.9	
>30	53	28.3		18.9	

Characteristic	N	Pregnancy rate per couple %	p value	Live birth rate per couple %*	p value
Women educational level					
High school	108	18.5	0.430	12.0	0.626
College	469	19.6		15.6	
Post college	87	25.3		16.1	
Men educational level					
High school	113	19.5	0.974	15.0	0.940
College	431	20.4		15.3	
Post college	120	20.0		14.2	
Infertility risk factors (Women)					
Pregnant history					
No	403	17.9	0.065	14.1	0.412
Yes	261	23.8		16.5	
Infertility length (months)					
12–23	149	26.2	0.100	18.1	0.459
24–35	166	19.9		15.1	
>=36	349	17.8		13.8	
Lifestyle risk factors (Women)					
Smoking					
Never	455	19.1	0.567	13.9	0.391
Current	80	23.8		16.3	
Past (>1 month ago)	129	21.7		18.6	
Coffee or tea drinking					
Never	74	16.2	0.008	13.5	0.007
Current	545	19.3		13.9	
Past (>1 month ago)	45	37.8		31.1	
Soda drinking					
Never	70	28.6	0.296	20.0	0.536
Current	543	19.3		14.2	
Past (>1 month ago)	50	18.0		18.0	
Alcoholic drinking					
Never	260	16.9	0.008	13.1	<0.001

Characteristic	N	Pregnancy rate per couple %	p value	Live birth rate per couple %*	p value
Current	274	18.3		11.7	
Past (>1 month ago)	128	30.5		25.8	
Marijuana trying					
No	311	19.9	0.825	13.5	0.532
Yes	342	20.5		16.4	
Unknown	11	18.2		18.2	
Cocaine trying					
No	524	19.7	0.857	13.9	0.396
Yes	131	22.1		19.1	
Unknown	9	22.2		22.2	
Occupational exposures (Women)					
Solvents					
No	513	21.3	0.460	16.0	0.564
Yes	91	18.7		13.2	
Unknown	60	13.3		10.0	
Lead					
No	604	20.9	0.426	15.2	0.743
Yes	8	25.0		25.0	
Unknown	52	11.5		11.5	
Paint					
No	517	20.3	0.457	15.1	0.309
Yes	129	21.7		17.1	
Unknown	18	5.5		0.0	
Pesticide					
No	539	21.7	0.095	16.1	0.167
Yes	88	17.1		13.6	
Unknown	37	5.4		2.7	
Metal fumes					
No	625	20.3	0.853	15.2	0.932
Yes	8	25.0		12.5	
Unknown	31	16.1		12.9	

Characteristic	N	Pregnancy rate per couple %	p value	Live birth rate per couple %*	p value
Anesthetic gases					
No	610	21.0	0.204	15.9	0.199
Yes	39	15.4		7.7	
Unknown	15	0.0		0.0	
Chemo drugs					
No	639	20.5	0.563	15.2	0.704
Yes	9	22.2		22.2	
Unknown	16	6.3		6.3	
Excess heat					
No	613	20.6	0.418	15.7	0.404
Yes	40	20.0		10.0	
Unknown	11	0.0		0.0	
Vibration					
No	627	20.9	0.304	15.6	0.321
Yes	21	9.5		9.5	
Unknown	16	6.3		0.0	
Radiation					
No	591	20.3	0.495	15.4	0.539
Yes	50	24.0		16.0	
Unknown	23	8.7		4.3	
Video display terminal					
No	171	21.6	0.623	15.8	0.768
Yes	487	19.9		15.0	
Unknown	6	0.0		0.0	
Electromagnetic field					
No	512	20.3	0.055	15.4	0.101
Yes	39	33.3		23.1	
Unknown	113	15.0		10.6	

ICI, intracervical insemination; IUI, intrauterine insemination.

COS-ICI, controlled ovarian stimulation and intracervical insemination.

COS-IUI, controlled ovarian stimulation and intrauterine insemination.

*Live birth rate was calculated as the ratio of the total number of patients who delivered a live birth to the total patients in the groups, regardless of their pregnancy status.

Table 3

Multivariable logistic regression analyses of risk factors for pregnancy outcome pregnant vs. non pregnant or live birth vs. non live birth

Characteristic	Odds ratio for pregnancy	95% CI	p value	Odds ratio for live birth	95% CI	p value
Treatment						
ICI	Reference			Reference		
IUI	2.5	1.3 – 5.0	<0.001	3.0	1.4 – 6.4	0.006
COS-ICI	3.3	1.7 – 6.6	0.009	3.4	1.6 – 7.5	0.002
COS-IUI	6.6	3.4 – 12.7	<0.001	5.1	2.4 – 10.9	<0.001
Women coffee or tea drinking						
Never	Reference			Reference		
Current	1.2	0.6 – 2.4	0.608	1.0	0.5 – 2.0	0.898
Past (>1 month ago)	4.0	1.6 – 10.2	0.004	3.1	1.2 – 8.1	0.023
Women alcoholic drinking						
Never	Reference			Reference		
Current	1.2	0.7 – 1.9	0.508	0.9	0.5 – 1.5	0.715
Past (>1 month ago)	1.9	1.1 – 3.2	0.017	2.1	1.2 – 3.7	0.007
Women exposure to pesticide						
No	Reference					
Yes	0.6	0.3 – 1.1	0.103			
Unknown	0.2	0.1 – 0.9	0.033			

ICI, intracervical insemination.

IUI, intrauterine insemination.

COS-ICI, controlled ovarian stimulation and intracervical insemination.

COS-IUI, controlled ovarian stimulation and intrauterine insemination.

Note: Only variables having a significant association with pregnancy are included in the final model and used for the calculation for the odds ratio from the logistic regression (using backward selection).

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Table 4

Bivariate analysis of risk factors for pregnancy outcome (pregnant vs. non pregnant; live birth vs. non live birth) among couples who are in the IUI groups (n=335)

Characteristic	N	Pregnancy rate per couple %	p value	Live birth rate per couple %	p value
Women coffee or tea drinking					
Never	36	13.9	<0.001	8.3	<0.001
Current	277	24.6		17.7	
Past (>1 month ago)	22	59.1		54.6	
Women alcoholic drinking					
Never	128	20.3	0.006	15.6	<0.001
Current	138	23.2		13.8	
Past (>1 month ago)	68	39.7		35.3	
Women exposure to pesticide					
No	264	27.7	0.259	20.8	0.285
Yes	49	22.5		16.3	
Unknown	22	9.1		4.6	