Preprints.org

Article

Not peer-reviewed version

Knowledge about Fertility in Croatia, Measured with the Croatian Version of the Cardiff Fertility Knowledge Scale (Cfks-HR), in Relation to Attitudes toward Having a Child and Associated Factors

Ante Buljubašić *, Deana Švaljug , Jelena Jerković , Martina Mudnić Pulje , Ivana Gusar , Iris Jerončić Tomić

Posted Date: 18 January 2024

doi: 10.20944/preprints202401.1360.v1

Keywords: fertility; fertility knowledge; reproductive decision-making; awareness

Preprints.org is a free multidiscipline platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

Knowledge about Fertility in Croatia, Measured with the Croatian Version of the Cardiff Fertility Knowledge Scale (CFKS-Hr), in Relation to Attitudes toward Having a Child and Associated Factors

Ante Buljubašić [1], Deana Švaljug [2], Jelena Jerković [3], Martina Mudnić Pulje [4], Ivana Gusar [5] and Iris Jerončić Tomić [6,*]

[1] University of Split, University Department of Health Studies, Split, Croatia; abuljubasic@unist.hr
[2] University of Rijeka Faculty of Health Studies Rijeka, Croatia; deana.svaljug@uniri.hr
[3] University of Split, University Department of Health Studies, Split, Croatia; jelena.jerkovic@kb-split.hr
[4] University of Split, University Department of Health Studies, Split, Croatia; martinamudnicpulje7@gmail.com
[5] University of Zadar, Department of Health Studies, Zadar, Croatia; igusar@unizd.hr
[6] University of Split, School of Medicine, Split, Croatia; ijtomic@unist.hr
* Correspondence: abuljubasic@unist.hr

Abstract: Background: Fertility is a crucial component of population maintenance and growth. A declining fertility trend has been observed over the past two decades, and it continues. **Objective:** The aim of this research was to examine the level of fertility knowledge, factors influencing fertility knowledge, and the relationship between fertility knowledge and the decision to have a child. **Methods:** A cross-sectional study was conducted on a sample of mothers in five hospitals on the Adriatic coast of the Republic of Croatia, involving 1541 mothers from September 2021 to December 2023. The Cardiff Fertility Knowledge Scale was used for the research. **Results**: The participants were divided into two groups based on fertility status in women, specifically the period of declining fertility in women. Group 1 included participants aged 18-31 with sustained fertility, and Group 2 included participants aged 32 and older experiencing declining fertility. Fertility knowledge was 58.9%. Women with higher educational status showed better results (62.3%). The most common sources of fertility knowledge were the healthcare system and the internet. Factors associated with the level of fertility knowledge included higher education, marital status, and higher economic status. **Conclusion:** The research results reveal a lack of fertility knowledge among participants, as well as an intention to have a child in later stages of life. The lack of formal education on this topic leads to information gathering from unreliable sources.

Keywords: fertility; fertility knowledge; reproductive decision-making; awareness

1. Introduction

The decline in fertility worldwide has been evident in the last two decades. Transition changes within families, prolonged education, and new lifestyles have resulted in a reduced number of children in families and delayed childbirth of the first child. The International Conference on Population and Development emphasizes fertility as one of the most important components of population growth [1,2]. The total world fertility rate has decreased from almost 5 births per woman in 1950–1955 to 2.5 in 2010–2015 [3]. Developed countries face the reality of childbirth at a later age and declining fertility [4,5]. In these countries, fertility is lower than 2.1 children per woman, which is necessary to maintain the population [6]. This approach to fertility can be explained by the focus of individuals in reproductive age on their professional life, changes in lifestyle, and misinformation about fertility [7-9]. According to recent data, the birth rate in the Republic of Croatia (HR) is continuously decreasing, 1.43 (2019), 1.42 (2020), 1.41 (2021), 1.40 (2022) [10]. This fertility decline

© 2024 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

trend is not unexpected and was predicted by demographers [11]. Simultaneously, there has been an increase in the maternal age at the birth of the first child, which has risen from 26.5 (2005) to 29.7 (2021) in the European Union (EU) [12]. The lowest is in Bulgaria (26.5), and the highest in Italy and Spain (31.6) [12]. In HR, the maternal age during that period increased from 26.5 (2005) to 29.2 (2021) [13]. Research on fertility knowledge has shown that it is insufficient in many countries [14-17]. A study conducted in Canada indicated the effectiveness of online education on fertility knowledge [18]. Research conducted in HR shows that women lack specific knowledge about fertility and the impact of certain conditions on fertility [19]. Low fertility has numerous aetiologies, and it is difficult to define specific factors. Research unequivocally shows that aging leads to a decline in fertility, occurring around the age of 32 and beyond [20]. Civilizational progress has led to social development, economic advancement, and consequently, changes in lifestyle [21]. A study conducted in 79 countries showed an average fertility knowledge test score of 56.9% [22]. Participants in Italy, Japan, Germany, Sweden, and other developed countries had a low level of fertility knowledge [23-27]. Interestingly, even healthcare professionals, doctors, nurses, and midwives, in some cases, showed a low level of fertility knowledge [28-30]. This is a consequence of the low level of fertility knowledge in the student population in conducted studies [31-34]. Research has proven that a higher level of fertility knowledge leads to the decision to have a child earlier [35]. In HR, there are no recent studies assessing women's knowledge of fertility. There are only studies based on the association of education and age at the birth of the first child. A study conducted in 2022 analyzed data from 500 mothers and showed that women with a lower level of education give birth at an earlier age and have a higher number of births, while women with a higher level of education give birth at a later age and have a smaller number of births [36].

The aim of this research was to examine the level of fertility knowledge among mothers in the coastal area of Croatia, associated factors influencing fertility knowledge, and the relationship between fertility knowledge and the decision to have a child. The obtained data enable a change in educational content and a more systematic approach to the topic of fertility.

2. Materials and Methods

Research Design

A cross-sectional study was conducted on a convenience sample of mothers in five hospitals on the Adriatic coast of HR from September 2021 to December 2022.

Participants and Materials

The study included mothers who, during the research period, were in the maternity wards of five hospitals on the Adriatic coast of the Republic of Croatia. The inclusion criteria were an age of 18 years or older, the absence of psychological problems determined by reviewing medical documentation and signing an informed consent confirming voluntary participation in the study. During the specified period, we collected data from 1573 participants. Through the analysis of completed questionnaires, we identified thirty-two incorrectly filled questionnaires, which were subsequently discarded. We analyzed data from 1541 participants.

Sample Size

The sample size was calculated based on the total population of mothers in the specified hospitals over a year, considering a 95% confidence level and a 2.5 confidence interval [37]. The required sample size for the study was 1332 participants.

Questionnaire

The questionnaire used in this study is the Cardiff Fertility Knowledge Scale (CFKS), developed by Boivin and colleagues (2013) [38]. CFKS measures the level of knowledge through 13 statements in three areas: indicators of reduced fertility, fertility misconceptions, and basic facts about infertility [36]. Statements are assessed as "correct," "incorrect," or "I don't know." A correct answer is scored one point, while an incorrect or "I don't know" response is assigned 0 points. Results are presented

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

as percentages of the maximum possible score. The CFKS has a Cronbach's α coefficient of 0.82, a test-retest reliability of 0.82, and a consistency index of 0.95. Approval for using CFKS was obtained from the authors. The questionnaire was translated into Croatian by two MA in English language and tested on a group of 106 students to confirm its clarity. Pilot data were not included in the study.

Sociodemographic Data

The questionnaire collected data on age, age at marriage, educational status, marital status, and economic status.

Childbirth Data

Participants provided information on the number of children born, age at the birth of the first child, and their intention to have more children in the future. In response to the question "Do you want to have more children in the future?" participants answered "yes" or "no."

Data on Fertility Education

Two questions focused on fertility knowledge. The question "Have you been educated about fertility so far?" required a "yes" or "no" response. If the answer was "yes," participants responded to the question "Where were you educated on fertility?" with options such as "family, friends, educational system, internet, healthcare system, other."

Data Analysis

Sociodemographic variables were presented using descriptive statistics. Categorical variables were compared using the chi-square test. T-tests and analysis of variance (ANOVA) were used to compare overall results among sociodemographic categories. Pearson's correlation was used to determine the relationship between the importance of childbirth and CFKS. Statistical significance was indicated by a p-value less than 0.05. The analysis was conducted using SPSS software (version 22.0) (IBM Corp., New York, USA).

Ethical Principles

The research was conducted in line with the Helsinki Declaration. All procedures carried out in this research were approved by the Ethics Committees of all healthcare institutions where the research was conducted. Permission to use CFKS was obtained from the authors. Participants were informed about the research by the investigators and through the informed consent, which was the first part of the survey questionnaire. By signing the informed consent, participants agreed to participate. Participation in the research was anonymous, voluntary, and confidential. To preserve anonymity, participants were asked not to provide any identification details or phone numbers on the survey questionnaire. All collected data are only accessible to the researchers.

3. Results

Sociodemographic Data

Table 1 displays the specifics of sociodemographic data. The participants were divided into two groups based on fertility status, distinguishing the period when fertility decreases in women [20]. Group 1 includes participants aged 18-31 with maintained fertility, while Group 2 comprises participants aged 32 and above experiencing a decline in fertility.

Table 1. Sociodemographic Characteristics of Participants (N=1573).

Age	N (%)
<32	892 (57)
=32>	681 (43)
Range	18-41
Age of marriage	Mean (SD)

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

<32	26,5 (3,41)	
=32>	25,7 (2,75)	
	N (%)	
Educational status	**<32**	**=32>**
Elementary school or less	181 (21)	142 (21)
High school	547 (61)	352 (52)
Higher education	164 (18)	187 (27)
Marital status	**<32**	**=32>**
Single parent	72(8)	69 (10)
Married	820 (92)	613 (90)
Economic status		
551 - 1000 €	455 (51)	293 (43)
1001-1500 €	348 (39)	286 (42)
1501-2000 €	80 (9)	82 (12)
>2001 €	10 (1)	20 (3)

Data on childbirth

Table 2 shows data on childbirth.

Table 2. Data on childbirth.

Age at the birth of the first child		
Mean (SD)	28,8 (3,6)	
Range	18-41 (23)	
Number of children born	**N (%)**	
First childbirth	802 (51)	
Second childbirth	503 (32)	
Third childbirth or more	267 (17)	
Do you want to have more children in the future?	**N (%)**	
	Da	**Ne**
First childbirth	1279 (83)	262 (17)
Second childbirth	647 (42)	894 (58)
Third childbirth or more	169 (11)	1372 (89)

Source of Knowledge on Fertility

Although participants show a positive attitude toward fertility education, they tend to avoid this topic due to a sense of discomfort, which is higher among participants outside of marital partnerships.

82% of participants provided positive answers to the question "Have you been educated about fertility?" (answered yes). They were then asked, "Where have you been educated about fertility?" The next question is "Do you think fertility education is necessary?" to which participants mostly responded positively (86%). When asked, "Do you feel uncomfortable discussing this topic in an environment where there are people who are not close to you?" participants mostly answered positively (75%), and this response was mainly given by individuals not in marital partnerships (72%).

Table 3 shows the results regarding sources of knowledge on fertility.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

Table 3. Sources of Knowledge on Fertility.

Source of Knowledge	N, %
Educational System	123 (8)
Family, friends	345 (22)
Television, newspapers	46 (3)
Healthcare system	521 (33)
Internet	491 (31)
Not sure	46 (3)

Knowledge on fertility and related factors

Participants responded to fertility statements with an accuracy of 59.8% (SD=22.4). There was a difference in responses between the groups. The group of participants up to 31 years of age responded with an accuracy of 56.6%, while the group of older participants over 31 years responded with an accuracy of 64%. Table 4 shows the data of the CFKS scale by statements. Table 5 presents the factors associated with fertility knowledge.

Table 4. Fertility knowledge.

	<32	=32>
Statements (T-true; F-false)	T (%)	T (%)
A woman is less fertile after the age of 36 years. (T)	69,5	72,3
A couple would be classified as infertile is they did not achieve a pregnancy after 1 year of regular sexual intercourse (without using contraception). (T)	45,6	48,2
Smoking decreases female fertility. (T)	74,2	86,4
Smoking decreases male fertility. (T)	71,6	75,3
About 1 in 10 couples are infertile. (T)	34,7	52,6
If a man produces sperm, he is fertile. (F)	67,2	66,5
These days a woman in her 40s has a similar chance of getting pregnant as a woman in her 30s. (F)	74,5	82,4
Having a healthy lifestyle makes you fertile. (F)	24,3	32,4
If a man has had mumps after puberty, he is more likely to later have a fertility problem. (T)	86,4	88,4
A woman who never menstruates is still fertile. (F)	36,3	45,2
If a woman is overweight by more than 13 kg then she may not be able to get pregnant. (T)	45,2	56,8

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

If a man can achieve an erection, it is an indication that he is fertile. (F)	67,7	78,6
People who have had a sexually transmitted disease are likely to have reduced fertility. (T)	38,5	46,6

Table 5. Factors Associated with Fertility Knowledge.

	<31 AS(SD)	*p*	=32> AS (SD)	*p*
Educational status				
Elementary school or less	41.5 (21.3)		42.8 (23.2)	
High school	43.7 (22.9)	0,42	45.5 (21.6)	0,54
Higher education	47.7 (23.4)		48.4 (23.1)	
Marital status				
Single parent	41,5 (22,4)	<0,05	46,2 (23,3)	0,04
Married	47,6 (23,2)		47, 8 (22,4)	
Economic status				
551 - 1000 €	42,3 (22,1)		46,7 (23,4)	
1001-1500 €	44,5 (23,4)	<0,05	47,6 (22,3)	0,09
1501-2000 €	44,8 (23,2)		49,4 (21,4)	
>2001 €	47,7 (21,2)		51,2 (22,7)	

4. Discussion

Knowledge on Fertility

The research we conducted on a population of women who gave birth showed a low level of knowledge about fertility. Similar results were obtained in other studies on fertility [21, 27]. An international study showed that knowledge about fertility was at 59.7%, while the research we conducted showed that the level of knowledge about fertility was at 59.8%. Participants who had a high level of education in our study had better results [22]. The share of 62.3% correct answers still cannot be considered good, although this result is slightly better than the results obtained in the international research, which was 56.9 [21]. In other studies, data clearly show that a higher level of fertility knowledge is associated with a higher level of education [22, 23, 35, 39]. Results indicating a lack of basic facts about fertility available in the literature are concerning. It is particularly important to highlight the described results based on information gathered without the need for advanced searches of professional literature. Analysis of the obtained data shows that participants do not demonstrate sufficient knowledge about the effect of diseases on fertility while at the same time thinking that having healthy habits is sufficient for preserving fertility. The attitudes of participants at this level of fertility knowledge can lead to delaying the decision to get pregnant and downplaying the importance of risk factors for reduced fertility. The described results resemble the data from a conducted study where a lack of knowledge was proven to be the main factor in incorrect health behavior [21]. Participants with higher socioeconomic status showed a higher level of fertility knowledge, as confirmed in previous studies [21, 27]. Although participants express a positive attitude towards fertility education, they avoid discussing this topic due to a feeling of discomfort. The feeling of discomfort is higher among participants who are not in a marital relationship. Similar data have been found in previously conducted studies [27, 32]. Previous research has proven that individuals with higher levels of education have a higher level of health literacy [40-43]. The data obtained from this research emphasize the need for engagement of the education system to raise the level of health literacy and destigmatize the topic of fertility, with a special focus on participants who

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

show a lower level of knowledge. Promotional activities need to be designed to empower the young population for critical thinking and making informed decisions related to fertility. Such activities have already shown their potential and contributed to changes in attitudes toward fertility, as confirmed by a study in Australia [44].

Decision on childbirth

In this study, only 11% of participants stated that they did not want a child at all, but the pregnancy occurred unplanned. Previous research on this topic has shown different data: Japan 18.0%, USA 14.2%, Sweden 4.1%, Hong Kong 19.1% [31, 33, 39, 45]. Responses to the question of how important it is to have a child showed that participants consider it extremely important to have children during their lifetime but do not want pregnancy to occur in their twenties, which is in line with studies conducted in other areas [46]. Since we know that women decide on their first childbirth at an increasingly later age, these data are consistent with epidemiological data in Croatia [47]. The low level of fertility knowledge and the decision to have a child at a later age when fertility declines may be a consequence of economic, economic, and political changes in Croatian society, although the factors of this trend are yet to be determined. The question is whether fertility education alone will bring a positive shift in Croatia, although research on this topic shows positive experiences [48].

Women's fertility knowledge has contributed to a positive attitude towards the decision to have a child [31, 33, 46]. Nevertheless, despite this, the postponement of childbirth to a later age is an increasingly common decision for women [49, 50]. This attitude is explained by the need for women to reconcile their maternal and professional roles [45]. Social changes have influenced women's priorities, which are increasingly dedicated to education and participation in the labor market than their mothers and grandmothers were. This attitude leads to the decision to postpone childbirth [51, 52].

Although most participants answered that they had prior knowledge of fertility, their knowledge was still poor. Most participants acquired knowledge about fertility through the influence of mass media such as the internet or television, and a smaller number within the education system. The results found in other studies are somewhat similar: Japan – internet and media 41.4%; USA – education system 46%, family 19%, media 35% [33, 45]. Seeking information about fertility from insufficiently accurate and quality sources is evidently present not only in Croatian but also in other social communities. The fertility problem is recognized on a global scale. Due to these facts WHO has emphasized the need to pay attention to reproductive health, which includes the field of fertility [53]. The recommendation to the health policies of individual countries is to establish an effective model of preventive activities aimed at promoting fertility. Some countries have recognized the fertility problem earlier, understood the importance of this issue, and defined a program to promote reproductive health and fertility to reduce the problem and its impact on demographic changes within society [54]. Education on fertility should be carried out in schools through existing health education topics and within the primary healthcare system. Such actions to raise the health literacy of the population are not yet carried out in Croatia, although their success has been confirmed by research [55, 56]. Of course, introducing this topic into the education system and the healthcare system, due to its specificity, requires additional education of educational staff [57]. It is also necessary to consider the possibility of controlling information on this topic in the media and the internet due to forming attitudes based on unreliable information. Individuals find these sources of information desirable due to the simplicity of access and finding answers to questions that interest them. Research has shown that the inclusion of the education system in a quality way contributes to an increase in knowledge about fertility [58-60]. The impact of greater knowledge on this topic is not to be overlooked in unfavorable situations, when a woman, despite knowledge and a positive attitude towards fertility, cannot get pregnant, which can result in feelings of anxiety [60, 61]. The results of this study confirm the results from other studies, including that mothers think that having a healthy lifestyle annuls the effect of other risk factors.

Considering the results obtained in this research, in future activities, attention should be directed towards verifying the effectiveness of education interventions and defining risk factors in forming a positive attitude towards the fertility problem.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

This relevant research also has its limitations.

The study is a cross-sectional study with convenience sample conducted on participants from one part of Croatia (coastal area) and does not reflect the entire population that might offer different responses.

5. Conclusions

The research has revealed a lack of knowledge about fertility and a tendency to have the first child later in life when changes and a decrease in fertility potential are already occurring. It has been proven that the lack of formal education on fertility leads to gathering information from unreliable sources such as social media. There is a need to reorganize the educational and healthcare systems at the primary healthcare level to provide adequate education on this topic. On a broader societal level, programs need to be developed to promote reproductive health and fertility with a positive impact on individual quality of life and improvements in the overall demographic structure of society.

Author Contributions: Conceptualization, A.B. and I.JT.; project administration, A.B.; methodology, A.B. and I.JT.; validation, A.B., and I.JT.; investigation, J.J., D.Š., I.G. and M.MP.; data curation, A.B.; supervision, A.B.; visualization, A.B.; writing—original draft A.B. and I.J.T.; writing review end editing, A.B. and I.J.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by Ethics Committee of Clinical Hospital Center Rijeka, 2170-29-02/1-21-2, 31. 05. 2021.; Ethics Committee of Clinical Hospital Center Split, 2181-147/01/06/M.S.-21-02, 28.05.2021.; Ethics Committee of General Hospital Zadar, 02-23673/21-4/21, 11.06.2021.; Ethics Committee of General Hospital Šibenik, 01-8010/1-21, 28.04.2021.; Ethics Committee of General hospital Dubrovnik, 01-49/4.4-21, 07.06.2021.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data used to support the findings of this study are available from the corresponding author upon request.

Public Involvement Statement: The study included mothers who, during the research period, were in the maternity wards of five hospitals on the Adriatic coast of the Republic of Croatia.

Guidelines and Standards Statement: This manuscript was drafted against the STROBE criteria for reporting cross-sectional studies.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. United Nations [Internet]. New York: Department of Economic and Social Affairs, Population Division. World Fertility Data. [cited 2023 Oct 28] Available from: https://www.un.org/development/desa/pd/content/family-planning-0
2. United Nations [Internet]. New York: Department of Economic and Social Affairs, Population Division. World Fertility Report. [cited 2023 Oct 28] Available from: https://www.un.org/development/desa/pd/data/world-fertility-data
3. United Nations [Internet]. New York: Department of Economic and Social Affairs, Population Division. World population prospects. [cited 2023 Oct 28] Available from: https://esa.un.org/unpd/wpp/Download/Standard/Fertility/.
4. George K, Kamath MS. Fertility and age. Journal of human reproductive sciences. 2010;3.3: 121. Available from: https://journals.lww.com/jhrs/fulltext/2010/03030/Fertility_and_age.3.aspx
5. Organisation for Economic Co-operation and Development (OECD) [Internet]. Paris: OECD Family Database, "Fertility Rates". [cited 2023 Oct 29] Available from: https://www.oecd.org/els/family/database.htm
6. Schmidt L, Sobotka T, Bentzen JG, Nyboe AA. Demographic and medical consequences of the postponement of parenthood. Hum Reprod Update. 2012;18(1):29–43. Available from: https://academic.oup.com/humupd/article/18/1/29/854296

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

7. Bunting L, Boivin J. Development and preliminary validation of the fertility status awareness tool: FertiSTAT. Hum Reprod. 2010;25(7):1722–33. Available from: https://academic.oup.com/humrep/article/25/7/1722/631258
8. Williamson LE, Lawson KL, Downe PJ, Pierson RA. Informed reproductive decision-making: the impact of providing fertility information on fertility knowledge and intentions to delay childbearing. J Obstet Gynaecol Can. 2014;36:400–5. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1701216315305855
9. Wojcieszek AM, Thompson R. Conceiving of change: a brief intervention increases young adults' knowledge of fertility and the effectiveness of in vitro fertilization. Fertil Steril. 2013;100:523–9. Available from: https://www.sciencedirect.com/science/article/pii/S0015028213004998
10. Statista [Internet]. Hamburg: Croatia Fertility Rate 1950-2023. Available from: https://www.statista.com/statistics/348296/fertility-rate-in-croatia/
11. Nejašmić I, Toskić A. Starenje stanovništva u Hrvatskoj–sadašnje stanje i perspektive. Hrvatski geografski glasnik. [Croatian]. 2013 Jul 1;75(1.):89-110. Available from: https://hrcak.srce.hr/clanak/155905
12. Eurostat [Internet]. Luxembourg: Fertility statistics. [cited 2023 Oct 29] Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Fertility_statistics
13. United Nations [Internet]. New York: Statistical Database. [cited 2023 Oct 29] Available from: https://w3.unece.org/PXWeb/en/Table?IndicatorCode=34
14. Daniluk JC, Koert E, Cheung A. Childless women's knowledge of fertility and assisted human reproduction: identifying the gaps. Fertil Steril. 2012;97:420–6. Available from: https://www.sciencedirect.com/science/article/pii/S0015028211028226
15. Daniluk JC, Koert E. The other side of the fertility coin: a comparison of childless men's and women's knowledge of fertility and assisted reproductive technology. Fertil Steril. 2013;99:839–46.Available from: https://www.sciencedirect.com/science/article/pii/S001502821202345X
16. Hammarberg K, Setter T, Norman RJ, Holden CA, Michelmore J, Johnson L. Knowledge about factors that influence fertility among Australians of reproductive age: a population-based survey. Fertil Steril. 2013;99:502–7. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0015028212023436
17. Lampic C, Svanberg AS, Karlström P, Tydén T. Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among female and male academics. Hum Reprod. 2006;21:558–64. Available from: https://academic.oup.com/humrep/article/21/2/558/614195
18. Daniluk JC, Koerrt E. Fertility awareness online: the efficacy of a fertility education website in increasing knowledge and changing fertility beliefs. Human Reproduction. 2015;30.2: 353-363. Available from: https://academic.oup.com/humrep/article/30/2/353/728578
19. Vidranski V, Radman A, Kajić K, Bronić A. Knowledge and awareness of iodine intake-survey among Croatian women of reproductive age. Biochemia Medica. 2020;30.1: 104-109. Available from: https://hrcak.srce.hr/clanak/340445
20. Garcia D, Brazal S, Rodriguez A, Prat A, Vassena R. Knowledge of age-related fertility decline in women: A systematic review. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2018;230,109-118. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0301211518309965
21. Hart RJ. Physiological aspects of female fertility: role of the environment, modern lifestyle, and genetics. Physiological reviews. 2016;96.3: 873-909. Available from: https://journals.physiology.org/doi/full/10.1152/physrev.00023.2015
22. Bunting L, Tsibulsky I, Boivin J. Fertility knowledge and beliefs about fertility treatment: findings from the international fertility decision-making study. Hum Reprod. 2013;28(2):385–97. Available from: https://academic.oup.com/humrep/article/28/2/385/597899
23. Hammarberg K, Collins V, Holden C, Young K, McLachlan R. Men's knowledge, attitudes and behaviours relating to fertility. Hum Reprod Update. 2017;23(4):458–80. Available from: https://academic.oup.com/humupd/article/23/4/458/3065332
24. Hammarberg K, Zosel R, Comoy C, Robertson S, Holden C, Deeks M, et al. Fertility-related knowledge and information-seeking behavior among people of reproductive age: a qualitative study. Hum Fertil. 2017;20(2):88–95. Available from: https://www.tandfonline.com/doi/abs/10.1080/14647273.2016.1245447
25. Meissner C, Schippert C, von Versen-Hoynck F. Awareness, knowledge, and perceptions of infertility, fertility assessment, and assisted reproductive technologies in the era of oocyte freezing among female and

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

male university students. J Assist Reprod Genet. 2016;33(6):719–29. Available from: https://link.springer.com/article/10.1007/s10815-016-0717-1

26. Sorensen NO, Marcussen S, Backhausen MG, Juhl M, Schmidt L, Tyden T, et al. Fertility awareness and attitudes towards parenthood among Danish university college students. Reprod Health. 2016;13(1):146. Available from: https://reproductive-health-journal.biomedcentral.com/articles/10.1186/s12978-016-0258-1
27. Maeda E, Sugimori H, Nakamura F, Kobayashi Y, Green J, Suka M, et al. A cross sectional study on fertility knowledge in Japan, measured with the Japanese version of Cardiff fertility knowledge scale (CFKS-J). Reprod Health. 2015;12:10. Available from: https://reproductive-health-journal.biomedcentral.com/articles/10.1186/1742-4755-12-10?report=reader
28. Revelli A, Razzano A, Delle PL, Casano S, Benedetto C. Awareness of the effects of postponing motherhood among hospital gynecologists: is their knowledge sufficient to offer appropriate help to patients? J Assist Reprod Genet. 2016;33(2):215–20. Available from: https://link.springer.com/article/10.1007/s10815-015-0640-x
29. Yu L, Peterson B, Inhorn MC, Boehm JK, Patrizio P. Knowledge, attitudes, and intentions toward fertility awareness and oocyte cryopreservation among obstetrics and gynecology resident physicians. Hum Reprod. 2016;31(2):403–11. Available from: https://academic.oup.com/humrep/article/31/2/403/2380094
30. Hammarberg K. Knowledge, attitudes and practices relating to fertility among nurses working in primary health. Aust J Adv Nurs. 2016;34(1):6–13. Available from: https://search.informit.org/doi/abs/10.3316/informit.576782069523178
31. Lampic C, Svanberg AS, Karlstrom P, Tyden T. Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among female and male academics. Hum Reprod. 2006;21(2):558–64. Available from: https://academic.oup.com/humrep/article/21/2/558/614195
32. Rovei V, Gennarelli G, Lantieri T, Casano S, Revelli A, et al. Family planning, fertility awareness and knowledge about Italian legislation on assisted reproduction among Italian academic students. Reprod BioMed Online. 2010;20:873–9. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1472648310001756
33. Peterson BD, Pirritano M, Tucker L, Lampic C. Fertility awareness and parenting attitudes among American male and female undergraduate university students. Hum Reprod. 2012;27(5):1375–82. Available from: https://academic.oup.com/humrep/article/27/5/1375/694164
34. Lucas N, Rosario R, Shelling A. New Zealand University students' knowledge of fertility decline in women via natural pregnancy and assis sted reproductive technologies. Hum Fertil. 2015;18(3):208–14. Available from: https://www.tandfonline.com/doi/abs/10.3109/14647273.2015.1006694
35. Maeda E, Nakamura F, Boivin J, Kobayashi Y, Sugimori H, Saito H. Fertility knowledge and the timing of first childbearing: a cross-sectional study in Japan. Hum Fertil. 2016;19(4):275–81. Available from: https://www.tandfonline.com/doi/abs/10.1080/14647273.2016.1239033
36. Tisaj Pigac S. Utjecaj formalnog obrazovanja na fertilitet žena: presječno istraživanje [Diplomski rad]. [Croatian]. Rijeka: Sveučilište u Rijeci, Fakultet zdravstvenih studija u Rijeci; 2022. Dostupno na: https://urn.nsk.hr/urn:nbn:hr:184:559931
37. surveysistem.org [Internet]. San Rafael. Sample Size. [cited 2021 Jun 15] Available from: https://www.surveysystem.com/sscalc.htm
38. Bunting, L., Tsibulsky, I., & Boivin, J. Fertility knowledge and beliefs about fertility treatment: findings from the International Fertility Decision-making Study. Human Reproduction. 2013;28(2), 385-397. Available from: https://academic.oup.com/humrep/article/28/2/385/597899
39. Daniluk JC, Koert E. Fertility awareness online: the efficacy of a fertility education website in increasing knowledge and changing fertility beliefs. Hum Reprod. 2015;30(2):353–63. Available from: https://academic.oup.com/humrep/article/30/2/353/728578
40. Reynolds R, Smoller S, Allen A, Nicholas PK. Health literacy and health outcomes in persons living with HIV disease: a systematic review. AIDS Behav. 2019;23(11):3024–43. Available from: https://link.springer.com/article/10.1007/s10461-019-02432-9
41. Du S, Zhou Y, Fu C, Wang Y, Du X, Xie R. Health literacy and health outcomes in hypertension: an integrative review. Int J Nurs Sci. 2018;5(3):301–9. Available from: https://www.sciencedirect.com/science/article/pii/S2352013217302971

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

42. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. Ann Intern Med. 2011;155(2):97–107. Available from: https://www.acpjournals.org/doi/abs/10.7326/0003-4819-155-2-201107190-00005
43. Al SF, Majumdar SR, Williams B, Robertson S, Johnson JA. Health literacy and health outcomes in diabetes: a systematic review. J Gen Intern Med. 2013;28:444–52. Available from: https://link.springer.com/article/10.1007/s11606-012-2241-z
44. Freilich K, Holton S, Rowe H, Kirkman M, Jordan L, McNamee K, et al. Sociodemographic characteristics associated with the use of effective and less effective contraceptive methods: findings from the understanding fertility Management in Contemporary Australia survey. Eur J Contracept Reprod Health Care. 2017;22(3):212–21. Available from: https://www.tandfonline.com/doi/abs/10.1080/13625187.2017.1304534
45. Yanhui Z, Yang L, Ting W, Yanhui C, Mingzhu C, Jingxia F. College students responding to the Chinese version of Cardiff fertility knowledge scale show deficiencies in their awareness: a cross-sectional survey in Hunan, China. BMC Public Health. 2020;20:810. Available from: https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-020-08937-6
46. Chan CH, Chan TH, Peterson BD, Lampic C, Tam MY. Intentions and attitudes towards parenthood and fertility awareness among Chinese university students in Hong Kong: a comparison with Western samples. Hum Reprod. 2015;30(2):364–72. Available from: https://academic.oup.com/humrep/article/30/2/364/728156
47. Hrvatski zavod za javno zdravstvo [Internet]. Porodi u zdravstvenim ustanovama u Hrvatskoj u 2021. godini. [Croatian]. [cited 2023 Oct 30] Available from: https://www.hzjz.hr/wp-content/uploads/2022/07/Porodi_2021.pdf
48. Williamson LE, Lawson KL, Downe PJ, Pierson RA. Informed reproductive decision-making: the impact of providing fertility information on fertility knowledge and intentions to delay childbearing. J Obstet Gynaecol Can. 2014;36(5):400–5. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1701216315305855
49. O'Brien Y, Wingfield MB. Reproductive ageing-turning back the clock? Ir J Med Sci. 2019;188(1):161–7. Available from: https://link.springer.com/article/10.1007/s11845-018-1769-2
50. Van der Heijde CM, Collard PR, Vonk P, Meijman FJ. Better informed is better decided: addressing the risks of delaying childbearing for female higher educational students. Int J Adolesc Med Health. 2018. Available from: https://www.degruyter.com/document/doi/10.1515/ijamh-2017-0175/html
51. MacIvor TL. The politics of female pain: women's citizenship, twilight sleep and the early birth control movement. Med Humanit. 2019;45(1):67–74. Available from: https://mh.bmj.com/content/45/1/67
52. Levin S. Sexual and reproductive health without freedom?: the conflict over abortion in Argentina. Salud Colect. 2018;14(3):377–89. Available from: https://scholar.google.com/scholar?hl=hr&as_sdt=0%2C5&q=52.%09Levin+S.+Sexual+and+reproductive+health+without+freedom&btnG=
53. World Health Organization & UNDP/UNFPA/UNICEF/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction. Sexual health and its linkages to reproductive health: an operational approach. World Health Organization. 2017. https://apps.who.int/iris/handle/10665/258738 .
54. Hammarberg K, Norman RJ, Robertson S, McLachlan R, Michelmore J, Johnson L. Development of a health promotion programme to improve awareness of factors that affect fertility, and evaluation of its reach in the first 5 years. Reprod Biomed Soc Online. 2017;4:33–40. Available from: https://www.sciencedirect.com/science/article/pii/S2405661817300163
55. Lucke J. Better sex education for Young people is a public health solution to the problem of advanced maternal age. Am J Bioeth. 2015;15(11):58–60. Available from: https://www.tandfonline.com/doi/abs/10.1080/15265161.2015.1088989
56. Mazza D, Cannold L, Nagle C, McKay F, Brijnath B. Making decisions about fertility--three facts GPs need to communicate to women. Aust Fam Physician. 2012;41(5):343–6. Available from: https://search.informit.org/doi/abs/10.3316/INFORMIT.265323119950520
57. Heywood W, Pitts MK, Patrick K, Mitchell A. Fertility knowledge and intentions to have children in a national study of Australian secondary school students. Aust N Z J Public Health. 2016;40(5):462–7. Available from: https://www.sciencedirect.com/science/article/pii/S1326020023011500

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 18 January 2024 doi:10.20944/preprints202401.1360.v1

58. Fehring RJ, Schneider M, Raviele K, Rodriguez D, Pruszynski J. Randomized comparison of two internet-supported fertility-awareness-based methods of family planning. Contracept. 2013;88(1):24–30. Available from: https://www.sciencedirect.com/science/article/abs/pii/S0010782412008992
59. Conceição C, Pedro J, Martins MV. Effectiveness of a video intervention on fertility knowledge among university students: a randomised pre-test/posttest study. Eur J Contracept Reprod Health Care. 2017;22(2):107–1. Available from: https://www.tandfonline.com/doi/abs/10.1080/13625187.2017.1288903
60. Boivin J, Koert E, Harris T, O'Shea L, Perryman A, Parker K, Harrison C. An experimental evaluation of the benefits and costs of providing fertility information to adolescents and emerging adults. Hum Reprod. 2018;33(7):1247–53. Available from: https://academic.oup.com/humrep/article/33/7/1247/4996985
61. Maeda E, Nakamura F, Kobayashi Y, Boivin J, Sugimori H, Murata K, Saito H. Effects of fertility education on knowledge, desires and anxiety among the reproductive-aged population: findings from a randomized controlled trial. Hum Reprod. 2016;31(9):2051–60. Available from: https://academic.oup.com/humrep/article/31/9/2051/2913883

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.