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Decline in ethical concerns about reproductive technologies among a representative sample of US women

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Abstract

Public awareness and utilization of assisted reproductive technology has been increasing, but little is known about changes in ethical concerns over time. The National Survey of Fertility Barriers, a national, probability-based sample of US women, asked 2031 women the same set of questions about ethical concerns regarding six reproductive technologies on two separate occasions approximately 3 years apart. At Wave 1 (2004–2007), women had more concerns about treatments entailing the involvement of a third party than about treatments that did not. Ethical concerns declined between Wave 1 and Wave 2, but they declined faster for treatments entailing the involvement of a third party. Ethical concerns declined faster for women with greater levels of concern at Wave 1. Initial ethical concerns were higher, and there was less of a decline in ethical concerns for women with higher initial levels of religiosity.

Keywords: biotechnology, ethics, genetic and reproductive technologies

1. Introduction

Louise Brown, the world's first "test tube" baby, conceived via in vitro fertilization (IVF), was born in England in 1978 (Johnson-Hanks et al., 2011). Brown's birth raised awareness of the possibility of infertility treatment and generated intense public debate about the ethics of assisted reproductive technologies (ARTs) or medical interventions used to help people conceive a child (Baruch et al., 1988; Henig, 2004). Ethical charges raised against ART included that it involved human interference with the designs of God (or nature, depending on the person making the charge), that it violated the sacredness of the human embryo, that it violated the sanctity of the marriage bond (in versions that involved donor sperm or eggs), that it represented science gone out of control, that it would upset the social order in undesired ways, and that it resulted in the exploitation of women.

The number of individuals utilizing ART has been increasing over the past three decades, and success rates are improving (Sunderam et al., 2014). Some observers have commented that ART has now become routinized and accepted by many as an ordinary aspect of human reproduction (Franklin, 2013; Henig, 2004; Mundy, 2004). The fact that some companies are now offering human egg freezing as a benefit for employees who want to reduce the risk of delaying childbearing suggests that ART has become mainstream (Bennett, 2014). The broader social implications of ART, however, are still subject to ethical debates (Deech and Smajdor, 2007; Franklin, 2013; Hertz, 2008; Mamo, 2007; Shannon, 2003). Ethicists, social critics, and public intellectuals have written about the ethical implications of ART, yet less is known about how the general public perceives the ethical concerns that ART raise or whether perceptions are changing.

Prior studies of attitudes toward ART have taken several approaches. Some studies have asked respondents whether they would be willing to use a particular technology in a hypothetical scenario (Daniluk and Koert, 2012; Halman et al., 1992; Ravin et al., 1997) while others have asked infertile individuals who are actually facing decisions about what ART they are willing to access (Sohrabvand and Jafarabadi, 2005; Ugwu et al., 2014). For example, Chliaoutakis (2002) and Chliaoutakis et al. (2002) asked Greek men and women whether they would be willing to use or encourage others to use technologies involving gamete donation. Genuis et al. (1993) asked respondents to state whether they would use or recommend that a friend use reproductive technologies described in vignettes. A number of studies have simply asked respondents to state the extent to which they approved of specific technologies, although it is often not clear in these studies whether disapproval was due to ethical or other concerns (Constantinides and Cook, 2012; Heikkila et al., 2004, 2006; Kazem et al., 1995; Kovacs et al., 2012; Minai et al., 2007; Sundby and Olsen, 1990; Suzuki et al., 2006).

A wide range of technologies have been examined. While some studies explored a variety of treatment options (Daniluk and Koert, 2012; Halman et al., 1992; Papaharitou et al., 2007; Ravin et al., 1997; Shreffler et al., 2010; Sundby and Olsen, 1990), others explored only the most socially and ethically complex options that involve utilizing gametes or a surrogate (Chliaoutakis, 2002; Genuis et al., 1993; Heikkila et al., 2004, 2006; Kazem et al., 1995; Minai et al., 2007; Sohrabvand and Jafarabadi, 2005; Ugwu et al., 2014). A series of Australian studies (summarized in Kovacs et al., 2003) asked about IVF and gestational surrogacy but did not consider artificial insemination using husband's sperm (AIH), artificial insemination using donor sperm (AID), egg donation, or traditional surrogacy. Constantinides and Cook (2012) questioned respondents about both traditional and gestational surrogacies. There appears to be a tendency for scholars to focus not on the full range of reproductive technologies but primarily on issues surrounding the ethics of ART that have become the subject of proposed legislation in the researcher's own country

(e.g. should donors remain anonymous, should people other than heterosexual married couple have access to the technologies, and should the technologies be state funded).

Few studies have examined the attitudes of participants in a population-based sample. A number of researchers have used convenience samples drawn from clinic populations (Heikkila et al., 2004, 2006; Kazem et al., 1995; Ravin et al., 1997; Sohrabvand and Jafarabadi, 2005; Sundby and Olsen, 1990; Ugwu et al., 2014) or students (Constantinides and Cook, 2012; Papaharitou et al., 2007; Sundby and Olsen, 1990). Halman et al. (1992) compared 185 infertile couples to 90 presumed fertile couples recruited through clinics, newspaper ads, and support groups. Daniluk and Koert (2012) employed an Internet sample of 599 childless women and 200 childless men in Canada. None of the studies just described used a sampling strategy that allows generalization to a broader population. Other researchers have made use of population-based samples drawn from small, usually urban, populations (Chliaoutakis, 2002; Chliaoutakis et al., 2002; Genuis et al., 1993). Only a few researchers have made use of random samples drawn from an entire country or region of a country (Minai et al., 2007; Shreffler et al., 2010; Suzuki et al., 2006). Therefore, it is difficult to determine how much concern exists about the ethics of ART in the broader population.

Few studies of attitudes toward reproductive technologies have explored how these attitudes may have shifted over time. Almost all studies to date are cross-sectional. Because the studies used different types of questions and were conducted with different types of samples in different countries, it is difficult to have confidence in any inferences one might make about within-person attitudinal changes over time. A notable exception is the work of Kovacs et al. (2012), who studied changing attitudes toward ART in Australia on 14 different occasions over a 20-year period. While Kovacs et al. found that support for IVF to help married infertile couples rose from 77% in 1981 to 79% in 2001, the study used a series of cross-sectional surveys, not a longitudinal design. Thus, it is impossible to know whether these changes were due to a cohort effect or due to changed attitudes in the same individuals over time. Suzuki et al. (2006) compared studies of attitudes toward gestational surrogacy in Japan in 1999 and 2003 and found no appreciable differences in attitudes over this 4-year period. This study also relied on two separate samples measured at two different times rather than a longitudinal design.

Yet there is reason to suspect that individuals' ethical concerns about ART might change depending on social factors and changes in the social context over time. Values change through individual process and through cultural change (Bardi and Goodwin, 2011). Cultural lag theory posits that there can be a period of adjustment between the development of new technologies and peoples' acceptance and comfort with using them (Ogburn, 1922). Shreffler et al. (2010) argued that cultural lag theory is relevant for understanding utilization of medical technologies for non-life-threatening conditions such as infertility. It is unclear how concerns might change over time, however. During the data collection period for this study, there was a slow but steady rise in the use of ART in the United States as well as a dramatic increase in the practice of "banking" eggs (Center for Disease Control, 2014). We might therefore expect to see decreasing ethical concern over time as women became more familiar with ART from media reports or encountered more people who had used ART (Gabe and Calnan, 1989). It is also possible that ethical concerns might increase due to media reports on controversial stories involving ART. For example, the story of Nadya Suleman (the "Octomom"), a single woman who conceived octuplets, engendered heavy backlash against the US fertility industry for pushing ethical boundaries (Garrison et al., 2009). A similar pattern was found following the introduction of Valium and Prozac; demands for rapid introduction were followed by increasing concerns and recommendations for restricted use (Marshall et al., 2009).

In the present investigation, a nationally representative sample of respondents were asked to report on the degree to which they felt a series of techniques raised ethical concerns (see Shreffler et al. (2010) for similar questions using a cross-sectional regional sample). We focused on US women's concerns about six reproductive technologies: artificial insemination using husband's sperm (AIH), artificial insemination using donor sperm (AID), IVF, the use of donor eggs, traditional surrogacy in which the surrogate gestates a fetus for which she has herself supplied the egg, and gestational surrogacy in which the egg is supplied by the a woman who wishes to have a child but cannot carry it to term. Note that three of these techniques involve the use of genetic materials from a third party while three do not. Gestational surrogacy perhaps represents an intermediate case, as a third party is involved even though that third party does not supply genetic material. In this study, we classified a method as a third-party method if it requires the involvement of a third party, regardless of whether that third party actually supplies gametes. We used these survey items to construct an overall ethical concerns measure plus two subscales (third party and no third party).

This study used the National Survey of Fertility Barriers (NSFB), a national, probability-based sample of US women. The NSFB includes data on 2031 US women who were asked the same set of questions about ethical concerns about reproductive technologies on two separate occasions approximately 3 years apart. These data therefore provide a way to assess stability or change in ethical concerns about ART among the same group of women over a rolling 3-year time frame. We also compared change scores for levels of ethical concerns for third-party and non-third-party technologies separately. We conducted supplemental analyses to discover whether, within the third-party category, attitudes and changes in attitudes would differ for techniques that involve some form of surrogacy as compared to techniques that do not involve surrogacy. Finally, we also identified sources of variation in attitudes toward ART at Wave 1 as well as sources of changes in attitudes toward ART over time.

2. Data and methods

Participants

The NSFB was designed to assess the social and behavioral consequences of infertility. The NSFB conducted telephone interviews with a probability-based sample of 4787 US women aged 25–45 during the years 2004–2007 (Wave 1) with follow-up interviews 3 years after the initial interview, roughly occurring in 2008–2010 (Wave 2). It took 3 years to collect the initial interviews (i.e. 2004 to the beginning of 2007); therefore, it took 3 years to conduct the follow-up interviews (from the end of 2007 through 2010). The time lapse between interviews was not selected as a specific time frame in which attitudes might change; rather the 3-year window reflects the maximum amount of time possible within funding constraints in which women and couples who had not met criteria for infertility at baseline might experience infertility.

The sample was generated using random digit dialing (RDD). Census central office codes with a high minority population were oversampled to ensure sufficient numbers of women for subgroup analyses. The response rate for the participants answering the screening questions using the American Association of Public Opinion Research (AAPOR) response rate 4 calculation is 53%, typical for contemporary RDD surveys (McCarty et al., 2006). Keeter et al. (2006) demonstrated that surveys with modest response rates can still have minimal bias. Information about the study design, measures, and power analysis can be accessed at: <http://sodapop.pop.psu.edu/codebooks/nsfb/wave1/>. The public-access data files can be accessed at: <http://sodapop.pop.psu.edu/nsfbpage1.html>. To assess generalizability of the NSFB, we compared basic demographic characteristics of women aged 25–45 to the comparable age group in the 2005 Current

Population Survey (CPS), which uses in-person interviews, and has a 90% response rate. Using inverse probability weighting to adjust for sampling strategy, we found close correspondence between demographic distributions in both samples. The sample for this analysis includes all women ($N = 2031$) who were interviewed during both Waves 1 and 2.

The NSF research team attempted to re-interview a subsample of main respondents and all partners 3 years after their original interview. Wave 2 yielded 2136 main respondent interviews. This number is 58% of those sought. Almost all of the attrition between waves of data collection reflects an inability to contact respondents; only 6% of those contacted refused to participate. The critical issue related to bias is whether the attrition affected the central variables related to the study. Logistic regression analysis suggests that there is little association between attrition and variables central to the questions of this study (Johnson et al., 2009).

Measures

Respondents were asked to express their attitudes to six types of assisted reproductive technologies: (1) artificial insemination using husband's sperm (AIH), (2) artificial insemination using donor sperm (AID), (3) IVF, (4) use of donor eggs, (5) traditional surrogacy, and (6) gestational surrogacy. Respondents were asked,

There are many ways medical science can help people with fertility problems have children. Some people think these procedures pose moral and ethical problems; other people believe it is okay to use these techniques to help people have the children they desire. For each of the following fertility treatments, please tell me whether you think this poses no ethical problem, some ethical problems, or serious ethical problems. If you are not sure what the treatment is, just ask and I'll explain it.

We provide the exact wording of the items and the explanations in the Supplementary material.

Each item was measured via three ordered categories: (1) no ethical problem, (2) some ethical problems, or (3) serious ethical problems. The items were examined separately and combined into a scale using the mean of all items. The alpha for the six-item scale was .86. To compare attitudes toward technologies involving the use of third-party genetic material to technologies that do not involve the use of third-party genetic materials, we also constructed a "third-party" scale, consisting of ethical concerns about AID, donor eggs, traditional surrogacy, and gestational surrogacy, and a second "no third-party" scale, consisting of AIH and IVF. According to the American Society for Reproductive Medicine (2012),

The phrase "third-party reproduction" refers to the use of eggs, sperm, or embryos that have been donated by a third person (donor) to enable an infertile individual or couple (intended recipient) to become parents. Donors may be known or anonymous to the intended recipient. "Third-party reproduction" also includes traditional surrogacy and gestational carrier arrangements.

In order to allow for the possibility that respondents might think of surrogacy as fundamentally different from gamete donation, we created two subscales of the third-party scale, one which included both forms of surrogacy and one which included only donor sperm and donor eggs. Change scores were created by subtracting Wave 2 scores from Wave 1 scores. A negative score indicates a decline in ethical concerns, while a positive score indicates an increase in ethical concerns.

A number of independent variables were included in our regression analyses to allow us to see what factors were associated with ethical concerns at Wave 1 and with changes in ethical

concerns from Wave 1 to Wave 2. Women with higher levels of income and education may have more understanding about how ART works and therefore may have fewer ethical concerns. Likewise, they are more likely to use ART or to know others who have used it. On the other hand, they may have greater access to ethical critiques and might therefore have more ethical concerns. Americans often find questions about income sensitive. Therefore, the survey asked about family income in ordinal categories that range from 1 (less than US\$5000) to 12 (US\$100,000+). To make the family income variable continuous, we substituted the dollar-value midpoint of each category for the category value. Education was measured in years.

Infertility is more common among Black and Hispanic than White women in the United States, yet treatment is more common among White women. Because minority women are less likely to utilize ART and because they may be more suspicious of medical institutions, they might be expected to have greater ethical concerns (Greil et al., 2011). We therefore included measures of race/ethnicity using the two standard census questions (US Census Bureau, 2011). To simplify analysis, all participants were assigned to a single racial category based on known patterns of racial identification in the United States. Individuals who reported multiple races/ethnicities were classified giving first priority to identification as "Hispanic" and second priority to identification as "Black." Based on this coding, dummy variables were constructed for Black, Hispanic, and Asian compared to White. The few respondents indicating "other" were included in the White category because earlier research has shown that women in the "other" category do not differ significantly from White women.

Younger survey participants grew up with the existence of ART while older participants were about 10 years old when Louise Brown was born; as a result, there may be more ethical concerns among older participants. Age was measured in years. All women were between the ages of 25 and 45 at the time of the Wave 1 interview. ART may have different levels of salience for parents and non-parents; parity might thus be related to levels of ethical concern. Parity was measured by three variables indicating 1, 2, or 3+ children compared to no children. Live birth by Wave 2 reflects whether respondents had a live birth between Waves 1 and 2. A variable indicating that a woman had a live birth between waves was included in the change score regression analysis only.

Prior studies have shown that more religious women have more ethical concerns about ART than less religious women (Greil et al., 2010; Shreffler et al., 2010). Religiosity was measured by four questions: (1) "How often do you attend religious services?" (2) "About how often do you pray?" (3) "How close do you feel to God most of the time?" and (4) "In general, how much would you say your religious beliefs influence your daily life?" The items were standardized and averaged; they form a single factor and have a high reliability ($\alpha = .78$). Religions vary in official positions on ART. Some religions are more supportive of ART than others (Schenker, 2005). Religious denomination was assessed by the question, "What is your religious preference? Is it Protestant, Catholic, Jewish, Islamic, or some other religion, or no religion?" The possible answers were (1) Protestant, (2) Catholic, (3) Jewish, (4) Islamic, (5) something else (please specify), and (6) no religion. Based on the open-ended questions, "something else" was divided into "other Christian" and "other religion." Protestant was treated as the reference category in our regression analyses.

Valuing motherhood could lead to fewer ethical concerns about ART as women who value motherhood more might see ethical concerns about treatments as less important than the goal of achieving motherhood. Importance of motherhood was constructed by averaging responses to five questions (e.g. "Having children is important to my feeling complete as a woman") and is a single factor scale ($\alpha = .86$). Women who have fertility barriers may be likely to have fewer ethical concerns than women without fertility barriers, again because the desire for motherhood might be expected to overshadow other concerns. Because we considered that ethical concerns were more likely to be associated with self-perception than with actually meeting the medical

criteria for infertility, we used a measure of self-perception in this study. Self-identifying as a person with a fertility problem was measured by an affirmative answer to either of the following questions: “Do you think of yourself as someone who has, has had, or might have trouble getting pregnant?” or “Do you think of yourself as someone who has or has had fertility problems?” Women who answered “no” to both questions were considered not to have self-identified as having had a fertility problem.

Statistical analysis

Our analysis proceeded through four stages. We first provide descriptive statistics for the analytical subsample (women who responded at both Waves 1 and 2). We next conducted a series of paired-samples *t*-tests showing changes in ethical concerns between Waves 1 and 2, followed by several paired-samples *t*-tests showing whether the change scores for ethical concerns varied by third-party versus non-third-party methods. Among those in the third-party category, we also examined whether attitudes and changes in attitudes differ for techniques that involve some form of surrogacy as compared to other techniques. We then conducted linear regression analysis to determine what factors were associated with ethical concerns about reproductive technologies at Wave 1. Finally, we conducted a second regression analysis to discover which factors were associated with change scores for ethical concerns from Wave 1 to Wave 2. Note that the purpose of this second regression analysis was to see which variables were associated with change scores for ethical concerns. We included a score for ethical concerns at Wave 1 based on the expectation that the change score for an individual might be associated with that individual’s baseline score.

3. Results

Table 1 presents descriptive statistics for our sample, weighted to adjust for sampling strategy and for attrition between Waves 1 and 2. Income and education levels for this sample were higher than national levels, yet race/ethnicity, parity, and religious denomination are similar to national data. Table 2 summarizes the ethical concerns scales (possible range is from a low of 1 to a high of 3). The mean score for the ethical concerns scale at Wave 1 was 1.49, a low to moderate level of ethical concerns toward ART. The highest score was 1.71 for traditional surrogacy, and the lowest score was 1.13 for artificial insemination using husband’s sperm (AIH). As can be seen from the comparison of third-party versus non-third-party technologies toward the bottom of the table, the concern score for technologies not involving a third party was significantly lower than the score for technologies that do involve a third party. Most effect sizes were quite small, but the effect size here was large (Cohen’s $d = -.80$). Within the third-party technologies, technologies not involving any form of surrogacy generated less concern than did technologies involving surrogacy. The mean score for the ethical concerns scale at Wave 2 was 1.45. The concern score for technologies not involving a third party was significantly lower than the score for technologies that do involve a third party at Wave 2, and the effect size was large (Cohen’s $d = -.78$). Within the third-party technologies, those not involving any form of surrogacy generated less concern than did technologies involving surrogacy at Wave 2.

The third set of columns in Table 2 displays the change in level of ethical concerns between Waves 1 and 2. The ethical concerns score at Wave 2 was significantly lower than the mean score at Wave 1. Ethical concerns about all technologies except IVF decreased significantly between Waves 1 and 2. The change score for technologies not involving a third party was significantly lower than the change score for technologies that do involve a third party. Within the

Table 1. Descriptive statistics for a subsample of 2031 women who were interviewed twice from the National Survey of Fertility Barriers.

Variable	%/M	SD
Income at Wave 1	66.97	40.50
Education at Wave 1	15.41	2.69
White (includes 65 "other race")	66.22%	
Black	16.45%	
Hispanic	12.21%	
Asian	2.61%	
Age at Wave 1	35.35	5.98
Never married at Wave 1	21.37%	
Parity 0 at Wave 1	36.14%	
Parity 1 at Wave 1	23.39%	
Parity 2 at Wave 1	24.08%	
Parity 3 + at Wave 1	16.40%	
Live birth by Wave 2	14.82%	
Religiosity at Wave 1	-0.21	2.93
Protestant at Wave 1	43.60%	
Catholic at Wave 1	26.49%	
Jewish at Wave 1	2.43%	
Islamic at Wave 1	0.40%	
Other religion at Wave 1	5.26%	
No religion at Wave 1	9.52%	
Other Christian at Wave 1	12.30%	
Importance of parenthood at Wave 1	3.19	0.76
Not subfecund at Wave 1 or Wave 2	46.09%	
Subfecund Wave 1 only	34.81%	
Subfecund Wave 2 only	6.06%	
Subfecund Wave 1 and Wave 2	13.05%	

SD: standard deviation

third-party technologies, technologies involving any form of surrogacy did not exhibit a significantly different change score for ethical concerns than did technologies not involving surrogacy.

Table 3 shows the results of the multiple regression analysis of factors associated with ethical concerns at Wave 1. Note that Tables 3 and 4 have three fewer cases than Tables 1 and 2 due to missing data introduced when additional independent variables were added to the analysis. This small loss of cases is unlikely to bias results. Women with higher educational attainment had slightly lower levels of ethical concerns for the overall scale. Black, Hispanic, and Asian women had higher levels of ethical concern on the overall scale than White women. Keith (2014) suggests using multiple comparison tests to determine the significance of dummy variables in multiple regression; the associations for Hispanics and Asians were no longer significant following a Bonferroni correction. Higher religiosity was associated with higher levels of ethical concern on the overall scale. More religious women had higher levels of ethical concern than less religious women on the third-party scale as well. Women who reported no religion had fewer concerns than women with a religious affiliation on the third-party scale, but this difference was no longer significant after a Bonferroni correction. Women with one or two children had higher ethical concerns about technologies with no third party than women with no children, although these associations were no longer significant after a Bonferroni correction. Self-identifying as

Table 2. Multiple regression analysis of factors associated with ethical concerns about infertility treatments at Wave 1, $N = 2171$.

Variable	Ethical concerns scale: all technologies				Third-party technologies				No third-party technologies			
	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>B</i>	<i>SE</i>	β	<i>p</i>
Income	-.01	-.02	.03	.402	.01	.01	.02	.467	-.02	.01	-.04	.082
Education	-.01	-.04	.02	.101	-.01	.01	-.05	.061	-.01	.00	-.08	.002**
Black	.08	.06	.02	.018*	.09	.03	.06	.010*	.04	.03	.03	.171
Hispanic	.07	.04	.02	.067	.07	.04	.05	.048*	.02	.03	.02	.403
Asian	.17	.05	.02	.018*	.15	.07	.05	.034*	.03	.06	.01	.594
Age	.00	.04	.02	.104	.00	.00	.04	.065	.00	.00	.02	.465
Never married	-.03	-.03	.03	.281	-.03	.03	-.02	.432	.01	.03	.01	.834
Parity 1	-.01	-.01	.03	.862	-.01	.03	-.01	.704	.03	.03	.03	.221
Parity 2	.01	.01	.03	.855	.01	.04	.01	.692	.06	.03	.07	.023*
Parity 3	.05	.04	.03	.206	.03	.04	.02	.482	.07	.03	.07	.020*
Religiosity	.13	.23	.03	.000***	.12	.02	.21	.000***	.07	.01	.16	.000***
Catholic	.01	.01	.03	.658	.01	.03	.01	.655	.06	.02	.07	.004**
Jewish	-.04	-.01	.02	.569	-.01	.07	.00	.866	.11	.06	.04	.055
Islamic	.15	.02	.02	.397	.05	.18	.01	.776	.11	.14	.02	.437
Other religion	.01	.01	.02	.829	.07	.05	.03	.172	.07	.04	.04	.096
No religion	.09	.05	.03	.043*	.09	.05	.05	.039*	.10	.04	.07	.005**
Other Christian	.06	.04	.02	.127	.08	.04	.05	.037*	.03	.03	.03	.284
Importance of parenthood	.00	.00	.03	.876	.01	.01	.03	.197	.00	.00	-.03	.293
Subfecund	.03	.03	.02	.178	.03	.02	.03	.200	.02	.02	.02	.423
Constant	1.43	.13		.000	1.493	.122		.000	1.49	.10		.000
R^2	.084				.073				.053			

SE: standard error.

* = $p < .05$; ** = $p < .01$; *** = $p < .001$

infertile was not associated with ethical concerns at Wave 1. The variables included did not explain a large portion of the variance of any of the scales; the R^2 values are quite low (.084 for the full scale, .017 and .012 for the subscales).

Table 4 displays the results of the multiple regression analysis of factors associated with changes in ethical concerns between Waves 1 and 2. Few characteristics were associated with change scores for ethical concerns. Ethical concerns declined overall, but those with higher concerns at Wave 1 had the largest declines in ethical concerns by Wave 2. The coefficient ($B = -.47$) is almost a whole standard deviation (SD) of the scale ($SD = .52$). Whenever we use survey data to measure change over time, there is the risk that what appears to be a true change actually reflects as regression to the mean (Campbell and Kenny, 2002). To evaluate whether our results could be explained by regression to the mean, we constructed a modified Galton Squeeze Diagram (Campbell and Kenny, 2002). We combined women into six categories based on ethical concerns scores at Wave 1 and graphed the change for each group between Waves 1 and 2 in order to see whether women at both extremes regressed toward the mean. Figure 1 shows modified Galton Squeeze Diagram for ethical concerns. The four higher scores all have declines—some quite large (over .50 on a scale from 1 to 3). The lower scores are steady (1.50) or have a slight increase (1.00). The patterns of change based upon Wave 1 scores suggest that some, but not all, of the changes in ethical concerns about ARTs are due to regression to the mean and that some are true changes.

Table 3. Paired-samples *t*-tests for ethical concerns, W1, W2, and change scores.

Variable	Wave 1		Wave 2		Change scores		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SE</i>		
Comparisons between Wave 1 and Wave 2								
Artificial insemination using husband's sperm	1.32	0.39	1.10	0.34	−0.03	0.01	−3.16	.002
Artificial insemination using donor sperm	1.56	0.67	1.50	0.65	−0.06	0.02	−3.84	.000
In vitro fertilization	1.34	0.58	1.31	0.56	−0.03	0.01	−1.80	.073
Donor eggs	1.59	0.69	1.53	0.67	−0.06	0.02	−3.86	.000
Traditional surrogacy	1.71	0.72	1.67	0.70	−0.04	0.02	−2.44	.015
Gestational surrogacy	1.62	0.71	1.59	0.68	−0.04	0.02	−2.25	.025
Ethical concerns scale	1.49	0.52	1.45	0.49	0.04	0.01	3.98	.000
No third-party scale	1.23	0.39	1.21	0.40	−0.03	0.01	2.77	.006
Third-party scale	1.62	0.51	1.57	0.59	0.05	0.01	4.22	.000
Third-party no surrogacy scale	1.57	0.58	1.51	0.63	0.06	0.01	4.40	.000
Third-party surrogacy scale	1.67	0.63	1.63	0.66	0.04	0.02	2.64	.008
	Wave 1		Wave 2		Change scores		<i>t</i>	<i>p</i>
	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>	<i>t</i>	<i>p</i>		
Comparisons between types of ethical concerns								
No third party versus third party	−35.96	.000	−35.17	.000	−2.01	.042		
Third-party no surrogacy versus third-party surrogacy	−6.64	.000	−10.25	.000	−1.20	.232		

SD: standard deviation; *SE*: standard error.

Only two other variables are associated with change in overall ethical concerns: parity 1 (compared to parity 0) and religiosity. Women with one child had an even larger decline in concerns than women with no children, but this effect was no longer significant after a Bonferroni correction. More religious women had less of a decline. For the third-party subscale, women who were Islamic had less of a decline compared to those who were Protestant, but this change was no longer significant after a Bonferroni correction. For all three ethical concerns scales, change scores were lowest among those who were more religious. For the non-third-party subscale, women with one or two children reported more of a decline in concerns than women with no children, but these changes were no longer significant after a Bonferroni correction. Contrary to expectations, the measures of importance of parenthood and self-perceived infertility problems were not associated with change in ethical concerns.

4. Discussion

Using the NSFB, we explored change in ethical concerns toward ART over a 3-year period among a probability-based sample of US women. We had two research goals. First, we explored whether ethical concerns with six types of reproductive technologies have decreased over time,

Table 4. Multiple regression analysis of factors associated with changes in ethical concerns about infertility treatments over a 3-year period, $N = 2033$.

Variable	Ethical concerns scale: all technologies				Third-party technologies				No third-party technologies			
	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>B</i>	<i>SE</i>	β	<i>p</i>	<i>B</i>	<i>SE</i>	β	<i>p</i>
Ethical concerns	-.47	.02	-.54	.000***	-.42	.02	-.40	.000***	-.60	.02	-.56	.000***
Income	-.01	.01	-.02	.333	-.02	.01	-.04	.089	-.01	.01	-.03	.196
Education	.00	.00	.02	.283	.01	.01	.04	.091	.00	.00	-.02	.399
Black	.00	.03	.00	.868	.00	.03	.00	.945	-.01	.02	-.01	.666
Hispanic	.04	.03	.03	.220	.05	.04	.03	.224	.03	.03	.02	.234
Asian	.07	.06	.03	.204	.12	.07	.04	.080	.05	.05	.02	.294
Age	.00	.00	.01	.501	.00	.00	.03	.277	.00	.00	.01	.750
Never married	-.04	.03	-.04	.112	-.06	.03	-.05	.065	-.03	.02	-.03	.243
Parity 1	-.06	.03	-.06	.023	-.06	.03	-.05	.056	-.06	.02	-.06	.016*
Parity 2	-.02	.03	-.02	.421	-.02	.04	-.02	.561	-.05	.03	-.05	.046*
Parity 3	.02	.03	.01	.590	.03	.04	.02	.389	.01	.03	.01	.837
Live birth by W2	-.03	.03	-.03	.214	-.02	.03	-.01	.521	-.03	.02	-.02	.259
Religiosity	.06	.01	.12	.000***	.09	.02	.14	.000***	.06	.01	.13	.000***
Catholic	.01	.02	.01	.741	-.01	.03	.00	.867	.01	.02	.01	.729
Jewish	.03	.06	.01	.578	.00	.07	.00	.994	.00	.05	.00	.938
Islamic	.21	.14	.03	.130	.36	.18	.04	.040*	.06	.13	.01	.662
Other religion	-.03	.04	-.02	.452	-.09	.05	-.04	.086	-.03	.04	-.01	.514
No religion	-.03	.04	-.02	.364	-.06	.04	-.04	.152	.02	.03	.02	.486
Other Christian	-.01	.03	-.01	.772	-.01	.04	-.01	.730	-.02	.03	-.01	.511
Importance of parenthood	.00	.00	.01	.596	.00	.01	-.01	.788	.00	.00	.02	.520
Subfecund W1 only	-.02	.02	-.02	.368	-.03	.03	-.02	.318	-.01	.02	-.01	.771
Subfecund W2 only	.03	.04	.02	.443	.04	.05	.02	.454	.02	.03	.01	.532
Subfecund W1 and W2	.02	.03	.01	.485	.03	.04	.02	.339	.03	.03	.02	.281
Constant	.57	.10		.000	.91	.25		.000	.74	.10		.000
R^2	.279				.170				.305			

* = $p < .05$; ** = $p < .01$; *** = $p < .001$

and, moreover, whether any change in attitudes has been uniform across type of treatment. We were especially interested in observing whether change scores for ethical concerns differed for third-party versus non-third-party technologies. Second, we identified sources of variation in both attitudes toward ART and changes in attitudes toward ART over time.

We found low to moderate levels of ethical concerns with ART at Wave 1. This is consistent with previous research. Generally, research has suggested favorable attitudes toward treatment when individuals were asked to consider how they might proceed if faced with an episode of infertility (Chliaoutakis, 2002; Daniluk and Koert, 2012). People also have tended to say that they would pursue treatment if they were infertile (Ravin et al., 1997). More than half of respondents in prior studies have reported attitudes favorable to gamete donation (Chliaoutakis, 2002; Chliaoutakis et al., 2002; Minai et al., 2007), and more than half of the respondents in one study said they would be willing to donate gametes (Genuis et al., 1993). Attitudes toward surrogacy have been reported to be less positive than attitudes toward gamete donation (Chliaoutakis,

Figure 1. Modified Galton Squeeze Diagram showing ethical concerns at Waves 1 and 2 by categories based on unadjusted mean score at Wave 1.

2002; Suzuki et al., 2006), with traditional surrogacy being seen as posing the most serious ethical concerns (Shreffler et al., 2010). Only a few women have reported being willing to become surrogates themselves, but it is unclear whether their reluctance is related to ethical concerns or something else (Poote and Van den Akker, 2009).

Ethical concerns were greater at Wave 1 for technologies that entailed the involvement of a third party than for technologies that did not entail such involvement. This is in line with the results of other studies that have addressed the question of whether attitudes toward technologies that entail the involvement of a third party differ from attitudes toward technologies that do not. Prior studies find that technologies involving donor gametes are viewed less favorably than those that maintain genetic ties (Daniluk and Koert, 2012; Halman et al., 1992; Papaharitou et al., 2007; Ravin et al., 1997; Shreffler et al., 2010; Sundby and Olsen, 1990). Shreffler et al. (2010) found that IVF poses few ethical concerns despite the high level of technological intervention. They argued that low perceived ethical challenges of this procedure result from the ability (when donor materials are not required) of both members of a couple to be biologically related to the resulting child. It is not just a genetic link that is important, however, because people also have reported concerns about gestational surrogacy (Chliaoutakis, 2002; Daniluk and Koert, 2012; Shreffler et al., 2010).

We found that higher levels of education were associated with lower scores on the ethical concerns scale as a whole and that ethnic/racial minorities had higher scores on this same scale, although these findings may well have been due to chance. Shreffler et al. (2010) found that those with higher incomes and higher educational levels expressed fewer ethical concerns with ART,

though Suzuki et al. (2006) found no relationship between income and attitudes toward gestational surrogacy in Japan. Genuis et al. (1993) observed that college graduates were more likely than those with less education to assert that they would be willing to donate gametes. Constantinides and Cook (2012) examined the influence of demographic factors on support for gestational and traditional surrogacies but only after controlling for perceptions of the experience of surrogacy. Had they treated perceptions of the experience of surrogacy as a mediating variable rather than as a control variable, they might have found that demographic characteristics were associated with attitudes toward surrogacy. The question of the relationship between demographic variables and ethical concerns must be regarded as not yet settled.

Unlike some studies that have found that older individuals express more ethical concerns with ART (Genuis et al., 1993; Papaharitou et al., 2007), we found no association between age and ethical concerns. It should be noted that the age range in our study was limited to women who were of reproductive age at Wave 1. Suzuki et al. (2006) found no difference in attitudes toward gestational surrogacy in Japan, while Shreffler et al. (2010) uncovered a curvilinear pattern for age, with women aged 30–40 expressing the fewest ethical concerns about reproductive technologies. In analyses not reported here, we added a curvilinear term for age, but the curvilinear term did not have a significant effect. In congruence with our findings, we found that greater religiosity was associated with higher degree of ethical concern at Wave 1 as measured by the scale as a whole and by the third-party scale. This is consistent with prior research suggesting that religiosity is associated with greater ethical concern with ART (Shreffler et al., 2010). As church attendance increases, intent to use ART decreases (Chliaoutakis et al., 2002). Similarly, Papaharitou et al. (2007) found that “practicing believers” reported more negative attitudes toward ART. Religious denomination may also be relevant to attitudes toward reproductive technology. Genuis et al. (1993) observed that Evangelical Christians appeared less willing to donate gametes than members of other religious denominations. Sohrabvand and Jafarabadi (2005) suggested that infertile couples in Iran express low levels of willingness to third-party technologies, which might be due to the respondents’ Islamic religion, but we had few Islamic women in our sample. In Nigeria (Ugwu et al., 2014), one-third of infertile individuals who rejected AID cited religious beliefs as the reason. In this study, we did not find strong evidence that religious denomination was associated with the degree of ethical concerns with ART. We did find that women who claimed no religion had lower levels of concern with third-party technologies at Wave 1 than Protestant women, although this finding could well be due to chance.

We found no relationship between self-identified fertility problems at Wave 1 and ethical concerns with ART. A few studies that compare presumed fertile and infertile couples find that those who actually experienced an episode of infertility had more favorable attitudes toward ART (Halman et al., 1992; Heikkila et al., 2004; Shreffler et al., 2010), although Shreffler et al. (2010) reported this finding for only one of their two samples. Our data provide no clear evidence why our results differ from other studies.

Overall ethical concerns declined between Waves 1 and 2. To our knowledge, this is the first study to employ data from a group of women who were asked the same set of questions about ethical concerns about reproductive technologies on two separate occasions 3 years apart. Compared to cohort change studies, we have strong evidence of within-person declines in ethical concerns. Cohort studies could reflect individual change, sample differences, or historical change. It is possible, however, that the change we observed was due to a “learning effect” driven by participation in the first wave. We know, for example, that knowledge of the technical aspects of ART has remained low (Chliaoutakis et al., 2002; Kiliaranta et al., 2011; Papaharitou et al., 2007). Individuals with more knowledge of ART and those who knew someone who had infertility treatments had more favorable attitudes (Papaharitou et al., 2007) which lends some support

to the idea that exposure to and understanding of the technical aspects of ART reduces ethical concerns. Jacobson (2015) found that many people are unclear about the meaning of gestational surrogacy and that people become more favorable to gestational surrogacy once they understand that it does not involve the use of donor gametes. Thus, it is possible that change in attitudes which appears to be due to thoughtful reconsideration of ART may be due to the fact that, at Wave 2, women have already been introduced to these technologies and have had a chance to consider them from the perspective of greater knowledge.

Ethical concerns declined between Waves 1 and 2 for all technologies except IVF. Our finding that concern with IVF did not decline contrasts with the findings of Kovacs et al. (2012), who reported that support for IVF in Australia rose dramatically between 1981 and 2001. We do not think this difference is due to a difference between attitudes in Australia and the United States. It seems more likely that support for IVF was already so high in the United States by 2004–2007, when our first wave of data was collected, that there was not much room for change. Our findings contrast with the work of Suzuki et al. (2006) who found no change in Japanese attitudes toward gestational surrogacy between 1999 and 2003. This difference may reflect real differences in Japanese and American attitudes toward gestational surrogacy, but we do not have a strong empirical foundation for making this claim.

Ethical concerns declined faster for technologies that entailed the involvement of a third party. This is likely due, at least in part, to the fact that concern about non-third-party techniques was already so low at Wave 1 that there was not a lot of room for change. Ethical concerns declined much faster among those women who had higher levels of ethical concern to begin with. Ethical concerns declined more slowly among religious women. Thus, there is evidence that religion still contributes to ethical concerns about ART for some women.

As with all studies, this study has some limitations. As we discussed above, we cannot rule out the possibility that our results may reflect a learning effect for sample participants. We should also note that effect sizes are relatively small. Another limitation is that we have reported on women only. We plan to conduct a future study that will compare ethical concerns for women and their male partners. In addition, we have looked at change over a relatively short time span only. We took advantage of existing data for this study; we have no rationale for determining the ideal time span to assess change in ethical concerns about ART. The fact that we were able to detect significant change over such a short time period is, therefore, all the more impressive. The data set used in this study (NSFB) did not include questions addressing embryo donation, known versus unknown donors, cloning, availability of ART to single and lesbian women, and so on. Furthermore, data collection ended in 2010, and this study therefore does not reflect any changes that may have happened since that time. Finally, this study was conducted in the United States, a country where there are minimal restrictions on ART but also little economic support for those who wish to utilize these technologies. It can therefore not be assumed that these findings can be generalized to other countries.

Future research should consider the question of the reasons for change in ethical concerns over time as well as the influence of personal relationships and network factors on ethical concerns. It will also be interesting to see whether the decline in concern we have observed continues into the future. We are especially interested in whether religiosity will continue to act as a brake on the decline in ethical concerns about ART. Our findings are important in their own right as documentation of the increasing acceptability of ART, but they also have some implications for practice. In particular, clinicians need to be sensitive to the fact that religious patients may require additional counseling to help them to make informed decisions about which technologies to avoid and which to utilize.

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