

## ***Attitudes towards Medically Assisted Reproduction among Students in Three Euro-Mediterranean Countries***



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**Abstract:** Human reproduction has traditionally been an important issue in medical ethics. Advances in medical technology and the development of medically assisted reproduction (MAR) procedures are creating new bioethical dilemmas. This study is based on a quantitative approach using the survey method on a convenience sample of students (N=1097) from five universities from four fields of study – Medicine, Law, Theology and Philosophy – in Croatia, Greece and Italy. The aim of this study was to investigate students' attitudes towards various aspects of medically assisted reproduction. Three hypotheses were tested using t-tests and ANOVA to examine differences in attitudes based on variables such as country, field of study, gender, year of study, religiosity, political orientation, financial status and size of their place of residence. Despite sharing a common Mediterranean cultural heritage, students from Italy showed a greater disapproval of MAR, but due to the small effect size, this difference should be interpreted with caution and the hypothesis could not be fully confirmed. In addition, Theology students had statistically significantly more negative attitudes toward MAR. Regarding differences in students' socio-demographic characteristics, women, older students, individuals who are not religious and those who are politically left-oriented tended to have more liberal attitudes toward MAR. The results enable further reflection on the concept of Mediterranean Bioethics. These findings highlight how disciplinary background and religiosity shape ethical attitudes toward MAR within the Mediterranean context.

**Keywords:** Medically assisted reproduction; healthcare; student attitudes; bioethics; Mediterranean.

## I. Introduction

In 2025, the scientific community will mark the first decade of successful application of genome editing to a human embryo while in 2028, Lulu and Nana, twins with edited genomes to confer resistance to HIV, will reportedly celebrate their tenth birthdays<sup>1</sup>. Such breakthroughs far exceed the interest of the scientific community and easily make it into the media headlines. Given the complexity of the issues involved, this is accompanied by a great deal of misunderstanding, confrontation and controversy.

Despite the fact that reproduction belongs to traditional topics of medical-ethical debate, in recent decades it has undergone a profound bioethical re-evaluation. The main reason for this change is the discovery of recombinant DNA in the 1970s, followed by the development and application of corresponding genetic procedures and technologies. The development of modern reproductive technologies has had its downs and ups over the years, including several Nobel Prizes, the most recent in 2020 for Chemistry (Emmanuelle Charpentier and Jennifer A. Doudna) for the discovery of CRISPR<sup>2</sup>. Medically assisted reproduction is simultaneously supported and criticized for a wide range of reasons and arguments, all sharing the same precondition: it affects people and society from biological, physiological, religious, financial and social perspective.

In 2009, the International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised the nomenclature aiming toward standardizing and comparison of medically assisted reproduction (MAR) on a global level. According to the standardized nomenclature, assisted reproductive technology (ART) (cf. Alon et al. 2023) includes “all treatments or procedures that include the in vitro handling of both human oocytes and sperm or embryos for the purpose of establishing a pregnancy” (Zegers-Hochschild et al. 2009, 1521). This includes, among others, in vitro fertilization and embryo transfer, cryopreservation, oocyte and embryo donation and surrogacy, although artificial insemination is excluded from the list of procedures (Zegers-Hochschild et al. 2009). Standardization of terminology related to ART was one of the recommendations of the meeting on “Medical, Ethical and Social Aspects of Assisted Reproduction” held at WHO headquarters in Geneva in 2001 (Vayena, Rowem, & Griffin 2001). From the beginnings of the application of MAR in the last decades of the 20th century to the present day, these procedures, which enable infertile couples to become parents, have been the subject of debate in medical, legal, ethical, theological and other fields.

The issue of high incidences of multiple pregnancies resulting from ART, the cryopreservation of male and female gametes (Jain & Singh 2023; Vayena, Rowe & Griffin 2001), the quality of services in certain countries as well as costs and who should cover

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<sup>1</sup> Funding: this work was fully supported by the Croatian Science Foundation under the project (IP-2020-02-7450).

<sup>2</sup> On CRISPR/Cas 9, or the promises and the perils of genetic engineering, see the identically titled chapter in Protopapadakis (Protopapadakis 2019, 75–106).

them are some of the issues being debated in the medical profession. According to Patrizio and Caplan, “the problem of the moral status of the embryo is one of the central problems of the ethical debate on IVF” (Patrizio & Caplan 2014). If the embryo is seen only as a set of cells that have the potential to become a human being, as in the libertarian secular bioethics of H. T. Engelhardt (Engelhardt 1996) and in the utilitarian bioethics of P. Singer (1995) IVF is usually considered acceptable. If, instead the embryo is considered a human being from the moment of fertilization, as in personalist bioethics (D'Agostino-Palazzani 2013; Gensabella Furnari 2018; Pessina 2020; Sgreccia 2012), IVF is less problematic, on condition that the dignity of the embryo's life is protected. The question of embryo dignity is present in many other ethical discussions, focusing on gamete donation, surrogacy, fetal reduction, embryo research or the destruction of stored embryos, preimplantation genetic testing (PGT), and the possibility of sex selection of embryos, not just in the case of PGT-M for sex-linked diseases (Patrizio & Caplan 2014; Vayena, Rowe, & Griffin 2001). In discussing the work of national and public commissions dealing with, among other things, the ethical aspects of ART, Cook and colleagues (Cook, Dickens & Fathalla 2003) note that the macro-ethical level predominates and that, for example, issues of gamete transfer, embryo transfer or surrogacy are more often considered in the context of social policy than in the context of enabling parenthood for an individual couple. However, in the context of the experience of a child born through ART and the potential impact on their identity and other issues, the micro-ethical level is applied (Ibid.).

Having in mind that reproduction is primarily related to a woman's body and health, medical assisted reproduction has raised different perspectives and questions (Gensabella Furnari 2018), including feminist one. The fundamental difference is between those who consider these techniques an additional means of liberation and empowerment for women (Firestone 2003), and those who consider them as an expropriation of the power that women have due to their particular role in procreation (Corea 1985). Proponents of IVF among feminists believe that it is acceptable if allows the woman to control reproduction (Patrizio & Caplan 2014). Issues surrounding ART include the age of the woman undergoing MAR, particularly from in relation to the protection of the mother's health and the child's perspective. Two fundamental issues are at the forefront: first, the life expectancy of the mother, i.e., the possibility of the child being left without a mother at a young age and, second, the health status of older mothers, i.e., their readiness to cope with the challenges of motherhood (Ibid.).

The issue of medically assisted reproduction is also discussed from a theological perspective. Sperm donation by a third party or the donation of embryos, for example, is not permitted in the Islamic world. The Catholic Church has already defined its position on ART in various documents, as *Donum Vitae* (Congregation for the Doctrine of the Faith 1987) and *Dignitas Personae* (Congregation for the Doctrine of the Faith 2008). Sigillo and colleagues (Sigillo et al. 2012, 251; as cited in Bartolomé-Peral & Coromina 2020) explain this with the Catholic Church's understanding of the beginning of life, according

to which life begins at conception, so that embryos deserve the same dignity as any other human being. Since the Church views procreation as an act that cannot be separated from the sexual act within the marriage, all artificial reproduction techniques, whether homologous (with the couple's gametes) or heterologous (with donor's gametes) cannot be considered ethical. Only techniques that do not replace the sexual act, but help and facilitate its natural purpose are permitted (Congregation for the Doctrine of the Faith 2008). The position of the Catholic Church also influenced national legislation. This was partly evident in Italy (Patrizio & Caplan 2014), since Law 40/2004 already strongly defended the dignity of the life of the embryo, but allows homologous IVF.

In addition to legal regulation, several factors contribute to the use of MAR at the country level. These factors include accessibility, cost<sup>3</sup> (reflected in legislation), and cultural norms and beliefs related to the societal age limit for childbearing<sup>4</sup> (Präg & Mills 2015; 2017). Furthermore, these cultural norms have been found to be more important than socio-economic and socio-demographic characteristics (Seiz, Eremenko, & Salazar 2023). Seiz and colleagues mention that there is a positive correlation between higher societal age limits for childbearing and the availability of MAR in European countries. Regarding the wealth of a country, measured by GDP per country, Präg and Mills (Präg & Mills 2017) found that GDP is a factor in the prevalence of ART treatment in a country, in such a way that the number of these treatments increases with the wealth of the country. However, in the study by Szalma and Djundeva (Szalma & Djundeva 2019), GDP was not a relevant indicator of attitudes towards ART. As expected, based on the factors mentioned, the incidence of ART procedures in European countries is highest in countries that have less restrictive legislation for certain treatments and in countries that are cross-border destinations for reproductive treatments, such as Denmark, Czechia, Belgium, Slovenia, Spain and Greece (cf. Seiz et al. 2023).

At the individual level, attitudes towards ART/MAR are influenced by religiosity, educational and income status, and (not) strong post-materialist and secular-rational values (emphasizing the autonomy of the individual) as well as traditional/modern attitudes towards families<sup>5</sup> (Bartolomé-Peral & Coromina 2020; Szalma & Djundeva 2019). In particular, people who describe themselves as less religious and politically left-oriented have a more positive experience of ART, with religiosity being a stronger predictor of attitudes towards ART than political orientation (Baltezersen 2022; Bartolomé-Peral & Coromina 2020). More specifically, people who identify as Catholic, Orthodox, or Muslim<sup>6</sup>,

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3 In the study by Präg and Mills (2017), it was shown that it is more important for access to ART at the country level that the resources are made available to residents than the formal right to a particular form of treatment.

4 This refers to "generally shared assumptions about when one is too old for having children" (Präg & Mills 2015, 6), also referred to as normative age limits for childbearing.

5 These attitudes are related to traditional family formation practices, which are in favor of the so-called "justification of homosexuality," the (non-)preferential treatment of homosexual neighbors and the acceptance of adoption by same-sex couples.

6 Catholics in particular have more negative attitudes towards ART compared to members of the

as well as people with a lower level of education and lower income, have a more negative attitude towards ART.

In the study by Fauser and colleagues (Fauser et al. 2019), the youngest age groups, men and members of sexual minorities showed a more positive view in IVF and the need to support it through public funding. In contrast, in the study by Szalma and Djundeva (2019), women had more positive attitudes towards ART. However, that study also showed that younger people have a more positive attitude, as do people with higher household incomes and people who have two children (Ibid.).

## **II. Mediterranean Bioethics: A Bridge between Interreligious and Intercultural Ethical Dilemmas in a Specific Geographical Area**

Whether we are talking about its geographical, historical, political, and cultural identity, there are many publications about the Mediterranean region. Among the many aspects studied, the concept of the Mediterranean diet, for example, has gained worldwide recognition. Also, the ideology of Mediterraneanism is based on the idea that there is a unique connection between the cultures and nations living in this region, characterized by common features (Herzfeld 1984). The Mediterranean is at a crossroads of diverse cultures and religions, linking Asia, Africa and Europe. In this context, where cultures, languages and religions intersect, the nations around the Mediterranean have more in common than the continents to which they geographically belong. Some of the most advanced, influential and richest civilizations were born there (Caenazzo & Borovečki 2022). However, this diversity of historical, cultural, philosophical, social and medical traditions culminated in the endeavour to find a discipline that would provide concrete answers to questions about life, death, health, disease, but also environmental issues that affect life. This discipline should have theoretical, practical and behavioural similarities to different cultural groups from the civilizational affiliation of their geo-political space (Matulić 2007).

The Mediterranean region is considered the cradle of medical ethics (Greece)<sup>7</sup> and later of Mediterranean bioethics (Spain) (Matulić 2007). Indeed, when we talk about the concept of Mediterranean Bioethics, we should start from the idea of Diego Gracia Guillén, a Spaniard with medical and philosophical education, who wanted to build a bridge between two ethical traditions – classical and modern – by developing an integrative bioethical method that unites and does not divide; that reconciles and does not quarrel; an ethics of virtues (Southern European), which is rescued from history and oblivion, and an ethics of principles and duties (Anglo-American), which is rescued from mere

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Orthodox Church and Protestants (Szalma & Djundeva 2019).

<sup>7</sup> For Aristotle, "virtue, then, is a state concerned with choice, lying in a mean relative to us, determined by reason and in the way that the prudent [man] would determine it" (*Nicomachean Ethics*, 1106b36–1107a2), and it was the basis of ethics, while we regard Hippocrates as the father of medical ethics.

formalism and proceduralism (Gracia 2001). We can consider Gracia Guillén as a true pioneer of the critique of the Anglo-American approach to bioethics, especially in the field of medicine, narrowed to medical practice and biomedical issues, which today have an increasingly solid foundation in the discovery of bioethics by F. Jahr (Rinčić et al. 2021). S. Privitera (1994) gave the initial impetus to Mediterranean bioethics in Italy, by combining Gracia's basic ideas with the need to sensitize different cultures in an intercultural and religious dialogue aimed at finding a common language for solving problems related to *life* in the Mediterranean region.

Such bioethics can be separate and specific – Mediterranean – because it belongs to a distinct cultural dialogue in which it is necessary to respect many ethical and legal aspects of different philosophical and religious traditions as part of the moral dilemmas in the field of life sciences and health care, and thus the responsibility for the preservation of national and racial diversity and for the dialogic exchange of valuable aspects of life, health, nature and culture on an intercontinental level that defines the Mediterranean area (Matulić 2007).

Mediterranean bioethics is a complex network of cultural, ecological and social elements that shape the unique bioethical dilemmas of this region. This contextual approach allows for a deeper understanding of bioethical issues that are usually global, but have specific manifestations and solutions within the Mediterranean area – respecting cultural differences while recognizing and acknowledging shared moral values. If we compare the national legislation of three Mediterranean countries, Italy, Greece and Croatia, which are all members of the European Union (EU), we can observe different approaches to ART. All three national legislations allow homologous artificial reproduction, the Greek and Croatian legislations also allow heterologous fertilization (Cecchi et al. 2017; Law on medically assisted fertilization, Official Gazette 2012). Although egg donation is permitted in Italy and Croatia; however, in Croatia no local donors are available, so sperm need to be imported (Calhaz-Jorge et al. 2020). Surrogacy is prohibited in both countries. In contrast to most European countries, surrogacy is permitted in Greece, where an embryo created in vitro from the gametes of one couple is transferred into the uterus of another woman (Baltzersen 2022; Leon, Papetta, & Spiliopoulou 2011). Croatian and Italian law also prohibits post-mortem fertilization. Furthermore, single women have access to MAR in Croatia (only in case of donated egg) and Greece, while in Italy only heterosexual couples have access to IVF/ICSI (Calhaz-Jorge et al. 2020). Greece is also characterized by the fact that the upper age limit for women to access MAR is 54 years, while in most European countries this limit is 45 years (Christoforidis et al. 2023). However, what is the same in all three EU Member States is the fact that their legal regulations on ART discriminate against same-sex couples (Bielińska et al. 2022; Riezzo et al. 2016).

According to the latest European Fertility Atlas (Fertility Europe 2024), among the Mediterranean countries, France has 85.5% of overall country progress<sup>8</sup> in terms of

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<sup>8</sup> This indicator assesses access to equitable, safe and efficient fertility treatments in 49 countries

fertility policy, Portugal 71.9%, Croatia 66.5%, Spain 65.2%, Malta 64.6%, Slovenia 59.5%, Greece 57.7%, Montenegro 43.4%, Italy 42.6%, Turkey 39.5%, Bosnia and Herzegovina and Cyprus 33.9% and Albania 21%. These data indicate that, despite the assumption of a common Mediterranean bioethics, there are different attitudes towards this challenging topic. They were also an incentive to examine the similarities and differences between the selected Mediterranean countries.

The present paper presents the results of the broader project “EuroBioMed – From diversity of traditions to a common Euro-Mediterranean bioethical platform – constructing a tool for dialogue and action,” which was carried out in three European Mediterranean countries in 2021-2024. Our aim was to investigate the attitudes of students from different study programs (medicine, philosophy, law and theology) in five cities in three European-Mediterranean countries (Messina, Italy; Rijeka, Split and Zagreb, Croatia; Thessaloniki, Greece) towards different bioethical dilemmas, including MAR. These study programs were chosen because they are relevant in the context of the development of bioethics. At the same time, these students are future experts who will very soon be involved in the decision-making on bioethical issues.

The study is a confirmatory research to test the hypotheses defined on the basis of the given literature review and research design, which can be found in the “Data Management Plan” of the project, available in open access (Tutić Grokša & Muzur 2023). Three hypotheses are tested in this paper. Since Croatia, Italy and Greece belong to the same Mediterranean cultural circle, there will be no statistically significant differences in attitudes towards MAR between the countries (H1). Due to the Catholic Church’s disapproval of MAR techniques, theology students will have a more conservative attitude (higher mean and statistically significant scores) towards MAR compared with medical, philosophy and law students (H2). And in terms of different socio-demographic characteristics, women, final year students, who are non-religious, politically left-oriented, from larger cities and of better financial status will have more liberal attitudes towards MAR (higher mean and statistically significant scores) compared with their counterparts (H3).

### III. Methods

#### III.1. Sample

In order to test the previously mentioned hypotheses, a quantitative approach was conducted using a pen-to-paper survey method. The survey was conducted in the period from December 2022 to June 2023 on a convenience sample of students from three countries and five universities (University of Rijeka, University of Zagreb,

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based on several criteria: legislation, data management, inclusive access, genetic testing, transparency, funding, support services, consultation and education. More about these criteria can be found on the website of the organization Fertility Europe (2024).

University of Split, Croatia; University of Messina, Italy; and Aristotle University of Thessaloniki, Greece). Participants were interviewed during classes at their universities (with the permission of the course instructors) or during a specific reserved time slot. The researchers were present during the completion of the questionnaire and were able to provide information about the research and answer any questions. The questionnaire included several bioethical topics and was written in English for all participants. The research was approved by the Ethical committee for Biomedical Research at the Faculty of Medicine of the University of Rijeka on September 27, 2022 (class: 007-08/22-01/61, issue number: 2170-24-04-3/1-22-7).

The total number of participants was 1097 with an average age of 23.06 ( $\pm 4.27$ ) years. A description of the sample is provided in Table 1. The survey included participants from five universities in three countries Croatia (59.8%), Italy (23.2%) and Greece (17.0%) and four different academic disciplines law (36.6%), medicine (30.6%), philosophy (20.4%) and theology (12.9%). The majority of participants were women (59.6%), people from small towns (38.05%) and those who identified themselves as believers (62.7%), while almost half of the sample reported their financial status as average (49.7%). Of the participants, 29.4% said they were politically left-oriented, 26.1% in the centre, 19.1% on the right and 25.4% of participants said they were not interested in politics.

Variable		Croatia	Italy	Greece	Total
		N=656	N=254	N=187	N=1097
Age M (SD) [range]		23.06 (4.27) [19-68]	23.99 (3.29) [19-45]	25.62 (7.73) [19-74]	23.71 (4.95) [19-74]
Gender %	M	36.6†	44.8	48.0	40.4
	F	63.4	55.2	52.0	59.6
University	UniRi	38.4	0	0	23.0
	UniZg	40.4	0	0	24.1
	UniSt	21.2	0	0	12.6
	UniMe	0	100	0	23.2
	A.U.Th.	0	0	100	17.0
Field of study %	Law	48.2	33.9	0	36.6
	Medicine	19.1	33.5	63.6	30.6
	Theology	17.2	11.4	36.4	12.9
	Philosophy	15.5	21.3	0	20.4
Year of study %	1 <sup>st</sup> -3 <sup>rd</sup>	55.2	45.2	25.8	47.9
	4 <sup>th</sup> -6 <sup>th</sup>	44.8	54.8	74.2	52.1
Religiosity %	Believer	62.2	61.7	65.9	62.7
	Indifferent	15.3	14.9	13.9	14.9
	Non-believer	22.6	23.4	20.2	22.3

	Left	23.5	50.3	28.5	29.4
Political orientation %	Centre	27.5	17.6	29.7	26.1
	Right	20.7	17	15.8	19.1
	Not Interested	28.3	15.1	25.9	25.4
Size of place of residence %	Small	41.0	39.3	26.3	38.0
	Medium	23.9	26.2	29.1	25.4
	Large	35.1	34.5	44.6	36.6
Financial situation %	Weaker	9.3	9.9	9.9	9.5
	As others	48.5	55.3	48.8	49.7
	Better	42.2	34.9	41.4	40.7

Table 1: Sample. Note: M = Mean; SD = Standard Deviation; UniRi = University of Rijeka; UniZg = University of Zagreb; UniSt = University of Split; UniMe = University of Messina; A.U.Th. = Aristotle University of Thessaloniki; † Valid percentages.

### III.2. Instrument

The Medically Assisted Reproduction instrument is the main construct consisting of 14 items and was part of a larger survey that included several instruments on various bioethical topics. The MAR instrument was originally developed at the Unit for Social Ecology, Department of Sociology, Faculty of Humanities and Social Sciences, University of Zagreb (as can be found in Cifrić 2005) and was modified and translated into English for the purposes of this survey. The items on the status of the embryo were taken from this study (Cifrić 2005). However, for the purposes of our study, other relevant aspects were added to the original instrument to reflect new approaches and new technologies that have since evolved and dominated the discussion in the bioethical and medical literature as well as in the media and the public, as outlined above in the theoretical background. Therefore, the final MAR instrument consisted of four items on the aspect of donation and disposal of gametes and embryos, three items on the aspect of fertilization and pregnancy, two items on the legal aspects of MAR and five items on other aspects of the MAR debate (use of embryos in research, demographic aspects, economic motivation, information rights for children born through MAR and the availability of MAR for singles and same-sex couples).

To reduce the dimension of the scale, a Principal Component Analysis (PCA) was carried out. We chose PCA because we are mostly dealing with new variables that have not been theoretically predefined (Jolliffe 2002), i.e., an instrument that has not yet been tested and does not test an existing theoretical model. Furthermore, PCA is usually used when many variables are measured (e.g., 7-8 variables/items) and when the variables measure the same underlying construct (Lund & Lund 2018). In a first step, Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were used to check whether the data were suitable for the analysis. Bartlett's Test was statistically significant ( $p < 0.001$ ) and  $KMO = 0.913$ , so 14 items were initially included in the analysis, but due to very

weak correlations with other variables (all correlations were  $r < 0.3$ ) five items were removed from the analysis: "A child born through medically assisted reproduction has the right to know their biological origin (information about the donor)," "Methods and techniques of medically assisted reproduction should be regulated by law," "Economic profit has become a decisive factor in the application of medically assisted reproduction," "Doctors have the right to dispose of egg cells as they wish without the knowledge and approval of the female donor" and "Medically assisted reproduction should not be used for scientific research purposes." The removed items addressed aspects that were conceptually more peripheral to the main attitudinal dimension captured by the scale. Their weak correlations ( $r < 0.3$ ) with other items suggested that they did not share sufficient common variance with the dominant underlying construct identified by PCA. Scale reliability analysis also supported the decision to remove these variables, with the final 9-variable solution having an  $\alpha = 0.862$ . After removing the variables, PCA analysis reduced the dimensionality of the scale to a single component (eigenvalue  $C = 4.577$ ), which explained 50.8% of the total variance. Although the removed items addressed distinct facets of the MAR debate, their exclusion did not compromise content validity as the remaining items continued to represent the main evaluative dimensions of approval, and disapproval toward MAR practices. The resulting component thus reflects a coherent attitudinal stance encompassing moral, legal and accessibility-related judgments. After inspection of the component matrix (Table 2), component (C) was labelled "Disapproval of MAR," with higher scores representing a more conservative attitude toward MAR. The name of the component was chosen because all retained items reflect varying degrees of moral opposition about medically assisted reproduction. Although the items address different aspects (e.g., donation, disposal, accessibility), they load strongly on a single component, suggesting they share a common attitudinal orientation.

Items	C
Donation of male sperm and female egg cells should be banned	.894
Donation of surplus embryos should be banned	.872
The creation of surplus embryos and their destruction or freezing should be banned	.866
Medically assisted reproduction must be available to singles or people living in same-sex unions	-.802
Medically assisted reproduction should not create multiple pregnancies (twins, triplets, etc.)	.641
Medically assisted reproduction is a private matter of the individual, and therefore society and the state should not interfere	-.625
A maximum of ten women may be fertilised with the sperm of a male donor if the man is healthy and has good physical characteristics	-.615
The use of medically assisted reproduction contributes to solving demographic problems in my country	-.500

Choosing the gender of a future child should be left as an option as part of medically assisted reproduction	-.442
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*Table 2: Component matrix of the component “Disapproval of MAR”. Note: Extraction Method: Principal Component Analysis. Only 1 component was extracted. Note: N (valid cases) = 984 after listwise deletion.*

There were ten questions that collected detailed information about the socio-demographic characteristics of the participants: four open-ended questions about the year of birth, the faculty and university the students attended, their ethnicity and religion, if they belonged to one. The other six questions were multiple-choice questions with only one answer on year of study and assessment of religious belief (1 – a strong believer, 5 – a strong opponent of religion; answers 1 and 2 were later recoded to “Believer” and 4 and 5 to “Nonbeliever”), political orientation (extreme left, left – recoded together to “Left”; centre; right and extreme right – recoded together to “Right”); and not interested, the assessment of their family’s financial situation (1 – considerably weaker than others, 5 – considerably better, later recoded into 3 groups “Weaker,” “As others,” “Better”) and one item regarding the size of the place of residence (later recoded into “Small place” – up to 20,000 inhabitants, “Medium-sized place” – 20,0001-100,000 and “Larger place” – more than 100,000 inhabitants).

## V. Statistical Methods

Hypotheses were tested using independent sample t-test and analysis of variance (One-Way ANOVA) to determine differences between means of different groups (according to country, field of study and sociodemographic characterises). Statistical significance was measured at  $p<0.01$ . Listwise deletion was performed, i.e., cases were excluded from the analysis if they had a missing value for at least one of the variables. The analysis was then only carried out with cases that contained a complete data set. All analyses were conducted using listwise deletion; therefore, the number of valid cases varies across analyses and is reported in each table. Statistical analyses were performed using IBM Statistical Package for Social Sciences (SPSS) for Windows (Version 25.0) and JASP (Version 0.16.3).

## VI. Ethical Considerations

The Ethics Committee for Biomedical Research at the Faculty of Medicine, University of Rijeka, approved this research on September 27, 2022 (class: 007-08/22-01/61, issue number: 2170-24-04-3/1-22-7). Throughout this research, the principle of voluntary participation and anonymity was respected. The respondents were provided with information about the research in written form before the start of data collection

/ at the beginning of the questionnaire, and the participants provided implicit informed consent (by filling out the questionnaire).

## VII. Results

### VII.1. Attitudes on Medically Assisted Reproduction

The dependent variable “Disapproval of MAR” is standardized ( $M=0.00$ ,  $SD=1.00$ ) with a range of (min-max) -1.82–2.47. The frequency of responses per item are shown in Table 3 and the basic descriptive statistics are shown in Table 4. The highest levels of agreement were for the items on the child’s access to information about the donor (76.8%) and the need for legal regulation of MAR (69.5%). Just over half of the participants believe that MAR should also be available to single people or people living in a same-sex partnership (51.4%). Less than a quarter of participants agree with the ban on the creation of surplus embryos (24.5%) or the donation of surplus embryos (21.3%) or gametes (18%).

	Disagreement					Unsure	Agreement
	1 %	2 %	3 %	4 %	5 %		
† A child born through medically assisted reproduction has the right to know their biological origin (information about the donor).	1.8	5.7	15.8	43.7	33.1		
† Methods and techniques of medically assisted reproduction should be regulated by law.	4.2	7.6	18.7	43.7	25.8		
† Economic profit has become a decisive factor in the application of medically assisted reproduction.	3.1	7.9	42.1	36.3	10.6		

Medically assisted reproduction must be available to singles or people living in same-sex unions.	21.6	10.4	16.7	23.5	27.9	
Medically assisted reproduction is a private matter of the individual, and therefore society and the state should not interfere.	11.5	24.7	22.1	22.8	18.8	
† Medically assisted reproduction should not be used for scientific research purposes.	11.6	26.0	26.8	22.5	13.2	
The use of medically assisted reproduction contributes to solving demographic problems in my country.	13.7	20.8	39.6	20.0	5.9	
A maximum of ten women may be fertilised with the sperm of a male donor if the man is healthy and has good physical	21.2	15.2	47.2	13.3	3.2	
The creation of surplus embryos and their destruction or freezing should be banned. (R)	28.4	27.6	19.4	8.7	15.8	
Medically assisted reproduction should not create multiple pregnancies (twins, triplets, etc.). (R)	17.7	33.3	30.3	13.4	5.3	

## Attitudes towards Medically Assisted Reproduction

Donation of surplus embryos should be banned. (R)	33.8	26.9	17.9	12.6	8.7		
Choosing the gender of a future child should be left as an option as part of medically assisted reproduction.	28.9	28.5	26.9	12.0	3.7		
Donation of male sperm and female egg cells should be banned. (R)	43.0	29.3	9.6	10.2	7.8		
† Doctors have the right to dispose of egg cells as they wish without the knowledge and approval of the female donor.	54.0	25.1	15.2	4.6	1.0		

*Table 3: Frequency distribution for items on Attitudes towards Medically Assisted Reproduction scale. Note: The items are listed in descending order of mean score. Items with (R) were included in the reliability analysis so that higher values represent agreement with the justification for MAR Items marked with † were removed from the final component solution. N (valid cases): Croatia N=586, Italy N=211, Greece N=160) and total sample N=957 after listwise deletion.*

	Croatia		Italy		Greece		Total sample	
	M	SD	M	SD	M	SD	M	SD
† A child born through medically assisted reproduction has the right to know their biological origin (information about the donor).	4.06	0.96	4.00	0.81	3.82	0.99	4.01	0.93
† Methods and techniques of medically assisted reproduction should be regulated by law.	3.71	1.12	4.00	0.85	3.80	0.94	3.79	1.04
† Economic profit has become a decisive factor in the application of medically assisted reproduction.	3.45	0.88	3.34	0.95	3.51	0.83	3.43	0.89
Medically assisted reproduction must be available to singles or people living in same-sex unions.	3.27	1.48	3.25	1.63	3.23	1.38	3.26	1.50

Medically assisted reproduction is a private matter of the individual, and therefore society and the state should not interfere.	3.23	1.33	2.94	1.24	2.99	1.16	3.12	1.29
† Medically assisted reproduction should not be used for scientific research purposes.	3.13	1.22	2.58	1.13	3.10	1.16	3.00	1.21
The use of medically assisted reproduction contributes to solving demographic problems in my country.	2.83	1.09	2.67	1.03	3.06	1.05	2.84	1.07
A maximum of ten women may be fertilised with the sperm of a male donor if the man is healthy and has good physical characteristics.	2.71	1.02	2.37	1.12	2.63	1.02	2.62	1.05
The creation of surplus embryos and their destruction or freezing should be banned. (R)	2.51	1.38	2.76	1.51	2.47	1.12	2.56	1.39
Medically assisted reproduction should not create multiple pregnancies (twins, triplets, etc.). (R)	2.61	1.38	2.52	1.13	2.39	0.91	2.55	1.09
Donation of surplus embryos should be banned. (R)	2.32	1.35	2.43	1.25	2.38	1.15	2.36	1.29
Choosing the gender of a future child should be left as an option as part of medically assisted reproduction.	2.32	1.16	2.33	0.95	2.37	1.19	2.33	1.12
Donation of male sperm and female egg cells should be banned. (R)	2.11	1.32	2.17	1.25	2.01	1.12	2.11	1.27
† Doctors have the right to dispose of egg cells as they wish without the knowledge and approval of the female donor.	1.72	0.90	1.70	1.04	1.82	0.96	1.74	0.94

Table 4: Descriptive statistics for items on Attitudes towards Medically Assisted Reproduction scale. Note: *M*= mean, *SD* = standard deviation. The items are listed in descending order of mean score. Items with (R) were included in the reliability analysis so that higher values represent agreement with the justification for MAR. Items marked with † were removed from the final component solution. *N* (valid cases): Croatia *N*=586, Italy *N*=211, Greece *N*=160) and total sample *N*=957 after listwise deletion.

## VII.2. Socio-demographic Predictors

The One-way ANOVA showed that there are statistically significant differences between the mean values of the disapproval of MAR by country (*N*=984,<sup>9</sup> Welch's

<sup>9</sup> As we used the listwise method for missing values, participants who did not answer one of the variables were removed from the analysis. The number of total valid cases and cases per group is given for each analysis.

$F(2,411.68)=3.300$ ,  $p=0.038$ ,  $\omega^2=0.005$ ), with Games-Howell post hoc showing that the only significant difference found was between Italy and Greece (mean difference of 0.221,  $p=0.045$ ), which can also be seen on the boxplot in Figure 1. Games-Howell post hoc was used because the assumption of homogeneity of variances was not met. Participants from Italy (N=216) in our sample had the highest mean ( $M=0.159$ ,  $SD=1.085$ ), then participants from Croatia (N=600,  $M=-0.040$ ,  $SD=1.031$ ) and the lowest mean was found for participants from Greece (N=168,  $M=-0.063$ ,  $SD=0.718$ ). Despite the statistical significance found between the countries, the small effect size ( $\omega^2=0.005$ ) indicated that only a limited proportion of the variance can be attributed to the independent variable.

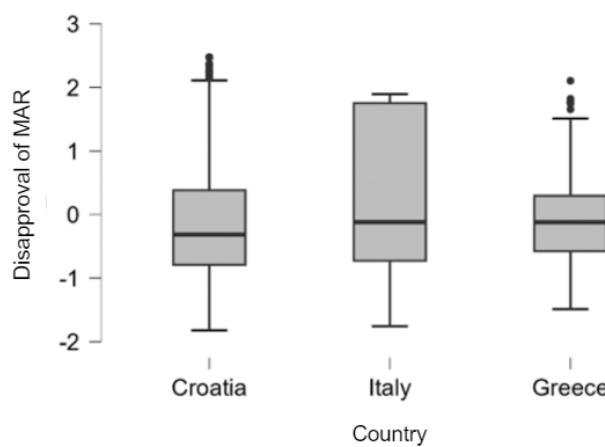


Figure 1: Boxplot illustrating the distribution of "Disapproval of MAR" scores among students in Croatia, Italy, and Greece.

The use of One-Way ANOVA to test the mean differences between the different groups of students in relation to their area of study revealed that there were statistically significant differences in the disapproval of MAR (N=984, Welch's  $F(3,405.37)=205.64$ ,  $p<0.001$ ,  $\omega^2=0.459$ ). The large effect size ( $\omega^2=0.459$ ) indicates a substantial difference between theology students and other groups, with theology students having statistically significantly higher scores (N=202,  $M=1.33$ ,  $SD=0.89$ ) than those studying philosophy (N=129,  $M=0.37$ ,  $SD=0.78$ ), medicine (N=306,  $M=0.32$ ,  $SD=0.68$ ) or law (N=347,  $M=-0.36$ ,  $SD=0.67$ ), and no significant statistical difference was found between the latter three groups.

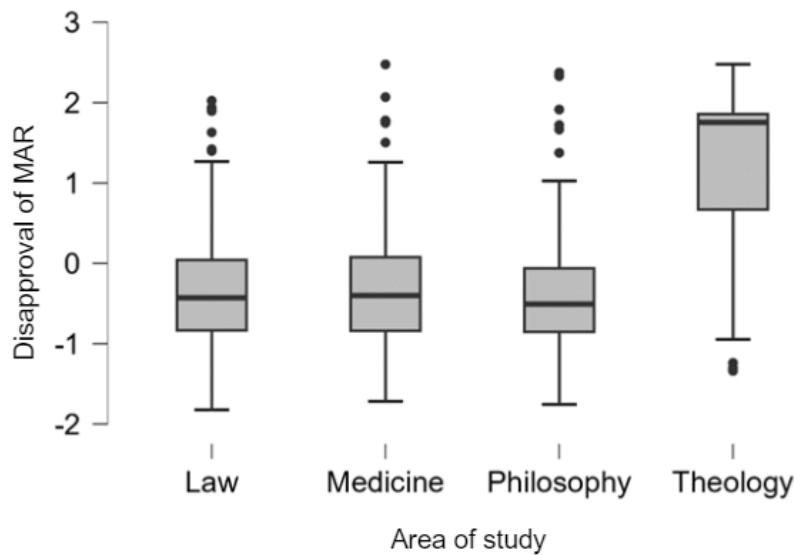


Figure 2: Boxplot illustrating the distribution of "Disapproval of MAR" scores among students of Law, Medicine, Philosophy and Theology.

To test H3, six independent analyses of mean differences were conducted to test differences by each socio-demographic characteristic. The Independent sample T-test showed that there were statistically significant differences between genders (N=956,  $t(671.68)=10.06, p<0.001$ , Cohen's  $d=0.699$ ) and between final year and first-year students (N=958,  $t(885.54)=2.648, p=0.008$ , Cohen's  $d=0.173$ ) with females (N=578) having 0.665 ( $\pm 0.067$ , CI [0.54-0.79]) lower scores than males (N=378) and final year (N=505) students having 0.173 ( $\pm 0.066$ , CI [0.05-0.30]) lower scores than first year (N=453) students. It should be noted that while the effect size was medium in the comparison by gender, which means that a significant part of the variance in disapproval of MAR can be explained by gender. However, in the other analysis, the effect size when comparing first and final year students was small, meaning that although the result is statistically significant, the difference between the first and final year groups of students is modest and the practical significance of this finding is limited. The One-way ANOVA test for differences between groups by religious identification showed that the differences were statistically significant (N=885, Welch's  $F(2,416.71)=154.31, p<0.001, \omega^2=0.207$ ), with the Games-Howell post hoc test showing significant ( $p<0.001$ ) differences between Believers (N=558,  $M=0.36, SD=1.06$ ) and Indifferent (N=129,  $M=-0.51, SD=0.48$ ) and Believers and Nonbelievers (N=198,  $M=-0.63, SD=0.62$ ), but without statistical significance found between Indifferent and Nonbelievers ( $p=0.762$ ). The statistically significant result and the large effect size ( $\omega^2=0.170$ ) indicate that religiosity has a significant influence on explaining the differences in the disapproving of MAR. There were statistically significant differences in mean scores for the disapproval of MAR (N=776, Welch's  $F(3,388.58)=52.02, p<0.001, \omega^2=0.207$ ), with politically Right-oriented respondents having the highest mean score (N=152,  $M=0.60, SD=1.24$ ) and Left-oriented respondents the lowest (N=227,  $M=-0.57, SD=0.63$ ). The differences between all groups were statistically significant ( $p<0.001$ ), with the exception of the Centre (N=201,  $M=-0.08, SD=0.85$ ) and Not interested (N=196,

$M=-0.09$ ,  $SD=0.91$ ) groups (Table 5). The statistically significant result and the large effect size ( $\omega^2=0.170$ ) indicate that political orientation has a potential practical significance in explaining differences in the disagreement on MAR. There were statistically significant differences according to the size of place of residence ( $N=904$ , Welch's  $F(2,527.08)=4.238$ ,  $p<0.015$ ,  $\omega^2=0.007$ ) and post hoc tests using Games-Howell showed the only statistically significant difference was found between people from small places ( $N= 341$ ,  $M=0.13$ ,  $SD=1.07$ ) and medium-sized places ( $N=235$ ,  $M=-0.11$ ,  $SD=0.96$ ) with a mean difference of (0.24,  $p=0.017$ ), but not with the larger sized places of residence ( $N=328$ ,  $M=-0.40$ ,  $SD=0.973$ ). However, due to the small effect size the practical significance of this result is limited, as only a small part of the disapproval of MAR could be explained by the size of the place of residence. We were unable to find any statistically significant differences in terms of financial situation ( $N=795$ ,  $F(2,729)=1.197$ ,  $p=0.275$ ,  $\omega^2=0.007$ ).

Comparison	Mean Difference	SE	t	df	p <sub>tukey</sub>
Left - Centre	-0.481	0.073	-6.593	365.570	< .001 ***
Left - Right	-1.160	0.100	-11.567	214.681	< .001 ***
Left - Not interested	-0.475	0.077	-6.175	340.589	< .001 ***
Centre - Right	-0.679	0.109	-6.226	271.073	< .001 ***
Centre - Not interested	0.006	0.088	0.066	391.844	1.000
Right - Not interested	0.685	0.112	6.128	285.119	< .001 ***

\*\*\*  $p < .001$

Table 5: Games-Howell Post Hoc Comparisons of Disapproval of MAR according to political beliefs. Note: results based on uncorrected means. Total N (valid cases) = 776 after listwise deletion.

## VIII. Discussion

The results show that students generally agree with the use of MAR, particularly regarding the child's access to information about the donor, the need for legal regulation of MAR and the availability of MAR procedures for singles or people living in a same-sex partnership. Only a small proportion of participants agreed with the ban on the creation of surplus embryos and the donation of male or female gametes. However, only a minority of the students agreed with the optional choice of the child's sex and the right of doctors to dispose of the gametes without the consent from the donor. This predominantly positive view of MAR is consistent with the results of previous research (Fauser et al. 2019; Szalma & Djundeva 2019), according to which younger people have a more positive attitude towards MAR – and the respondents of our research are mostly younger. Nevertheless, their attitudes reflect the ethical dilemmas presented in the Introduction of this article (Cook, Dickens & Fathally 2003; Patrizio & Caplan 2012; Vayena, Rowe, & Griffin 2001).

Although our analysis showed that there was a statistically significant difference in the disapproval of MAR between students in Italy and Greece, the effect size ( $\omega^2=0.005$ ) was small, that, although statistically significant, the country-level differences in attitudes toward MAR were minimal in practical terms. To address the distinction between statistical and practical significance, it is important to note that several of the effects

observed in our study, although statistically significant, are small in magnitude. These results should therefore be interpreted with caution, as statistical significance in large samples may reflect even minimal differences that have limited substantive implications. In this sense, our findings highlight patterns that are theoretically informative but not necessarily of high practical impact in real-world contexts. In other words, the first hypothesis that there are no differences between the countries due to the shared cultural heritage of these Mediterranean countries could not be fully confirmed.

Possible differences in the means in Greece and Italy could be explained by different legal regulations and the availability of MAR technologies. As already mentioned, Greece has one of the least restrictive legal regulations for MAR in Europe. This even leads to so-called “reproductive tourism”, a form of health tourism (Christoforidis et al. 2023). Approximately 1000 patients come to Greece every year to undergo MAR treatment. The most common reasons are restrictive legal regulations in their countries (e.g., Italy and Germany) and long waiting lists.

It was also previously pointed out that the theological perspective, or more specifically the position of the Catholic Church, can influence national legislation, which is particularly evident in Italy (Patrizio & Caplan 2014). ART in Italy is regulated by Law 40/2004, which is often referred to as a ‘Catholic law’ due to its ideological alignment with the values of the Catholic Church, more specifically its stance towards the unborn child (Bulletti & Bulletti 2024). This is made clear by the several bans imposed by Law 40/2004, such as prohibition of experimentation on embryos, of interventions that are not exclusively for therapeutic and diagnostic purposes, of any form of eugenic selection, of the disposal of embryos, of the creation of more embryos than strictly necessary for a single simultaneous implantation, of no more than three embryos, of any form of heterologous reproduction, and so on (*Ibid.*).

Also, the opinion of those to whom this law applies goes in the direction of greater openness. According to a study by Cioffi and colleagues (Cioffi et al. 2023), infertile women in Italy do not consider the bans on preimplantation genetic diagnosis, cryopreservation, and heterologous insemination to be justified. They also disagree with the upper age limit for women who have access to ART procedures (43 years). However, at the same time, the majority of them would not grant single women and same-sex couples’ access to ART procedures and would not allow surrogacy or embryo experimentation (Cioffi et al. 2022).

The second hypothesis was confirmed in this study, with large effect size, which assumed that theology students have a more conservative attitude towards MAR than medical, philosophy, and law students. In the Introductory part of the paper, it was pointed out that the theological perspective, especially that of the Catholic Church, is critical of ART (Sigillo et al. 2012, 251, as cited in Bartolomé-Peral & Coromina 2020; Schenker 2005, as cited in Szalma & Djundeva 2019). If we assume that theology students are also strongly religious, then we can state that our research builds on previous studies that religiosity is a key factor in attitudes towards ART (Baltezersen 2022; Bartolomé-Peral &

Coromina 2020; Szalma & Djundeva 2019). While no statistically significant differences were found in attitudes towards MAR between philosophy, medicine, and law students, it is interesting to note that law students are the most opposed to the disapproval of MAR (they have the lowest mean value of  $M=-0.36$ ,  $SD=0.67$  compared to theology  $M=1.33$ ,  $SD=0.89$ , from which they also differ statistically significantly, as well as compared to philosophy  $M=0.37$ ,  $SD=0.78$  and medicine  $M=0.32$ ,  $SD=0.68$ , although no statistical significance could be found with the latter two). This may be due to their area of study area. However, due to the imbalances in the sample (explained in more detail in the *Limitations* section), we urge caution in interpreting the results, as these group disparities may have affected the statistical robustness and stability of the findings.

The third hypothesis was partially confirmed. It states that, in terms of different socio-demographic characteristics, women, final year students, who are non-religious, politically left-oriented, come from larger cities and have a better financial status have more liberal attitudes towards MAR. The results show women, people who are not religious, and those who are politically left-oriented have more liberal attitudes towards MAR in our study, although these effects were modest in size. While gender and religiosity emerged as statistically significant predictors of attitudes, the corresponding effect sizes indicate that these variables explain only a moderate proportion of the variance, underscoring the need for cautious interpretation. While there were statistically significant differences between first and final year students and between students from small and medium-sized places of residence, the small effect size – indicating a modest influence of these variables on attitudes to MAR – suggests that the practical significance of these results is quite limited. This partially confirms the third hypothesis and is in line with the results of previous research (Baltezersen 2022; Bartolomé-Peral & Coromina 2020; Szalma & Djundeva 2019). Although previous research points to the importance of financial status in the formation of attitudes towards MAR, our results do not confirm this. However, one should bear in mind that the majority of students are not fully financially independent and may not yet grasp the relevance of this financial aspect, i.e., the financial burden such procedures can have on individuals and couples.

## IX. Limitations

The MAR instrument is new and most of the items it contains have not yet been tested. While we are satisfied with the results, as we were primarily interested in assessing students' attitudes toward a number of related aspects of this topic, future studies could focus more on the instrument itself, further improving its validity and reliability, and further testing for possible multidimensionality. Although our decision to remove certain items was based on correlations and reliability tests, we recognize that several of these excluded items address important dimensions of the MAR debate, such as legal regulation, information rights, and ethical considerations. Future research should therefore revisit

and refine these items to explore their potential contribution to a broader and possibly multidimensional understanding of attitudes toward MAR.

Even though this study included a multi-level item scale, it is not possible to generalize the results due to convenience sampling and the imbalance of certain socio-demographic characteristics across groups, it is not possible to generalize the results. The imbalanced numbers on participants per group, as well as no students from Law and Philosophy in the Greek sample, could have influenced the robustness of statistical test, e.g. group differences could have been over- or under-estimated by these imbalances. Therefore, the results should be interpreted with caution, and future studies should aim for more balanced samples to enhance the reliability and generalizability of the findings. This imbalance was particularly pronounced in the Greek sample, where Medical students accounted for more than 60% of respondents and no Law or Philosophy students participated. Although post hoc corrections (e.g., Welch's F-test) were applied to mitigate unequal variances, these compositional differences may still have influenced cross-country comparisons, especially regarding H1. Therefore, results are interpreted with appropriate caution.

Moreover, no causal conclusions can be drawn due to the cross-sectional design of the study. The use of an English-language instrument had the advantage of avoiding discrepancies in meaning that might arise from translation, which made it easier to compare the data. This decision was justified as it was assumed that students in the EU have a B2 level of proficiency in English. Nevertheless, it should be acknowledged that not all students may have met the expected proficiency level and that the terminology used to describe MAR procedures might be unfamiliar or unclear to students, potentially leading to difficulties in understanding certain terms or items in the questionnaire. It is also worth noting that one of the institutions where the survey was conducted, the Law Department at the University of Messina, translated the questionnaire into their native language, Italian. Since the data from this group did not differ significantly from the overall sample, these participants were not excluded from the analysis. Although research (Selma & Djundeva 2019) has shown that the acceptance of MAR varies according to religious denomination, we were unable to test for these differences in this study. The question in the survey about the denomination to which participants belong was open-ended, so the majority of participants either left it blank or wrote 'Christian', which meant that we could not identify a specific denomination. However, the degree of religiosity was examined with a reliable instrument, so we could correlate this data with their bioethical attitudes, i.e., we could see how strongly they adhered to the doctrines of their denomination. Future research would benefit from including exact religion as well.

## X. Conclusion

Medically assisted reproduction is a complex bioethical issue. As shown in the Introduction, experts from different professions and different social groups perceive this issue in different ways and no consensus has been reached. Through the 'EuroBioMed' project, we wanted to determine how belonging to a certain profession and sociocultural circle, as well as certain sociodemographic characteristics, contribute to the attitude about MAR with the ultimate goal of verifying what the results show in the context of the concept of Mediterranean Bioethics.

Our research showed that respondents mostly agree with the child's right to access information about the donor and the need for clear legal regulation of MAR, while the lowest level of agreement was expressed regarding restrictions on the creation or donation of surplus embryos and gametes. It has also been shown that there are differences between students in attitudes towards MAR with regard to the country of residence, the study program they attend and sociodemographic characteristics. Although previous research explains some of the causes of these differences, future qualitative studies should focus on specific subgroups of students to explore these attitudes in greater depth.

These findings can also be interpreted within the broader framework of Mediterranean bioethics, which emphasizes dialogue between diverse cultural, religious and philosophical traditions of the European South. Although Croatia, Italy and Greece share historical roots and a common Mediterranean identity, their differing legal, theological and socio-political contexts appear to shape students' ethical orientations toward medically assisted reproduction. The relatively conservative attitudes observed among Italian and Theology students are likely influenced by the continuing presence of Catholic personalist ethics, whereas the views among Greek and Croatian students may reflect exposure to more permissive bioethical traditions. In this respect, the results illustrate how the Mediterranean region functions as a meeting ground of traditional moral values and contemporary bioethical pluralism as an interplay that is central to the concept of Mediterranean bioethics. This interpretive lens underscores the value of situating empirical bioethical research within its cultural and normative context, revealing that shared geographical belonging does not necessarily imply ethical uniformity.

The main strength of this research is the use of a scale that encompasses several different aspects of MAR technology use, capturing multiple dimensions of these practices and their ethical context. This approach revealed that certain aspects of the MAR debate – such as the use of embryos in research or the economic motivations for developing these technologies – are perceived as conceptually distinct from the core debate about the availability of MAR procedures for personal reproduction. It is also important to note that the removal of certain items from our analysis may reflect issues of wording or other methodological factors.

The results of our study show that the concept of 'Mediterranean Bioethics' proves

to be promising as a common platform. Taken together, these findings provide an initial comparative insight into how young people in Mediterranean countries understand and evaluate medically assisted reproduction, contributing to the broader discussion on the cultural foundations of bioethical reasoning.

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