

## Article

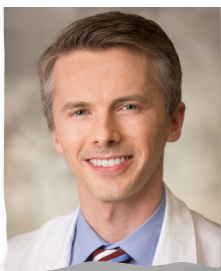
# Sociocultural determinants of US women's ethical views on various fertility treatments



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### KEY MESSAGE

Ethical concerns over fertility treatments are not 'all-or-nothing', but rather are often specific to the treatment approach. Race, religious affiliation and religious attendance are three determinants of these ethical concerns. Increased understanding of such ethical concerns is important for improving the physician–patient relationship and may impact access to care.

## ABSTRACT

Ethical concerns over treatments for infertility can discourage patients from pursuing fertility healthcare. This study aims to evaluate the sociocultural factors that influence the ethical views of reproductive-aged women regarding various fertility treatments. A publicly available cross-sectional survey of 4792 nationally representative US women aged 25–52 years was analysed to identify the frequency of ethical concerns over such interventions. Concerns were most common for treatments that increase the chance of twins (54%), followed by third-party reproductive strategies (48–51%), IVF (30%) and partner insemination (14%). Regression analysis revealed distinct sociocultural determinants for each of the treatment approaches. While being black was associated with a higher level of concern for several distinct fertility treatments, Hispanic ethnicity was only associated with increased ethical concern about donor eggs. Additionally, religious attendance predicts increased odds of ethical concern for IVF and all third-party approaches, while Catholic or Christian religious affiliations also predict ethical concern over partner insemination. These findings show that ethical concerns over fertility treatments are not generally 'all-or-nothing', but rather are often specific to the treatment approach. This knowledge may help explain differences in help-seeking behaviours and improve the physician–patient relationship.

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## Introduction

Dating to the first report of successful donor insemination in the early 1900s, ethical concerns have been raised about treatments for

infertility (Hard, 1909). Reproductive healthcare providers play an active role in evaluating the ethical issues surrounding such treatments, formalizing professional recommendations and guidelines through such entities as the ASRM Ethics Committee (Ethics Committee of the American Society for Reproductive Medicine, 2014). While physician

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self-regulation is an essential component of maintaining public trust in the healthcare industry (Cruess and Cruess, 2005), broad acceptance of fertility treatments is also contingent upon the ethical approval of laypersons. When this approval is lacking, public policy can be employed to restrict the scope of legal interventions available to the infertile, such as via the Italian IVF restrictions from 2004 to 2009 (Benagiano and Gianaroli, 2010) or in proposed US personhood legislation (Collura and Collins, 2013). More indirectly, ethical concerns among laypersons have been associated with decreased likelihood of pursuing evaluation and treatment for infertility (Greil et al., 2011).

Given their role in both influencing legislation and discouraging fertility treatments, the ethical views of the general population regarding infertility healthcare are worthy of close examination. Previous research has focused predominantly on ethical concerns with fertility treatments in general, where several sociocultural factors have been found to associate with heightened opposition. Across the USA, ethical concerns over fertility treatments are more common among black, Hispanic and Asian women than among whites (Greil et al., 2011). A survey of women throughout the Midwest found greater ethical concern among older women with lower income and less education (Shreffler et al., 2010). Religion is also significantly associated with general ethical concern over fertility treatments (Missmer et al., 2011), mediated both by attendance at religious services (Greil et al., 2010) and by religious affiliation (Greil et al., 2016).

While previous research has investigated the sociocultural factors that predict ethical concern over fertility treatments collectively, there are reasons to suspect that such ethical concern is not truly an all-or-nothing phenomenon. Rather, it is likely that distinct sociocultural factors display a more nuanced effect on different treatment options. For instance, no major religions in the USA oppose ovulation induction or surgical treatment for infertility; partner insemination is uniquely opposed by the Catholic Church; and only assisted reproductive technologies involving donor gametes are of ethical concern in most Jewish and Islamic traditions (Schenker, 2005). Additionally, black women who are evaluated for infertility are significantly less likely than their white counterparts to pursue IVF, even after adjusting for socioeconomic status, education, insurance status and religion. Given that black and white utilization of medical and surgical treatments for infertility is the same (Kessler et al., 2013), this suggests that IVF is subject to different cultural reluctance among black women than other treatment modalities.

In this study, the association between relevant sociocultural factors and the ethical views were examined for a large representative sample of US women of reproductive age regarding various fertility treatments, including partner insemination, IVF, donor sperm, donor oocytes, gestational carriers, and treatments that incur an elevated risk of multiple gestation.

## Materials and methods

### Survey

Data were obtained from the National Survey of Fertility Barriers (NSFB), a large, nationally representative survey of US women of reproductive age, which was performed to assess the relationships between personal values, sociocultural factors, demographic characteristics, overall health and fertility outcomes. Funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the NSFB was designed by a multi-institutional team of

sociologists, who conducted a random-digit dialling telephone survey of 4792 women aged 25–52 years. The publicly-available Wave 1 of survey data was collected from 2004 to 2007. The sample is nationally representative, with oversampling of racial and ethnic minorities and women with fertility problems; this oversampling was factored into the analysis using sample weights provided by the NSFB. Further details on the design of the NSFB have been previously published (Greil et al., 2011; Park and Hill, 2014). Because the current study only involved the use of this de-identified, publicly-available data set, it was not subject to review by our local Institutional Review Board, in accordance with the Common Rule definition (45 CFR 46).

Surveyed women were asked whether they had ethical problems with various reproductive interventions, including intrauterine insemination (IUI) with partner sperm, IVF, IUI with donor sperm, use of a donor oocyte, use of a gestational carrier (GC), and the more general ‘use of medical procedures which increase the chance of twins’. Valid responses included ‘no ethical problem’, ‘some ethical problem’, ‘serious ethical problem’ and ‘don’t know’. Respondents were not given any detailed explanation about the nature of these various techniques, so ‘don’t know’ was the encouraged response if they were not familiar with a specific concept; such respondents (1.1% of the total) were excluded from the subsequent analysis. Because linearity could not be assumed for increasing ethical concern on a standard Likert scale (i.e. the difference between no ethical problem and some ethical problem may be less substantial than the difference between some ethical problem and serious ethical problem), the different levels of ethical concern were treated as ordinal variables.

In addition to value assessments, the NSFB also obtained pertinent demographic data, including respondent age, race/ethnicity, level of education, family income, marital status, current place of residence, religious affiliation, and frequency of attendance at religious services. Due to small numbers of such respondents, the races of Native Americans and Pacific Islanders were recoded as ‘other race’, and the religious affiliations of Jewish and Islamic women were recoded as ‘other religion’. Divorced, widowed and separated women were recoded as ‘formerly married’ and cohabitating women and those in a lesbian partnership were recoded as ‘never married’. Education level was recoded as ‘less than high school graduate’, ‘high school graduate or GED’, ‘some higher education’ or ‘4+ years of higher education’. Family income was recoded as ‘less than \$15,000’ (roughly equal to the poverty line for a family of two at the time of the survey), ‘\$15,000–\$29,999’, ‘\$30,000–\$39,999’, ‘\$40,000–\$49,999’, ‘\$50,000–\$59,999’, ‘\$60,000–\$74,999’, ‘\$75,000–\$100,000’ and ‘greater than \$100,000’. Current place of residence was coded by location in one of nine US Census Divisions and by whether or not the respondent resided in one of the US Office of Management and Budget’s metropolitan areas (i.e. within or surrounding an urban core of at least 50,000 residents). Regular religious attendance was defined as attending a religious service nearly every week or more often.

The NSFB also asked respondents for information on their pregnancy and fertility history. For women with a history of prior pregnancy, information was obtained on pregnancy outcomes. Women with no history of prior pregnancy or live birth were coded as nulligravid and nulliparous, respectively. Women with a history of 12 months of regular, unprotected intercourse without conception were coded as infertile.

### Analysis

Multivariate logistic regression models were constructed to identify significant sociocultural factors which predict the level of ethical

concern with the six fertility treatments described above. Each model included the following covariates based upon known sociocultural determinants of general ethical concern over fertility treatments: race/ethnicity [Greil et al., 2011], age, marital status, family income, level of education [Shreffler et al., 2010], religious service attendance [Greil et al., 2010] and religious affiliation [Greil et al., 2016]. Additionally, each model included the following covariates, based upon our *a priori* hypothesis of plausible impact: nulligravidity, nulliparity, geographic region of residence and metropolitan versus non-metropolitan residence. All analyses were conducted with the Stata statistical analysis software (StataCorp., College Station, TX, USA).

While ordered logistic regression is often used to model ordinal outcome variables, the parallel lines assumption may be violated in this approach. In such cases, the generalized ordered logit function offers a more parsimonious alternative to non-ordinal multinomial logistic regression [Williams, 2006]. Using the *gologit2* functionality in Stata, the parallel lines assumption was tested for all variables in all models. Because several key variables violated the parallel lines assumption in each model, the partial proportional odds model (with the *autofit* function in Stata) was used for all regressions. Regression analyses were fully adjusted, and results were reported as odds ratios with associated 95% confidence intervals. For variables where the parallel lines assumption was violated, odds ratio and confidence interval results were generated for all cut-points (i.e. any ethical concern versus no ethical concern, and serious ethical concern versus no serious ethical concern). Consistent with prior literature [Kessler et al., 2013; Missmer et al., 2011], predictor variables in our model are reported at the 5% significance level, acknowledging that 5% of identified significant predictor variables will result from random variation and be spurious.

## Results

### Demographic characteristics

As seen in Table 1, the NSFB achieved a nationally representative sample through targeted oversampling and population weighting. The age range of participants is 25 to 52 years, with a median age of 35.5. A majority of participants were white, non-Hispanic, married and living in metropolitan areas. Additionally, participants were most frequently Protestant and had significant higher education. Survey respondents had a wide range of family income levels and lived in all parts of the USA.

### Ethical concerns

Ethical concerns varied substantially across different fertility treatments [Figure 1]. While fewer than 15% of US women were found to have ethical problems with partner IUI, the frequency of ethical concern approached or exceeded 50% for all third-party reproductive strategies, including donor IUI, donor egg, and the use of a GC. The fertility practice which elicited ethical concern among the greatest number of women, however, was treatments that cause a higher risk of multiple gestation. Serious ethical concerns were most common regarding the use of GCs (15%), while serious concerns with partner IUI were rare (2% of the population). IVF had intermediate amounts of serious ethical concern (5%) and fewer ethical concerns (24%).

While overall ethical concern with partner IUI was low, several predictor variables associated with increased odds of such concerns

Table 1 – Demographic data on NSFB participants.

	n	%	Weighted %
Race			
White	2861	69.0	73.9
Black	974	23.5	17.3
Asian	124	3.0	6.9
Other race	185	4.5	1.9
Ethnicity			
Hispanic	743	15.7	16.3
Marital status			
Married	3028	63.2	63.5
Formerly married	691	14.4	15.7
Never married	1069	22.3	20.9
Education			
Less than high school graduate	232	4.8	11.4
High school graduate or GED	965	20.1	28.3
Some higher education	1402	29.3	28.6
4 + years of higher education	2193	45.8	31.7
Family income			
Less than \$15,000	376	8.6	11.9
\$15,000–\$29,999	675	15.4	15.8
\$30,000–\$39,999	452	10.3	10.3
\$40,000–\$49,999	517	11.8	11.6
\$50,000–\$59,999	491	11.2	12.2
\$60,000–\$74,999	559	12.8	12.4
\$75,000–\$100,000	657	15.0	13.8
Greater than \$100,000	645	14.8	12.0
Region of residence			
New England	141	2.9	4.9
Mid-Atlantic	633	13.2	13.6
East North Central	643	13.4	15.2
West North Central	340	7.1	6.5
South Atlantic	879	18.3	18.8
East South Central	320	6.7	5.9
West South Central	687	14.3	11.7
Mountain	325	6.8	6.8
Pacific	824	17.2	16.7
Urban–rural continuum			
Metropolitan	4051	86	85.1
Religious affiliation			
Protestant	2049	44.1	42.1
Catholic	1234	26.6	27.5
Other Christian	611	13.2	13.5
Other religion	352	7.6	7.7
No religion	397	8.6	9.2
Religious attendance			
Regular attendee	1544	46.7	44.7
Obstetric history			
Nulligravid	924	19.3	14.7
Nulliparous	1226	25.6	19.4

[Table 2]. Compared with white women, black and Asian women were more likely to have ethical concerns with partner IUI ( $P < 0.01$  and  $P < 0.001$ , respectively). Several classes of women from lower-income families, most notably women from families below the poverty line ( $P < 0.001$ ), also had increased ethical concern with IUI. Additionally, compared with women with no religious affiliation, Catholics and Protestants ( $P < 0.05$ ) were more likely to have ethical concerns with partner IUI. Other non-Protestant Christians were more likely to have serious ethical concerns with partner IUI ( $P < 0.001$ ). Conversely, women with 4 + years of higher education ( $P < 0.05$ ) were less likely to find partner IUI to be ethically problematic, and women living in metropolitan areas were less likely to have serious ethical concerns with partner IUI ( $P < 0.01$ ).

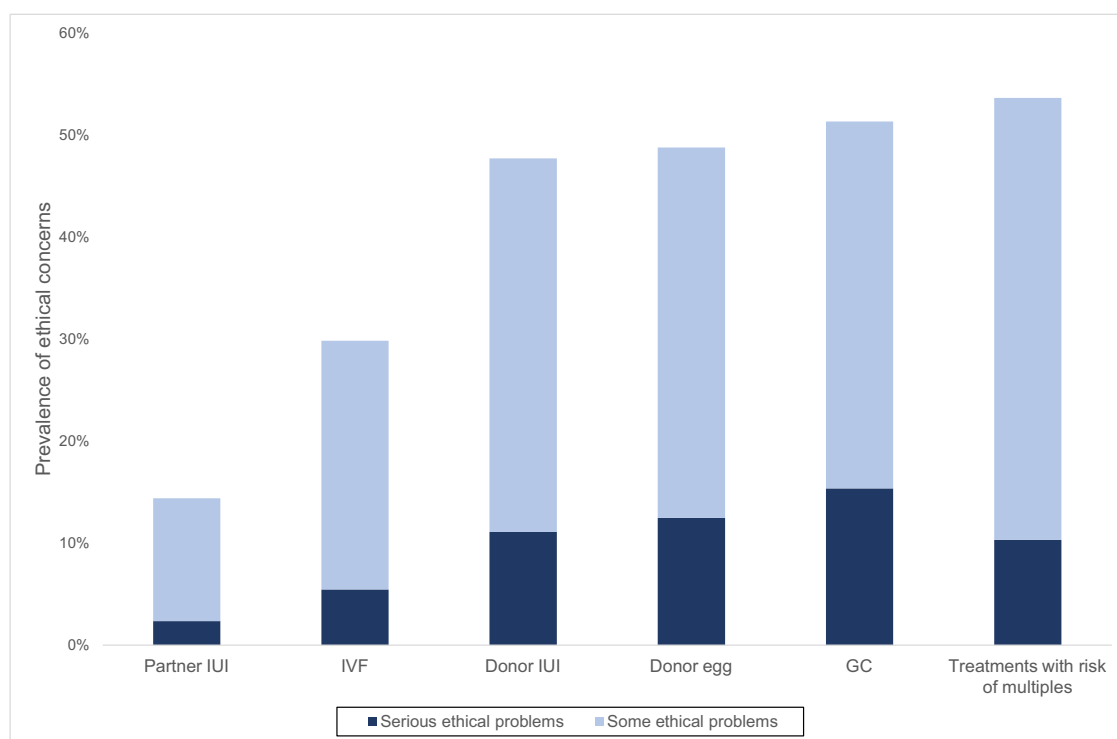


Figure 1 – Prevalence of ethical concerns with fertility treatments among US women of reproductive age. GC = gestational carrier.

Ethical concerns over IVF were more than twice as common as ethical concerns over partner IUI (Figure 1). Relative to whites, Asian women were more likely to have serious ethical concerns with IVF ( $P < 0.01$ ; Table 2). Geographic differences in ethical concern were noted for IVF, with women in the South Atlantic USA (including the states of Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia and Washington, DC;  $P < 0.01$ ) and the Pacific USA (including the states of Alaska, California, Hawaii, Oregon and Washington;  $P < 0.05$ ) more than twice as likely to have serious ethical concerns as women from the Mid-Atlantic states of New Jersey, New York and Pennsylvania. Compared with women with no religious affiliation, Protestants and other Christians ( $P < 0.05$ ) were also more likely to have ethical concerns over IVF. Furthermore, women who attend religious services regularly were more likely to have ethical concerns over IVF ( $P < 0.05$ ). As was seen with partner IUI, women with 4 + years of higher education ( $P < 0.01$ ) were less likely to find IVF to be of serious ethical concern.

Among third-party reproductive strategies, donor IUI was more likely to be of serious ethical concern with advancing age ( $P < 0.01$ ) and was generally more problematic among black ( $P < 0.001$ ) and Asian women ( $P < 0.01$ ) when compared with white women (Table 2). Additionally, women who regularly attend religious services ( $P < 0.001$ ) and identify as Protestant ( $P < 0.05$ ) or other Christian ( $P < 0.01$ ) were more likely to find donor IUI ethically problematic (Table 2). Donor egg use was met with higher ethical concern by black, Asian and Hispanic women ( $P < 0.01$ ) when compared with their white and non-Hispanic counterparts (Table 2). Relative to women with no religious affiliation, Protestants ( $P < 0.05$ ) and other non-Protestant Christians ( $P < 0.01$ ) were more likely to have ethical concerns over egg donation. Regular attendance at religious services ( $P < 0.01$ ) was associated with an increased chance of having some, but not serious, ethical concerns over donor egg use. GC use was more likely to be

ethically problematic to Asian women, when compared with white women ( $P < 0.01$  for lesser concerns,  $P < 0.001$  for serious concerns). Additionally, GC use was of greater ethical concern among Catholic women ( $P < 0.05$ ) and was more likely to be of serious ethical concern to those women who regularly attend religious services ( $P < 0.01$ ).

While fertility treatments associated with a higher risk of twins were the most common cause of ethical concern among survey participants, only residence in the Pacific USA significantly predicts this ethical concern ( $P < 0.01$ ; Table 2). Unlike for the other fertility treatments, race and religion did not predict this ethical concern.

## Discussion

Using a large, nationally representative survey, the first systematic assessment of the ethical views of US women of reproductive age regarding specific fertility treatments was performed. While previous studies have used non-representative convenience samples (Constantinidis and Cook, 2012), limited their scope to people seeking treatment for infertility (Ugwu et al., 2014) or focused on subpopulations of women, such as medical students (Heikkila et al., 2006), this is the first study to use a nationally representative sample of all potential consumers of infertility healthcare. This offers the benefits of maximal generalizability to all US women who may consider such treatments, while avoiding exclusion of those women whose ethical concerns (or other sociocultural barriers) keep them from seeking care. Furthermore, while previous studies have analysed ethical concerns over fertility treatments in general (Greil et al., 2010; Shreffler et al., 2010), this study is the first to examine ethical concerns over individual therapies. Our findings confirm that this is an

Table 2 – Sociocultural determinants of ethical concerns with various fertility treatments.

	Adjusted odds ratio* [95% confidence interval]					
	IUI	IVF	Donor IUI	Donor egg	GC	Treatments with increased risk of twins
Age	<b>1.03 (1.00–1.07)<sup>a</sup></b>	0.99 [0.96–1.02]	1.00 [0.98–1.02] / <b>1.05 (1.01–1.08)<sup>b</sup></b>	1.01 [0.98–1.03]	1.03 [1.00–1.05]	1.01 [0.99–1.03]
Race						
White	1.0 (Referent)					
Black	<b>2.04 (1.26–3.33)<sup>b</sup></b>	1.53 [0.96–2.44]	<b>1.94 (1.35–2.78)<sup>c</sup></b>	<b>1.89 (1.21–2.94)<sup>b</sup></b>	1.53 [0.98–2.41]	1.08 [0.73–1.59]
Asian	<b>5.48 (2.10–14.3)<sup>c</sup></b>	2.62 [0.95–7.25] / <b>9.80 (2.34–41.0)<sup>b</sup></b>	<b>3.87 (1.69–8.87)<sup>b</sup></b>	<b>3.49 (1.38–8.83)<sup>b</sup></b>	<b>4.01 (1.49–10.8)<sup>b</sup> / 11.1 (3.80–32.7)<sup>c</sup></b>	1.65 [0.78–3.46]
Other race	1.62 [0.66–4.02]	0.23 [0.05–1.13]	0.72 [0.35–1.51]	0.28 [0.07–1.08] / 1.27 [0.26–6.13]	1.95 [0.68–5.61]	0.87 [0.40–1.90]
Ethnicity						
Hispanic	1.71 [0.97–3.01]	1.28 [0.76–2.14]	1.41 [0.96–2.06]	<b>1.98 (1.26–3.12)<sup>b</sup></b>	1.18 [0.71–1.97]	0.84 [0.55–1.29]
Not Hispanic	1.0 (Referent)					
Marital status						
Married	1.0 (Referent)					
Formerly married	0.98 [0.56–1.72] / 1.90 [0.82–4.43]	0.87 [0.55–1.40]	0.87 [0.58–1.31]	0.83 [0.53–1.30]	0.81 [0.49–1.34]	0.91 [0.60–1.36]
Never married	1.01 [0.60–1.71]	0.93 [0.60–1.44]	0.86 [0.58–1.26]	0.68 [0.45–1.04]	0.93 [0.59–1.48]	1.06 [0.73–1.52]
Family income						
Less than \$15,000	<b>5.02 (2.03–12.4)<sup>c</sup></b>	<b>2.15 (1.07–4.35)<sup>a</sup></b>	1.60 [0.86–2.99]	1.42 [0.72–2.79]	1.09 [0.48–2.47]	1.78 [0.94–3.37]
\$15,000–\$29,999	<b>2.10 (1.01–4.33)<sup>a</sup></b>	1.18 [0.61–2.29]	1.07 [0.68–1.68]	0.83 [0.47–1.47]	0.91 [0.50–1.66]	1.01 [0.60–1.69]
\$30,000–\$39,999	2.02 [0.95–4.31]	0.79 [0.42–1.51]	1.46 [0.92–2.32]	0.87 [0.49–1.54]	1.20 [0.64–2.22]	0.80 [0.46–1.36] / 1.90 [0.99–3.67]
\$40,000–\$49,999	<b>3.46 (1.77–6.74)<sup>c</sup></b>	1.50 [0.84–2.68]	<b>1.86 (1.17–2.96)<sup>b</sup></b>	1.33 [0.76–2.34]	1.26 [0.70–2.26]	1.18 [0.71–1.95]
\$50,000–\$59,999	1.77 [0.77–4.08]	1.15 [0.60–2.22]	1.49 [0.89–2.50]	0.83 [0.43–1.60]	0.87 [0.42–1.80]	0.82 [0.48–1.40]
\$60,000–\$74,999	<b>2.87 (1.38–5.94)<sup>b</sup></b>	0.86 [0.45–1.64]	1.27 [0.79–2.04]	0.68 [0.40–1.18]	0.93 [0.52–1.65]	1.10 [0.65–1.84]
\$75,000–\$100,000	1.0 (Referent)					
Greater than \$100,000	2.12 [0.96–4.70]	1.01 [0.53–1.92]	1.12 [0.72–1.75]	0.76 [0.44–1.33]	0.68 [0.37–1.23]	0.89 [0.55–1.44]
Education						
Less than high school graduate	0.54 [0.24–1.18]	0.74 [0.37–1.48]	1.28 [0.76–2.15]	0.60 [0.29–1.24] / 1.27 [0.55–2.96]	1.19 [0.60–2.37]	1.24 [0.70–2.23]
High school graduate or GED	1.0 (Referent)					
Some higher education	0.73 [0.45–1.18]	1.06 [0.67–1.67]	1.20 [0.84–1.72] / 0.74 [0.45–1.22]	1.35 [0.90–2.03]	1.14 [0.73–1.78]	0.86 [0.58–1.26]
4 + years of higher education	<b>0.57 (0.33–0.99)<sup>a</sup></b>	0.79 [0.50–1.24] / <b>0.30 (0.14–0.63)<sup>b</sup></b>	1.12 [0.77–1.64]	0.97 [0.64–1.49]	1.06 [0.67–1.70] / 0.58 [0.31–1.08]	0.97 [0.67–1.41]
Region of residence						
New England	0.47 [0.15–1.42]	1.13 [0.42–3.05]	1.15 [0.63–2.11]	1.36 [0.64–2.88]	0.71 [0.30–1.66] / 2.31 [0.75–7.10]	1.38 [0.65–2.93]
Mid-Atlantic	1.0 (Referent)					
East North Central	1.20 [0.58–2.47]	1.53 [0.78–3.01]	0.92 [0.55–1.57]	1.14 [0.66–1.96]	0.99 [0.57–1.73]	1.63 [0.99–2.67]
West North Central	0.47 [0.21–1.07]	1.32 [0.64–2.71]	0.92 [0.55–1.53]	0.96 [0.52–1.77]	0.66 [0.34–1.30] / 1.49 [0.62–3.59]	1.10 [0.64–1.92]

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Table 2 – (continued)

	Adjusted odds ratio* [95% confidence interval]					
	IUI	IVF	Donor IUI	Donor egg	GC	Treatments with increased risk of twins
South Atlantic	0.83 [0.43–1.60]	1.34 [0.72–2.48] / <b>3.51 (1.41–8.70)<sup>b</sup></b>	1.23 [0.77–1.98] / 0.64 [0.34–1.20]	1.01 [0.59–1.72]	1.02 [0.61–1.71]	1.13 [0.68–1.85]
East South Central	1.20 [0.47–3.03]	1.82 [0.83–4.01]	1.43 [0.72–2.85]	1.54 [0.75–3.14]	1.38 [0.51–3.74]	1.01 [0.52–1.98]
West South Central	0.79 [0.38–1.65]	1.00 [0.52–1.94] / 2.71 [1.00–7.40]	0.89 [0.53–1.49]	1.14 [0.65–2.00]	1.04 [0.58–1.88]	1.47 [0.87–2.48]
Mountain	0.96 [0.40–2.32]	0.85 [0.38–1.90]	0.94 [0.53–1.69] / <b>0.32 (0.13–0.79)<sup>a</sup></b>	0.73 [0.38–1.43]	0.75 [0.40–1.44]	1.40 [0.73–2.68] / 0.45 [0.17–1.20]
Pacific	1.21 [0.57–2.56]	1.19 [0.64–2.24] / <b>3.00 (1.26–7.15)<sup>a</sup></b>	1.06 [0.63–1.79]	0.95 [0.58–1.56]	0.80 [0.47–1.33]	<b>1.93 (1.18–3.16)<sup>b</sup></b>
Urban–rural continuum						
Metropolitan	0.68 [0.41–1.11] / <b>0.20 (0.08–0.54)<sup>b</sup></b>	0.90 [0.55–1.46]	0.77 [0.54–1.10]	0.66 [0.43–1.01]	0.89 [0.56–1.40]	0.91 [0.62–1.35]
Not metropolitan	1.0 (Referent)					
History of pregnancy						
Nulligravid	0.78 [0.38–1.62]	1.27 [0.61–2.64]	1.17 [0.74–1.85]	1.16 [0.63–2.16]	1.15 [0.63–2.10]	0.99 [0.54–1.82]
Not nulligravid	1.0 (Referent)					
History of live birth						
Nulliparous	1.21 [0.64–2.30]	0.73 [0.37–1.43]	0.76 [0.50–1.17]	0.81 [0.46–1.41]	0.88 [0.50–1.54]	1.01 [0.56–1.81]
Parous	1.0 (Referent)					
Religion						
Protestant	<b>2.31 (1.07–4.99)<sup>a</sup></b>	<b>2.14 (1.01–4.57)<sup>a</sup></b>	<b>1.71 (1.03–2.84)<sup>a</sup></b>	<b>2.38 (1.10–5.12)<sup>a</sup></b>	1.73 [0.86–3.48]	1.28 [0.76–2.15]
Catholic	<b>2.58 (1.16–5.73)<sup>a</sup></b>	1.97 [0.89–4.35]	1.64 [0.97–2.78]	1.91 [0.89–4.07]	<b>2.06 (1.01–4.20)<sup>a</sup></b>	1.23 [0.71–2.12]
Other Christian	2.02 [0.87–4.68] / <b>7.54 (2.29–24.8)<sup>c</sup></b>	<b>2.52 (1.08–5.87)<sup>a</sup></b>	<b>2.61 (1.45–4.71)<sup>b</sup></b>	<b>3.59 (1.56–8.29)<sup>b</sup></b>	2.17 [0.96–4.90]	1.74 [0.92–3.30]
Other religion	1.64 [0.66–4.04]	1.16 [0.46–2.92]	1.13 [0.62–2.06]	1.84 [0.80–4.26]	1.10 [0.51–2.39]	0.95 [0.51–1.77]
No religion	1.0 (Referent)					
Religious attendance						
Regular attendance	1.40 [0.93–2.11] / 0.53 [0.27–1.05]	<b>1.44 (1.01–2.07)<sup>a</sup></b>	<b>1.62 (1.22–2.15)<sup>c</sup></b>	<b>1.64 (1.17–2.28)<sup>b</sup></b> / 1.00 [0.64–1.55]	1.28 [0.90–1.83] / <b>2.04 (1.19–3.49)<sup>b</sup></b>	1.08 [0.80–1.44]
No regular attendance	1.0 (Referent)					

GC = gestational carrier; IUI = intrauterine insemination.

Where two odds ratios are reported, the first reflects the comparison of any ethical concern versus no ethical concern, while the second reflects the comparison of serious ethical concerns versus no serious ethical concerns.

\* Odds ratios are adjusted for respondent race/ethnicity, age, marital status, family income, level of education, religious service attendance, religious affiliation, nulligravidity, nulliparity, geographic region of residence, and metropolitan versus non-metropolitan residence.

<sup>a</sup>  $P < 0.05$ .

<sup>b</sup>  $P < 0.01$ .

<sup>c</sup>  $P < 0.001$ .



essential approach, as ethical concern over fertility treatments is not an ‘all-or-nothing’ phenomenon; rather, concerns often differ among specific treatment modalities for people of different social and cultural backgrounds.

When examining the overall level of ethical concern over different fertility treatments, a hierarchy of concern is evident. Among the techniques assessed, partner IUI is ethically problematic to the fewest number of women in the USA. This is consistent with previous ethical evaluations of insemination, where concerns have been limited to religious concerns about the moral impurity of standard collection methods and the procedural medicalization of procreation (Ford, 2008; Schenker, 2005). The increased level of ethical concern noted with IVF described relates to the fact that the moral status of the pre-implantation embryo holds significant weight for some women (Shenfield et al., 2001), while the same limited concerns about partner IUI still apply. Additionally, IVF enables additional approaches which add their own ethical concerns, such as pre-implantation genetic diagnosis for adult-onset disorders (Ethics Committee of the American Society for Reproductive Medicine, 2013b) and sex selection (Ethics Committee of the American Society for Reproductive Medicine, 2015b), which may further increase the overall level of ethical concern with this strategy. The treatments with the greatest frequency of serious ethical concern among US women are third-party reproductive strategies. These approaches compound the concerns over IUI or IVF with issues of traditional family structure (Schenker, 2005), commodification (Ethics Committee of the American Society for Reproductive Medicine, 2013a), exploitation (Ethics Committee of the American Society for Reproductive Medicine, 2016) and privacy/anonymity (Ethics Committee of the American Society for Reproductive Medicine, 2014). It is likely that the summation of underlying ethical issues involved in third-party reproduction explains the frequency of serious ethical concern with these approaches found among the general population; however, the exact reasons for the increased ethical concern is an area in need of further research.

While third-party reproduction raises serious concerns in the greatest number of reproductive age women, the treatment approaches with the highest frequency of overall ethical concern are, surprisingly, those that cause an increased risk of multiple gestation. This ethical concern was not subject to many of the same sociocultural influences as other fertility treatments; for example, race, ethnicity and religious attendance did not affect the likelihood of having such ethical concerns. There is limited literature on the ethical views of iatrogenic multiple gestation. Prior discourse has focused on the maternal and neonatal morbidity and social challenges which multiple gestation can incur (ESHRE Task Force on Ethics and Law, 2003). Future studies should evaluate whether it is these associated risks or other issues which underlie the high frequency of ethical concern over fertility treatments that cause an increased chance of multiple gestations.

Among the sociocultural factors found to impact the likelihood of ethical concerns with specific fertility treatments, one of the most notable was the participant’s race and ethnicity. Black women had increased ethical concern over partner IUI, donor IUI and donor egg approaches. This was consistent with previous literature showing increased ethical concerns among black women for infertility treatments in general (Greil et al., 2011) and may represent an important social underpinning of the decreased utilization of assisted reproductive technologies among black women, even after controlling for income (Kessler et al., 2013). Noteworthy, however, was the fact that black women’s views on the ethics of treatments which may lead to multiple

gestation were no different from white women. This demonstrates that black women do not have an increased global ethical objection to all reproductive interventions. The fact that utilization of ovulation induction, an approach which can bring the highest risk of multiples (Practice Committee of American Society for Reproductive Medicine, 2012), does not significantly differ among black and white women (Kessler et al., 2013) suggests that the acceptance of different fertility treatments by black women may at least in part be mediated by their ethical views of the options.

Hispanic ethnicity, on the other hand, was only predictive of increased ethical concern over donor oocytes and not with any other approaches. This finding provides a more nuanced understanding of the ethical concerns of infertility treatment among Hispanic women, which previously was presumed to apply to all types of fertility treatments (Greil et al., 2011). Given their lack of heightened ethical concerns in general, it is likely that Hispanic women’s decreased utilization of fertility treatments (while accounting for language and financial barriers) (Feinberg et al., 2007; Jain and Hornstein, 2005; Kessler et al., 2013) is driven by other sociocultural factors, such as increased sense of stigma (Greil et al., 2011) or the influence of religion.

Another key sociocultural domain influencing ethical concerns with specific fertility treatments was religion. Regular attendance at religious services was associated with increased levels of ethical concern over IVF and the third-party strategies. Notably, regular religious attendance did not increase ethical concerns over the use of partner IUI or approaches that increase the chance of twins, both of which are permissible to most religious groups in the USA (Schenker, 2005). Partner IUI, however, goes against the teachings of the Catholic Church (Ford, 2008); consistent with this, Catholic respondents in the current study were significantly more likely to find partner IUI ethically problematic. Future studies with targeted oversampling of minority religious populations, such as Jewish and Islamic women, should seek to clarify whether US women of these faiths align their views with their religion’s teachings regarding specific fertility treatments. Furthermore, additional studies should examine whether such treatment-specific ethical concerns manifest in different management decisions for infertile women of various faith traditions.

In addition to race, ethnicity and religion, several other sociocultural factors were noted to have a different impact on ethical views for specific treatment approaches. For instance, family income was found to predict ethical views of partner IUI, donor IUI and IVF (where lower-income respondents were more likely to have concerns), while the level of education only impacted ethical views for partner IUI and IVF (in that 4 + years of higher education associated with a significantly decreased likelihood of ethical concern). Additionally, IVF and treatments that increase the chance of twins were the only treatments with increased ethical concern in specific geographic regions of the USA (i.e. portions of the West and Southeast). Because the model adjusts for relevant covariates such as racial and income status, it is likely that local cultural differences underlie these regional variations in ethical concerns. However, further research into the reasons for these different views will be needed in order to better understand their implications.

As increased ethical concern over fertility treatments in general has been shown to result in decreased medical help-seeking (Greil et al., 2010), it is essential that fertility healthcare providers and their colleagues continue to educate the public about fertility treatments and engage in public discourse regarding the ethical concerns that such treatments bring. Overall trends towards increased acceptance of reproductive technologies have been attributed to increased

public awareness [Greil et al., 2016; Kovacs et al., 2012]. As access to care is reliant upon overcoming both financial and social barriers [Ethics Committee of the American Society for Reproductive Medicine, 2015a], assuaging ethical concerns is essential in order to increase the desirability of existing treatment options for a broader segment of the infertile population.

While increased public discourse is necessary, education alone may not be sufficient to overcome ethical concerns among some segments of the population. For instance, women whose ethical concerns are borne out of religion have been shown to have less change in their views of fertility treatments over time when compared with women who are not religious [Greil et al., 2016]. While one approach may be to ignore this segment of the infertile population, the findings of the current study show that specific treatments may be acceptable to religious women while others are not. Thus, efforts should be made to support and further develop fertility treatments which provide an acceptable option for these women, such as tubal surgery in lieu of IVF, oocyte cryopreservation in lieu of embryo cryopreservation [Boldt et al., 2003], and research on *in vitro* gametogenesis rather than reliance on gamete donation [Hikabe et al., 2016]. Furthermore, physicians should be sensitive to any deeply held ethical views that their patients have and consider these concerns when formulating a treatment plan when possible, thereby improving patient satisfaction and the physician–patient relationship.

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