

WHAT SHAPES PUBLIC ATTITUDES TOWARDS ASSISTED REPRODUCTION TECHNOLOGIES IN EUROPE?¹

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ABSTRACT

By examining attitudes on assisted reproduction technologies (ART) in 42 European countries, we highlight individual and country-level factors that are associated with the level of social acceptance or rejection of ART. This paper contributes to the literature on social acceptance of artificial insemination and in-vitro fertilization, the two most prominent examples of ART in Europe, and directs attention to several previously under-researched aspects. The empirical base of this study is the fourth round of the European Values Study, conducted in 2008–2010. Using a multilevel random-intercept linear regression model, we examine the impact of several individual- and country-level characteristics on the agreement level with the statement that artificial insemination or in-vitro fertilization can always be justified, never be justified or it is evaluated in a mixed manner. According to our findings, there are strong relationships between attitudes towards ART and socio-demographic variables, as well as religiousness and some individual attitudes, including those related to traditional family formation practices, “justification for homosexuality”, (non-)preference for homosexual neighbors and acceptance of adoption by homosexual couples. For country-level characteristics we find significant association only in the case of mean age at first birth of women. We do not find a significant relationship between attitudes towards ART and country-level variables such as GDP, religiosity and same-sex couples’ access to ART.

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Keywords: assisted reproductive technologies, European comparison, attitudes, European Values Study (EVS), multilevel regression

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ON-LINE SUPPLEMENTARY MATERIAL

The electronic supplementary material for this article can be found on-line at the journal's website: <https://demografia.hu/en/publicationonline/index.php/demografiaenglishedition/issue/view/363>.

INTRODUCTION

In 1978 the first baby was born who was conceived through in-vitro fertilization (IVF) – Louise Brown. Since that time, millions of children were conceived by using IVF (Adamson et al., 2013). This method was invented for treating cases of female infertility by fertilizing oocytes using sperm in a laboratory, where the embryo was surgically implanted into the woman's womb. However, to tackle male fertility problems, such as low sperm counts or poor sperm quality, new methods were invented, such as intracytoplasmic sperm injection (ICSI) in the late 1980s. ICSI is a special kind of IVF procedure in which a single sperm is injected directly into the egg (Präg and Mills, 2017).

On the one hand, the development of assisted reproduction technologies (ART) has made it possible for individuals who would have previously suffered from childlessness, such as individuals with fecundity problems due to advanced age or medical problems, single women, or same-sex couples to experience parenthood with the help of artificial insemination, IVF and surrogate motherhood

(Bartels, 2004; Blaževičienė et al., 2014; Hudson et al., 2009). Although technological options can help to a degree with age-related fertility issues, they cannot completely compensate for the drop in fertility (Leridon, 2004; Liu and Case, 2017).

On the other hand, ART has been used to help avoid several serious illnesses by pre-implantation diagnosis within the context of IVF programs or even by three-person IVF, which has recently become legal in the United Kingdom (The Human Fertilisation..., 2015).

Despite the fact that artificial insemination and IVF have been used to alleviate the problems of involuntary childlessness for almost four decades, we know much less about the social aspects of these reproductive technologies compared to what the medical scientific literature holds on the biological aspects of them. The most extensive literature on ART focuses on the attitudes of people who have donated or used donated gametes in fertility treatments (Kazem et al., 1995; Kirkman, 2003). Previously conducted research focused mostly on single respective areas, such as egg donations or surrogacy (Beckman and Harvey, 2005; Bolton et al., 1991; Kazem et al., 1995) and did not examine the attitudes towards assisted reproduction in general terms. Nonetheless, the general public probably has more reservations about ART than its users do (Bolton et al., 1991; Shreffler et al., 2010). Several studies have been conducted among university students (Meissner et al., 2016; Vujčić et al., 2017), making it difficult to evaluate the knowledge related to ART among the older and the lower educated fertile age population. Another limitation of previous studies is that they were usually carried out in a single given context (Shreffler et al., 2010; Wennberg et al., 2015).

Most of the recently conducted research on ART focuses on social policies in European countries with regards to the access to ART treatments and procedures (Präg and Mills, 2017). However, the analyses are limited to selected countries and do not provide information on how individual characteristics of citizens influence the attitudes towards ART. In addition, knowledge is relatively scarce about how the national contexts are associated with individual characteristics in shaping public opinions. The goal of this study is to find out how the most recent social changes, related to family background and religiousness, economic development and the legal background of family formation have influenced public attitudes towards ART.

The investigation of attitudes of the general public is crucial because it can provide several benefits for academic research and public policy. Social aspects of ART, such as national attitudes towards artificial insemination and IVF are important for regulating ART, influencing its availability and utilization in the long run. This is because the acceptance of ART by the general public can affect not only the demand for, but also the supply of ART (Ziebe and Devroey, 2008).

For example, public attitudes can influence the willingness to become a gamete donor. Moreover, the families who use ART may have to face a variety of negative public attitudes. If ART is more accepted in a society, these families might face less prejudices (Hudson et al., 2009). Given that ART also relates to declining fertility rates and the problem of aging populations in Europe (Kohler et al., 2002), ART is sometimes expected to be more than a means to alleviate the individual suffering from involuntary childlessness. In addition, some see it as a potential policy tool to raise fertility rates (Präg and Mills, 2017). Thus, ART might become part of the family policy mix in Europe.² Lastly, public attitudes are important in the context of cross-border care (also named reproductive tourism), where individuals who cannot successfully have treatment in their own country for various reasons seek medical assistance through ART in other countries, usually with less restrictive legal environments. This can result in higher costs for families, less regulation and control by the health authorities of given states (Mills and Djundeva, 2013; Präg and Mills 2017).

The aim of this study is to examine the attitudes of European societies on artificial insemination and IVF, the two most prominent examples of ART. In order to enable a better understanding of the main determinants, we consider both individual- and country-level factors, by doing a multilevel analysis. Our analysis is based on data from 42 European countries, with differences in many respects such as cultural and family related attitudes, economic circumstances, and the legal background of ART. We use the fourth wave of the European Values Study (EVS), which was carried out between 2008 and 2010.³ A great benefit of using EVS is that it is a large-scale, highly standardized, academically conducted survey where questions are asked in the same way in all of the countries.

BACKGROUND AND HYPOTHESIS

In this chapter, we summarize the findings of previous research related to attitudes towards ART. We formulate hypotheses based on theoretical considerations. Since there is no study yet which examines the country-level factors of acceptance of ART, first we investigate the wider context related to fertility change, religious background, economic and policy related settings that

² For example, the Hungarian government makes efforts to increase the birth rate by providing more financial support for ART users and to increase access to it (4/2020 I. 31. Government Decree).

³ The latest (fifth) round of EVS was already fielded in 2017 (although the final data was not yet released at the time of this study). However, we believe that the results of this study are still relevant because in general attitudes change slowly.

might influence the attitudes towards ART across countries. Afterwards, we present previous research related to the individual-level factors and the results relating to characteristics of individuals.

National-level factors in attitudes towards ART in the analyzed period

There are two main comprehensive theories which explain the rapid decline in fertility rates. The New Home Economics emphasizes that women pursuing careers in larger numbers has a negative influence on fertility (Becker, 2009; McDonald, 2004). This is due to the increase in female education levels and a greater availability of opportunities for women in the labor market. Thus, having children raises the issue of “opportunity costs” for women. The assumption being that women would drop out of the labor force when their children are very young (Rindfuss et al., 2016). At the same time the widely acclaimed second demographic transition (SDT) framework stresses the changes in value systems, such as individualism and declining religiosity, in order to explain the ongoing changes in family and fertility patterns (Lesthaeghe, 2010; Lesthaeghe and Moors, 2000; van de Kaa, 1987). “The model countries” of the spread of the SDT values and behaviors have experienced postponement of first birth, but their fertility rates surpass other countries’ fertility rates in Europe. At the same time childbearing is becoming less frequently seen as a “duty towards society,” while it increasingly serves individual self-fulfillment and private joy (Sobotka, 2008).

There are huge differences among countries in the mean age of women at first birth (CIA World Factbooks, 2010). For example, the mean age of first birth was above 29 in Denmark, Luxembourg, Switzerland and Germany in 2008, while it was below 26 in Latvia, Lithuania, Romania and Bulgaria in the same period. The age-related subfertility is considered to be the main factor that can lead to the use of ART (Schmidt et al., 2012). Thus, we assume that there is an association between mean age at first birth and the acceptance of ART at the country level. *We expect that a higher mean age at first birth is associated with a greater acceptance of ART at the country level (H1a).*

Religious groups vary greatly in their attitudes towards ART. The attitudes of the Jewish community seem to be the most liberal, allowing the practice of all techniques of assisted reproduction, while the Roman Catholic view seems to be very restrictive (Schenker, 2005). In Catholicism, human procreation is forbidden to be separated from sexual intercourse of married spouses and the embryo has a moral status of a human being starting from the conception. Thus, all

assisted reproductive technologies are disapproved of, whereas the Protestant, Anglican and Orthodox doctrines can be found between these two extremes. Islam seems to be more liberal than Catholicism in this sense because it accepts physicians trying to help an infertile couple to achieve conception. However, ART is allowed only for a husband and a wife during their marriage and a third party is unacceptable in cases like providing an egg, sperm, embryo or uterus (Schenker, 2005). We expect that the overall religious environment relates to the acceptance of ART, namely, that in more religious environments we expect less of an acceptance of ART.

We expect that in countries where attendance of religious services is higher, there should be a lower acceptance of ART. Or in other words, in a society where the proportion of those who attend religious services is high, people are less permissive when it comes to attitudes towards ART (H1b). We also expect that in societies where the dominant religious denomination is Catholicism, people are less tolerant towards ART, compared to those people who live in countries where the dominant denomination is Protestant or Orthodox Christian (H1c).

There are two main factors when it comes to the access and availability of ART: possible limitations in access to ART and the extent to which ART services are reimbursed by a health insurance (Final Report, 2008; Präg and Mills, 2017; Ory et al., 2014).

Access to ART can be hindered based on several criteria, such as: marital status (married or legally living together), maximum age of the woman, maximum age of the man, and the welfare of the child (more specifically, regarding the HIV status and the criminal records of the parents). The most important selection criteria for the access to ART is the couples' age, followed by the couples' marital status (Ziebe and Devroey, 2008; Final Report, 2008). Previous studies found that people support the use of donated gametes less in case of the treatment of lesbian, single or older women (Kailasam et al., 2001; Westlander et al., 1998). Possible reasons for these restrictions might be related to keeping the traditional paradigm of families: two-parent, heterosexual, biologically connected family in certain age interval (Fasouliotis and Schenker, 1999). In 2008, most of the European countries had a limitation to ART based on women's age, except for example Hungary and Italy⁴ (there is no data for: Cyprus, Latvia, Lithuania, Malta, Poland, Slovakia and non-EU countries) (Final Report, 2008). Furthermore, Austria, France, Germany, Sweden

⁴ The lack of age limit does not mean that these societies are more tolerant with ageing women who want to have children. To the contrary, the age norm of childbearing is stricter for example in Hungary and in Italy than in other countries (Szalma, 2014), so there is no need for legal limitation to exclude older women from ART because the social norms might suffice.

and the UK also apply a limitation based on men's age (Final Report, 2008). Despite the increase in the average age at first birth for women in all European countries, there are social norms and medical reasons to limit the access to ART based on women's age. Medical reasons include the risk of preterm births and stillbirths, for which there is a higher likelihood among mothers 35 years of age and older (Schmidt et al., 2012). However, male age is also a crucial factor in infertility and for the reproductive outcome (Schmidt et al., 2012), however, limitation to ART is based only on women's age in most societies. This might derive from the fact that men and women are not seen as making the same commitment when it comes to parenting, or that in most societies it is expected that women should be the primary caregivers of children (Fasouliotis and Schenker, 1999).

Looking at marital status, the following countries did not apply any limitations based on such prerequisites: Belgium, Bulgaria, Denmark, Finland, Greece, Latvia, Estonia, Ireland, Luxemburg, the Netherlands, Slovenia, Spain and Switzerland. (There is no data for: Cyprus, Lithuania, Malta, Poland, Slovakia and non-EU countries) (Final Report, 2008; Präg and Mills, 2017). Restriction of ART to married or cohabiting couples may be explained by the widely accepted public view that children raised in two-parent families have an advantage over children living with a single parent (Fasouliotis and Schenker, 1999; Carbin et al., 2011). Previous studies also stated that children in single-parent families do worse than those in two-parent households, due to the financial strain of single parent households, less parental involvement and less supervision of activities outside the home (Astone and McLanahan, 1991; Manning and Lamb, 2003). In addition, marital restriction might be motivated by homophobic attitudes in countries where same-sex marriage is not allowed (Beckman and Harvey, 2005; Jacob, 1997; Takács, 2018). However, several studies show that it is not the number or the gender of the parents but the quality of parenting is what matters (Stacey and Biblarz, 2001; Biblarz and Stacey, 2010). Some studies found evidence that children who grow up with lesbian or gay parents develop just as well as children whose parents are heterosexual (Biblarz and Stacey, 2010; Tasker, 2010). Despite this, in most countries, lesbians are not allowed to utilize ART (Präg and Mills, 2017). Through comparing different regulatory frameworks across Europe, it becomes evident that lesbian couples' access to ART is allowed in fewer countries than it is for single women. Consequently, there is a paradox: in some countries (for example in Hungary) lesbian couples can have access to ART as single parents, but not as a couple (Takács, 2018), which introduces discrimination against children raised by same-sex couples (as they are allowed to have only one legal parent instead of two).

The laws regarding parenting for singles and same-sex couples (for example via adoption or access to ART) can have an effect on permissive attitudes towards ART, making it possible for single women and lesbian couples to become parents. Such approach is frequently criticized for the assumption of reverse causality. A more tolerant society is beyond doubt more likely to introduce permissive ART legislation; however, we do have a reason to assume that permissive ART legislation also affects the shaping of social attitudes. Since ART is permissive for single women and lesbian couples (“modes of existence“; Bech, 1997), people will regard it as part of everyday life. Therefore, *we expect that there is a positive association between the permissive legal background towards parenting of same-sex parents and the acceptance of ART (H1d). Both of them are associated with modern values towards families.*

The reimbursement of ART seems to play an important role in understanding cross-national differences in the acceptance of ART, since it is still a very expensive method for most users. While Belgium and Denmark are known for their comparably generous reimbursement policies for couples and individuals undergoing ART, there are no reimbursements for ART (in 2008) for example in Belarus, Ireland, Switzerland, Malta, Poland, and Slovakia (Final Report, 2008; Präg and Mills, 2017). Chambers and colleagues (2014) showed that ART affordability was positively associated with ART utilization. Thus, we consider that economic development of the country might be related to better health services and that in countries with higher GDP, individuals are more likely to afford fertility treatments. *We expect positive association between usage and acceptance of ART. Thus, in countries with higher GDP, people are more permissive towards ART (H1e).*

Overview of individual-level factors and hypotheses in the analyzed period

Previous research conducted on selected small samples in various settings found some evidence for the differences in perception of ART based on gender, age, education level and household income (Hudson et al., 2009; Shreffler et al., 2010). However, they found mixed results regarding gender and age (Hudson et al., 2009; Kailasam et al., 2001; Shreffler et al., 2010). In addition, we examine two dimensions of religiosity. One dimension being one’s belonging to a particular denomination, while the other is the frequency of attending religious services. Furthermore, we also focus on two additional factors which were not examined in previous studies, such as attitudes towards homosexuality and towards the concept of traditional families.

Socio-demographic factors that may influence the attitudes towards ART

Previous research yields mixed results for gender differences when it comes to attitudes to ART. Some studies found that women are more likely than men to hold tolerant attitudes towards ART, because the experience of infertility more directly affects them (Baluch et al., 1994; Shreffler et al., 2010). Additionally, for women it is considered to be more important to have children in order to have fulfilling lives than it is for men in most European countries (Szalma, 2014). Therefore, *we expect that women are more tolerant in terms of ART than men (H2a)*. However, some studies found the opposite: suggesting that men are more permissive towards ART than women (Kazem et al., 1995; Chilaoutakis et al., 2002).

Most studies show that the increasing age of women at first birth is one of the possible key factors in explaining low fertility rates (Kohler et al., 2002). On an individual level, there is evidence that women who have their first child at a later age have fewer children than women who become mothers at a younger age (Billari and Borgoni, 2005). As for attitudes toward ART, there are two opposite expectations related to age. The young are more likely to support ART than older individuals because they are generally more open towards new ideas and technologies (Kailasam et al., 2001). However, in a US sample Shreffler and co-authors (2010) found a curvilinear relationship between age and the acceptance of artificial reproductive technologies. The assumption is that young women and men are anticipating themselves to be fertile and thus find ART less useful. In comparison, ART might be perceived as being less disturbing later in life as having children becomes a more urgent matter (Shreffler et al., 2010). *We assume a curvilinear relationship between age and attitudes towards ART, as we expect that individuals at the end of their fertility periods have the highest level of acceptance towards ART by being more personally affected (H2b)*.

Both economic theories (Becker, 2009; Waldfoegel, 1997) and the theory of the second demographic transition (Lesthaeghe and Neels, 2002; Sobotka, 2008) suggest that higher level of education is related to later and lower fertility among women because they have high opportunity costs in terms of their work career, income and social status by becoming mothers (Schmidt et al., 2012). Since the higher educated are more likely to face infertility because they tend to postpone childbearing, we can expect that they are more likely to have a supportive attitude towards ART. Secondly, studies have also shown that higher educated individuals often have more tolerant attitudes towards new ideas and technologies, therefore they should be also more tolerant towards ART

(Shreffler et al., 2010). However, some studies have also found that education had little influence on attitudes (Kazem et al., 1995). *We expect to find that the acceptance of ART is greater among those with higher educational attainment compared to lower educated respondents (H2c).*

Besides education, economic circumstances are highly predictive of attitudes. Firstly, women with high earnings are more likely to postpone their childbearing to a later age in favor of their careers (van Bavel, 2010). Since with aging women become less fertile, they are also more likely to turn to ART (Ziebe and Devroey, 2008). Secondly, more affluent individuals have better access to ART, as in most cases the costs are not covered fully by health insurance (Buckles, 2008; Shreffler et al., 2010). *We expect that having higher income is positively associated with the acceptance of ART (H2d).*

Several studies focus on the relationship between acceptance of ART and *religiosity*, but most of them are based on religious discourses rather than on empirical research (Chilaoutakis et al., 2002; Schenker, 2005). On an individual level, researchers showed that those who participate in religious services in accordance with the regulations of the church are more likely to have children, regardless of denomination (Frejka and Westoff, 2008; Zhang, 2008). However, research identifies differences between types of religions: Orthodox adherents, relative to Catholics and Protestants, showed lower tendency to have another child (lower levels of actual fertility), as well as intentions to have another child (Philipov and Berghammer, 2007). According to the authors, this might be due to several underlying reasons, such as differences based on ethnicity and socio-economic factors (Philipov and Berghammer, 2007). Previous studies found a strong negative relationship between church attendance and acceptance of ART (Chilaoutakis et al., 2002; Shreffler et al., 2010). *We expect that those who belong to the Catholic denomination are the least likely to accept artificial insemination or in-vitro fertilization, because they regard infertility as being determined by God's will (H2e). In addition, we also expect that attendance of religious services is negatively related to the acceptance of ART on an individual level (H2f).*

The role of preferences

Previous research shows that respondents who have experienced infertility are more supportive of ART (Genuis et al., 1993; Shreffler et al., 2010) because they are likely to have a greater degree of understanding of and interest in treatments, and perhaps more empathy for other people also experiencing infertility. However, infertility is not the only reason why people turn to ART: the lack of a partner, or

being gay or lesbian also may have led people to involuntary childlessness. The adoption by same sex couples and/or ART can be interpreted as a creation of a new paradigmatic frame for alternative families, in which heterosexuality is no longer a prerequisite to procreation and where the family is premised on choice, not necessarily on a biological condition. *We hypothesize that the acceptance of homosexuality also goes hand in hand with the acceptance of artificial insemination or in-vitro fertilization (H3a).*

In spite of the fact that ART has implications for family lives, so far, no research has examined the direct relationship between attitudes towards ART and family related norms, beliefs and values. There are two views regarding the effect of ART on families. One view is that assisted reproductive technologies can be considered conservative because "...instead of threatening traditional families, these technologies merely replicate them, allowing infertile couples to create biologically related children" (Rao, 1996: 47). A high preference for traditional family formation practices reflects the view that (heterosexual and fertile) married couples can provide the best and most preferred environment for childrearing. Meanwhile, there is another, opposite overarching view about ART: namely, that it might threaten the traditional family by allowing singles and lesbian to have children, which implies that children growing up in non-traditional families can potentially face disadvantages. *We also expect that individuals who are in favor of traditional family practices are less likely to support ART (H3b).*

DATA AND METHODS

Data

We use data from the fourth wave of the European Values Study (EVS). The EVS is a large-scale longitudinal survey research program, which has been conducted every nine years since 1981 in a number of European countries. The sample design of the survey was a representative multi-stage stratified random sampling of the adult population of 18 years old and older. Face-to-face interviews with a standardized questionnaire were conducted between 2008 and 2010. The EVS provides insights into the ideas, beliefs, preferences, attitudes, values and opinions of citizens all over Europe, through the use of standardized questionnaires.

The fourth EVS wave covered 47 European countries and over 67,491 respondents in Albania, Armenia, Azerbaijan, Austria, Belarus, Belgium,

Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Northern Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Georgia, Greece, Hungary, Iceland, Ireland, Northern Ireland, Italy, Kosovo, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Republic of Moldova, Republic of Montenegro, the Netherlands, Norway, Poland, Portugal, Romania, Russian Federation, Serbia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, and Great Britain. After a reduction based on missing values, the size of the analytic sample has been reduced to 41,969 individuals nested in 42 countries. Because of many missing values in all variables, we excluded five countries from the analyses: Azerbaijan, Cyprus, Northern Cyprus, Northern Ireland and Kosovo. Additional analyses were performed to account for those who did not answer the question, and what implication that might have for the study. For further details on sample selection and missing values, please refer to the Appendix.

Measurement

The dependent variable

The dependent variable measures the acceptance level of artificial insemination or in-vitro fertilization on a ten-point scale, ranging from “never” (1) to “always” (10). The question is formulated as follows: “Please, tell me whether artificial insemination or in-vitro fertilization can always be justified, never be justified or something in between.” This question was only asked in the 2008 module of the EVS. After accounting for missing values in relation to the rest of the variables used in the analyses, only Malta and Moldova had missing value rates higher than 10%. We used the information of all individuals who answered the question on ART and the additional questions on socioeconomic factors, homosexuality and family norms. Additional analyses were performed to check on those who did not answer the question(s) and what implication that might have for our study.

Table 1 shows the mean values of the dependent variable in 42 European countries. As we can see, the mean value in our sample was 6.02. However, there were great differences in between countries. The highest rate was measured in Iceland, followed by Sweden, Denmark, Bulgaria, Norway and Finland. Whereas the lowest rate was measured in Georgia, followed by Armenia, Romania and Turkey. *Table 1* indicates that the Nordic countries as well as Bulgaria have the

Table 1: Agreement level with the statement "Artificial insemination or in-vitro fertilization can always be justified, never be justified or something in between" (1 – never; 10 – always) in 42 European countries, 2008–2010

Country	Mean	Standard deviation	Country	Mean	Standard deviation	Country	Mean	Standard deviation
1. Albania	4.48	3.16	16. Greece	7.19	2.66	31. Romania	4.25	3.23
2. Austria	5.64	3.26	17. Hungary	6.08	3.41	32. Russian Federation	5.87	3.27
3. Armenia	4.20	3.12	18. Iceland	8.87	1.79	33. Serbia	6.19	3.56
4. Belgium	6.95	2.63	19. Ireland	5.11	3.06	34. Slovak Republic	5.88	2.98
5. Bosnia Herzegovina	4.73	3.66	20. Italy	5.20	3.22	35. Slovenia	7.13	3.09
6. Bulgaria	7.65	3.02	21. Latvia	5.46	2.98	36. Spain	7.26	2.73
7. Belarus	6.66	2.97	22. Lithuania	6.14	2.89	37. Sweden	8.00	2.61
8. Croatia	6.23	3.35	23. Luxembourg	6.69	3.21	38. Switzerland	6.01	2.78
9. Czech Republic	6.72	3.09	24. Malta	3.62	3.11	39. Turkey	4.50	3.76
10. Denmark	8.00	2.52	25. Moldova	3.51	3.13	40. Ukraine	5.86	3.22
11. Estonia	6.42	2.85	26. Montenegro	7.05	3.36	41. Macedonia	6.38	3.62
12. Finland	7.43	2.60	27. Netherlands	7.28	2.45	42. Great Britain	6.12	3.02
13. France	7.04	2.69	28. Norway	7.55	2.46			
14. Georgia	3.88	3.03	29. Poland	5.04	3.24			
15. Germany	5.70	3.22	30. Portugal	5.96	3.02	Total sample	6.02	3.03

Source: authors' calculations using European Values Study wave 4.

most positive attitudes towards ART, while people living in South-Eastern countries hold the most negative attitudes.

Explanatory variables

We include five country-level explanatory variables: (1) *The mean age at first birth* is calculated as the weighted average of the different childbearing ages, using age-specific fertility rates as weights for first-order births.⁵ (2) We introduce two country-level *religious variables*: one binary variable measures whether more than 60% of the respondents in a certain country stated that they went to a religious place of worship either weekly, once a month or for holy days. (3) The other religious variable presents the *dominant* (the mode or the most commonly reported) *religious denomination* of a country (Roman Catholic, Protestant Christian, Muslim, Orthodox Christian, other and non-religious), based on responses from the EVS 2008. (4) We also included the *country-level GDP*, measured as purchasing power parity (PPP) in USD (CIA World Factbook, 2008). (5) The last country-level variable is a measurement of *the legal policy environment*: whether same-sex couples had access to ART services in a given country or not in 2008.

Individual-level explanatory variables include measurements of basic demographic features. Respondents' age was coded into six age groups: 18-29; 30-39; 40-49; 50-59; 60-69; and 70 and above. *Education* was coded using the ISCED-97 codes (level 0 – pre-primary education; level 1 – primary education or first stage of basic education; level 2 – lower secondary or second stage of basic education; level 3 – (upper) secondary education; level 4 – post-secondary non-tertiary education; level 5 – first stage of tertiary education; level 6 – second stage of tertiary education). *Household income* is measured in PPP USD, a measure made through finding the values (in USD) of a basket of consumer goods that are present in each country (such as orange juice, pencils, etc.). The PPP household income also takes the costs of living into account and it is most often used to measure the quality of life in a country. In addition, the PPP method eliminates the effects of differences and changes in relative price levels, particularly in terms of non-tradable goods, and therefore provides a better overall measurement on the real value of outputs produced by an economy

⁵ Information was taken from the United Nation Statistical Database, and when missing, it was derived from the CIA World Factbook (only for Azerbaijan for 2010; for Armenia for 2013; for Cyprus for 2005; for France for 2006; for Netherlands for 2005; for Sweden for 2005; for Turkey for 2013; for Macedonia for 2010). The final results are not sensitive to the data source.

compared to other economies (The World Bank, 2015). *Marital status* was coded into five groups (married, registered partnership, widowed, divorced or separated, never married or never in registered partnership). *Number of children* range from 0 to 3 and more.

Individual-level religiosity was captured by two variables: *type of denomination* (Roman Catholic, Protestant Christian, Muslim, Orthodox Christian, other and non-religious) and *frequency of attending religious services* (weekly or more often; once a month; on holy days; rarely; and never).

The second set of individual-level variables measure *attitudes* towards homosexuality. The first question asks whether “homosexual couples should not be able to adopt children”, and it is coded on a five-point scale ranging from strongly disagree to strongly agree. The second question asks whether “you would not like to have homosexuals as neighbors”, and it measures answers as a binary indicator (0=yes, 1=no). Attitudes toward the traditional family were measured using two questions. The first question is about the approval of living together without getting married (“It is alright for two people to live together without getting married”). The variable was reversely coded on a five-point scale, from strongly disagree to strongly agree. The second variable is related to traditional family values: “If someone says a child needs a home with both a father and a mother, would you tend to agree or disagree?”.

Methods

Following a multilevel approach, our analyses take into account the hierarchical data structure (individuals clustered in countries) by using a two-level linear model (for detailed technical information on multilevel models, see Snijders and Bosker, 1999 and Hox, 2002). We use a random intercept model for several reasons: we want to test level-two effects; the countries are regarded as a sample from a population and the inference focuses on this given population; and the group effects are approximately normally distributed.

To examine the variances in attitudes towards ART at the individual- and country-levels before introducing any specific predictors, we computed an empty two-level hierarchical model with only variance components (not reported in tables). This revealed that the individual-level variance to be explained is 9.476, while the country-level variance is comparatively smaller, 1.552. Hence, the intra-class correlation is $1.552/(1.552+9.476) = 0.141$, which means that around 14% of the variation in attitudes towards ART is located on the country level.

This captures the correlation between attitudes towards ART for two randomly selected individuals in a randomly selected country. The intra-class correlation statistics confirm that there is significant variance in attitudes towards ART measured on both levels.

The regression analyses are conducted in MLwiN 2.28 and STATA 13. Applying multilevel models has the advantage of recognizing the partial interdependence of individuals within the same group, or citizens within the same country in our case. Multilevel models are useful for analyzing data characterized by a complex variance structure, caused by individual observations being nested in groups. We performed additional tests by performing a likelihood ratio test and examining whether or not the inclusion of each additional variable in the model improves the model fit. For the sake of parsimony and better interpretation of results, we present only the final models in *Table 1*.

RESULTS

We ran two models. In the first model, we included only the individual-level predictors, and the country-level predictors were added only later. In this section, first we show the effects of the socio-demographic variables, then we present results regarding attitudes and norms towards homosexuality and the traditional family. Finally, we discuss the results of the complete model, that contains all the country-level variables. (Intermittent models with one country-level variable per model are not shown in the paper).

Socio-demographic factors

The multilevel model presented in *Table 2* includes all individual-level characteristics. We found that women are more likely to have favorable attitudes towards assisted reproduction than men. This goes in line with hypothesis *H2a*, that women are more likely to support ART. The gender differences might be because childbearing is more important to women than it is to men in most European countries. Thus, women are more willing to support ART that can assist them to become parents in certain situations.

We did not find a clear curvilinear pattern for age, but the results show that older people are less supportive of ART than younger people. There is no significant difference between younger age groups (18–29 and 30–39), which

means that we fail to confirm our hypothesis of a curvilinear relationship based on age in attitudes towards ART (hypothesis *H2b*). However, there is a clear trend that shows that acceptance of ART declines with age. With regards to education we found a rather linear trend: the more educated people are, the higher tolerance they hold towards ART (hypothesis *H2c*).

We also found support for our assumption that higher household income coincides with higher acceptance of assisted reproduction (hypothesis *H2d*). This might be due to the fact that those who have higher income have more possibilities to finance ART treatments⁶ if they need them, so they are more likely to be supportive of them. In addition, individuals with higher income also have better access to information about the treatments.

We found significant association between the particular affiliations with denominations and people's acceptance of ART. Those who belong to the Orthodox Church, as well as Protestants, are more likely to accept these technologies than their Catholic counterparts. At the same time, Muslims are generally less supportive than Catholics. Whereas those who belong to other denominations have less support for ART, the non-religious individuals were not significantly different in their acceptance of ART compared to Roman Catholics (hypothesis *H2e* is only partially supported).

Apart from belonging to a denomination, the frequency of attending religious services is also quite important in explaining the acceptance of assisted reproduction technologies. We found support to the hypothesis that those who visit religious institutions frequently are less supportive of ART, or to put it differently, the more frequently people attend religious services, the less tolerant they are towards assisted reproduction (hypothesis *H2f*).

We controlled for the number of children and for marital status. Those who have two children are significantly more tolerant than those who are childless. Meanwhile, the association between marital status and the attitude toward ART dissipates in the full model where all individual-level characteristics are included.

⁶ Even if these treatments are financed completely by health insurance, there are some additional costs which are not included, such as costs of travelling and time associated with the treatments.

Table 2: Multilevel model on the acceptance of ART in 42 European countries: the role of individual characteristics, 2008–2010

	β	Standard error
Intercept	3.97***	0.20
Sex (ref.: male)		
Female	0.34***	-0.03
Age (ref.:18–29)		
30–39	-0.03	0.05
40–49	-0.15**	0.06
50–59	-0.23***	0.06
60–69	-0.34***	0.06
70 and above	-0.62***	0.07
Education (ref.: ISCED 3)		
ISCED 0	-0.65***	0.10
ISCED 1	-0.41***	0.06
ISCED 2	-0.30***	0.04
ISCED 4	0.11	0.07
ISCED 5 and 6	0.38***	0.04
Household income (PPP USD)	0.12***	0.01
Denomination (ref.: Roman Catholic)		
Protestant	0.16*	0.07
Muslim	-0.40***	0.10
Orthodox Christian	0.45***	0.07
Other	-0.27*	0.11
Non-religious	0.01	0.05
Frequency of attending religious services (ref.: weekly or more often)		
Once a month	0.50***	0.06
For holy days	0.80***	0.05
Rarely	0.70***	0.06
Never	1.00***	0.05
Number of children (ref.: 0)		
1	0.08	0.06
2	0.15**	0.06
3 and more	0.09	0.06
Marital status (ref.: married)		
Registered partnership	-0.05	0.11
Widowed	-0.03	0.06
Divorced or separated	0.09	0.05
Never married/partnered	0.00	0.06
Disapprove of homosexual couples adopting children	0.03*	0.01
Do not like homosexuals as neighbors	-0.35***	0.04
Approve of living together without getting married	0.38***	0.02
Child needs both parents	-0.28***	0.04
Variance (level 2)	0.90***	0.20
Variance (level 1)	8.73***	0.06
N		42
n		41,969
Log likelihood		-105,107

Source: authors' calculation using European Values Study wave 4.

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. ISCED level 0 – pre-primary education; level 1 – primary education or first stage of basic education; level 2 – lower secondary or second stage of basic education; level 3 – (upper) secondary education; level 4 – post-secondary non-tertiary education; level 5 – first stage of tertiary education; level 6 – second stage of tertiary education.

The role of attitudes towards homosexuality and the traditional family

There is a positive association between the acceptance of assisted reproduction technologies and attitudes towards homosexuality (hypothesis *H3a*). Those who agree with the statement that “Homosexual couples should be able to adopt children” and disagree with that “You would not like to have homosexuals as neighbors” are also more likely to support assisted reproduction technologies. The association between the support for adopting children by homosexual couples and attitudes towards ART dissipates in the full model with all individual-level characteristics included. However, these results suggest that ART creates a new paradigm regarding families – those who are favorable towards ART might not think that heterosexuality is a prerequisite of procreation. The results held true even when given countries were removed from the analyses, for example, those countries where the same-sex marriage and/or adoption by same-sex couples are legally possible.

As for the preference for the traditional family, we found that people who disagree with the statement “It is all right for two people to live together without getting married” are less likely to accept assisted reproduction technologies (hypothesis *H3c*). In addition, the other attitude in question, preference for the traditional family (“If someone says a child needs a home with both a father and a mother, would you tend to agree or disagree?”), is also significantly associated with ART in the previously expected direction, namely, those who agree with the statement are less supportive towards assisted reproduction technology (hypothesis *H3b*).

The role of the country-level factors

In the next step we introduce all country-level variables to the model presented in *Table 2* (see *Table 3*). We note that within expectation, in countries with higher mean ages at first birth it seems that there is greater support for ART, which supports our *H1a* hypothesis.

In countries where the majority of the population views themselves as practicing a religion (over 60% visit holy temples daily, weekly or for holy days), religion has no significant association with the attitudes towards ART (thus hypothesis *H1b* is not supported). The other country-level indicator of religion, the most common religious denomination, also has no significant association with attitudes towards ART when viewed next to individual religiosity (*H1c*).

We tested whether the fact that same-sex couples had access to ART in 2008 had any effect on attitudes towards ART. We found no significant association with attitudes towards ART. An alternative model, with the legal policy framework being the only country measure included, revealed that it did not have any significant association with the variance in attitudes on a country level, therefore we were not able to find support for hypothesis *H1d*.

Finally, we used a country-level GDP indicator (measured as purchasing power parity) to investigate whether the economic differences between countries have an impact on individual attitudes towards ART. We found that GDP alone has no significant association with attitudes towards ART, implying that the economic situation is an important factor only on the individual level (hypothesis *H1e*). An alternative model, where country GDP was used as a logged country-level predictor (omitting age at first birth and country religious frequency), yielded identical results (results are omitted and available upon request).

Table 3: Multilevel model on the acceptance of ART in 42 European countries: the role of country-level variables, 2008–2010

Country characteristics	β	Standard error
Female age at first birth	0.20*	0.09
Over 60% religious	-0.40	0.29
Dominant religious denomination (ref.: Roman Catholic)		
Protestant	0.32	0.40
Muslim	0.29	0.74
Orthodox Christian	0.09	0.37
Same-sex couples' access to ART	0.20	0.40
GDP (PPP USD)	0.00	0.00
Variance (level 2)	0.064***	0.14
Variance (level 1)	8.730***	0.06
N		42
n		41,969
Log likelihood		-105,107

Source: authors' calculation using European Values Study wave 4. The model also controls for all individual variables presented in *Table 2*.

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

CONCLUSIONS

In this study, we used unique international data that contains a question on the acceptance of ART, in order to reveal public attitudes towards these technologies in an international comparison. As biomedical technologies continue to expand, and as individuals become more knowledgeable about ART, it is essential to examine the relevant attitudes of the general public towards a set of medical procedures that seem to become more common in public use.

One of the contributions of this paper is that it investigates the role of five country-level factors that can influence attitudes towards ART, such as mean age at first birth, rate of religiosity, dominant religious denomination, country-level GDP and regulation related to same-sex couples' access to ART. We found that one country-level measure, the mean age at first birth has a statistically significant association with the acceptance of ART on a national level. This means that the more women postpone the transition to motherhood in a society, the more permissive attitudes towards ART are overall (on a country level). This may be due to the evidence-based fact that women at later age are more likely to face fertility problems.

Contrary to expectations, GDP, as a relevant indicator of economic prosperity of a given country, is not related to public attitudes towards ART. We did not find a significant association in the case of regulation related to the access to ART by same-sex couples. This result might be due to the reproductive tourism, which enables individuals who live in more restrictive countries to travel to and receive the preferred treatment in countries that will grant them ART services. Surprisingly, we also did not find a significant relationship with any of the other dimensions of the country-level religiosity variables.

However, our results suggest that attitudes towards ART are more influenced by individual-level factors: both socio-demographic variables and the role of attitudes and norms are relevant for the acceptance of ART on an individual level. It is important to note that a large proportion of individual differences remains unexplained, considering how the individual-level variance was initially much higher, and the addition of covariates reduced this variance by only about 8%, even if there are several significant variables on the individual level. Besides women, higher educated and younger people seem to have higher levels of acceptance in this question. We also found that the income level of households matters for how individuals perceive ART. Those who are in a better financial situation, regardless of the national context, are more likely to support fertility treatments. We assume this is related to one's overall social status and

health literacy, and of course to wealthier individuals having greater access to information and also better access to ART. Furthermore, not only does one's belonging to a denomination has an effect on attitudes towards ART on the individual level, but the type of the denomination is also important. Unexpectedly, those who belong to the Orthodox Church are the most tolerant towards ART, which might be due to the fact that the Eastern Orthodox Church supports medical treatment of infertility, as opposed to the Catholic Church.

As for the role of attitudes and norms, we found that the rejection of assisted reproduction technologies relates to the disapproval of the traditional family and homosexuality.

Taking all into account, our findings indicate that the acceptance of ART is mainly determined by individual-level factors. However, there are considerable differences among European countries in some respects. Most of those country-level factors which relate to the second demographic transition, such as secularization (frequency of attending religious services) and postponement of becoming a mother (mean age at first birth among women) are also important. This may imply that the acceptance of ART is related to the progress of social change on a country level and the acceptance of these kinds of changes (non-traditional families) on an individual level. The findings have important implications for family policy, because there is an ever-increasing use of ART to assist people to be able to have the families they desire. So far, policies such as flexible employment, maternity and paternity leaves have been considered to stabilize or even increase fertility rates. However, in the future, due to the social acceptance of ART, policymakers can also reasonably rely on the utilization of ART in the policy mix.

LIMITATIONS

Several limitations have to be mentioned in terms of the study of attitudes towards ART. The dependent variable was phrased in the following way: "Artificial insemination or in-vitro fertilization can always be justified, never be justified, or something in between", and thus might potentially incorporate different assisted reproduction practices (insemination, IVF, and different – homogenous and heterogeneous – types of sources of semen and gamete). It is possible that the results would be different if separate questions were to have been asked about these practices. Furthermore, it is not clear how and if individuals are aware of

the implications of the question on single women's access to ART in any given society (meaning that a lesbian can also have access as an individual).

Additionally, we were not able to measure additional country-level characteristics, such as the financial support for ART, due to the lack of available information for all the investigated countries. Further investigation analyzing public attitudes would be very important, because with the increased use of these kinds of new technologies and the rising levels of their availability for a greater number of people it might be expected that attitudes towards ART will change over time. The latest (fifth) round of EVS was already fielded in 2017, although the final data has not yet been released when this study was conducted. This new round is now available, which makes it possible to monitor the changes in attitudes towards ART over time.

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APPENDIX

Sample selection and missing values

The initial sample of the European Values Study wave 4 data (2008–2010) counts 67,491 respondents in 47 European countries, out of which 62,734 (93%) individuals answered the question on the acceptance of artificial insemination or in-vitro fertilization. Out of the respondents that answered the question, 62,262 reported educational levels; 62,077 gave information on religiosity (regarding frequency of visiting holy temples). Around 62,225 individuals reported on their number of children and 62,344 reported their marital status. Further 60,978 respondents reported on their attitude towards family formation (“A single woman wants to have a child as a single parent, but she does not want to have a stable relationship with a man”), but only 59,336 respondents answered the questions on attitudes on homosexuality (“Homosexual couples should not be able to adopt children” and “Homosexuality can always be justified, never be justified, or something in between”, 88% of the initial sample); and even fewer, 55,447 respondents reported household income (in country-adjusted power purchasing parity units; 82% of the initial sample; 88% of the respondents that have also answered the question on attitudes on ART). The final sample counts 43,841 respondents that have no missing values on any of the study variables (67% of respondents that answered the question on attitudes on ART). *Table A1* in the Appendix shows the sample selection per country, based on non-missing values for each country.

Table A2 below shows the frequency of missing values per variable under the condition that all other variables have no missing values (gender, age and denomination do not have any missing values).

More detailed analyses of patterns of missing variables show that all variables but household income seem to be missing at random. We show the results of a placebo multilevel regression in *Table A3* where all variables are coded as dummy variables (0=non-missing, 1=missing). This reveals that those individuals who have missing information on education, household income, approving homosexuality, approving living together without getting married and approving woman as single parents are less likely to support ART (variables with coefficients 0 have no missing values in the full sample of this analysis). This provides information about the importance of these factors on the attitudes towards ART and speaks of possible selection effects. Due to the multilevel structure of the data, entailing complexity on two levels, we opted to use all cases that had no missing values, while descriptively addressing possible selection effects.

Table A1: Sample selection and number of cases per country

Country	Initial N	Analytical N	Reduction, %
Albania	1,534	923	39.8
Azerbaijan	1,505	1,171	22.2
Austria	1,510	1,121	25.8
Armenia	1,477	1,090	26.2
Belgium	1,509	1,324	12.3
Bosnia Herzegovina	1,512	1,063	29.7
Bulgaria	1,500	991	33.9
Belarus	1,500	1,093	27.1
Croatia	1,498	1,091	27.2
Cyprus	999	701	29.8
Northern Cyprus	495	0	100.0
Czech Republic	1,793	1,175	34.5
Denmark	1,507	873	42.1
Estonia	1,518	1,207	20.5
Finland	1,134	870	23.3
France	1,499	1,301	13.2
Georgia	1,498	1,035	30.9
Germany	2,051	1,487	27.5
Greece	1,498	1,166	22.2
Hungary	1,513	1,230	18.7
Iceland	808	614	24.0
Ireland	982	349	64.5
Italy	1,519	776	48.9
Latvia	1,506	1,077	28.5
Lithuania	1,499	958	36.1
Luxembourg	1,609	1,090	32.3
Malta	1,497	564	62.3
Moldova	1,551	943	39.2
Montenegro	1,516	1,111	26.7
Netherlands	1,552	1,207	22.2
Norway	1,090	969	11.1
Poland	1,479	934	36.9
Portugal	1,553	648	58.3
Romania	1,489	863	42.0
Russian Federation	1,490	900	39.6
Serbia	1,512	1,122	25.8
Slovak Republic	1,509	907	39.9
Slovenia	1,365	758	44.5
Spain	1,497	850	43.2
Sweden	1,174	599	49.0
Switzerland	1,271	891	29.9
Turkey	2,327	1,767	24.1
Ukraine	1,507	933	38.1
Macedonia	1,494	1,193	20.2
Great Britain	1,549	906	41.5
Northern Ireland	495	0	100.0
Kosovo	1,601	0	100.0
Total sample	67,491	43,841	37.6

Source: authors' calculation using European Values Study wave 4 (2008–2010).

Table A2: Missing-value pattern for individual-level explanatory variables

Variable	n
Education	472
Marital status	390
Number of children	509
Frequency of religious attendance	657
It is alright to live together without getting married	966
Woman as single parent, no stable relationship	1,756
Do not want homosexuals as neighbors	1,983
Homosexual couples adopt children	3,146
Household income (ppp)	10,771

Source: authors' calculation using European Values Study wave 4 (2008–2010).

Table A3: Placebo multilevel model of acceptance of ART in 42 European countries (2008–2010)

Variable	b	Standard error
Constant	5.88***	0.20
Gender	0.00	0.00
Education	-0.66***	0.14
Household income (ppp)	-0.08**	0.03
Frequency of religious attendance	-0.05	0.12
Denomination	0.00	0.00
Age	0.00	0.00
Disapprove of homosexual couples adopting children	0.12	0.06
Do not want homosexuals as neighbors	0.06	0.07
Approve of living together without getting married	-0.56***	0.10
Approve of women as single parents	-0.20**	0.08
Number of children	0.00	0.00
Marital status	0.00	0.00
Variance (level 2)	1.89***	0.39
Variance (level 1)	9.48***	0.05
n	62,734	

Source: authors' calculation using European Values Study wave 4 (2008–2010).

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$