

Ethnic group and reason for assisted reproductive technology failure: analysis of the Human Fertilisation and Embryology Authority registry data from 2017 to 2018

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Introduction

The chance of achieving live birth after assisted reproductive technology (ART), either in vitro fertilization (IVF) or intracytoplasmic sperm injection (ICSI), differs by a woman’s ethnic background¹. Women who are Asian or black have lower live birth rates than those who are white, and disparities exist across the fertility pathway². Ethnicity is a complex exposure that could affect a woman’s chance of live birth for different reasons: socioeconomic disadvantage; poorer access to quality healthcare; or different health behaviours and healthcare expectations. Health inequalities arise from differences in the socioeconomic and environmental conditions of health between groups³.

Aim

To understand how the risk of different assisted reproductive technology (ART) failure types varies by ethnic group and explore the role of mediation by maternal age and suspected aetiology.

Population

This study makes secondary use of the HFEA’s anonymized data set on ART conducted in 2017–2018, which contains unlinked data with respect to ART cycle. The data set contained information on women who were between 18 and 50 years of age. We included women who underwent their first cycle of ART for the purpose of primary fresh embryo transfer. Surrogate pregnancies and planned freeze-all cycles for any reason, including for preimplantation genetic testing, were excluded.

Method

We compared mutually-exclusive outcomes from across the ART treatment pathway. These types of ART failure were cycle cancellation, failed fertilization, unintended freeze-all, failed implantation, and pregnancy loss. We compared the risk of ART failure types between ethnic groups (Asian, Black, Mixed ethnicity, ‘Other’ ethnicity), with reference to White ethnicity, and with reference to an outcome of live birth over 24 weeks of gestation using Poisson regression to produce relative risks with 95% confidence intervals. We conducted a mediation analysis to estimate the indirect potential-effect of ethnic group through maternal age or indication for treatment on outcomes based on the time-ordered nature of ethnic group⁴.

Outcomes	
IVF failure type outcome	Definition
Cycle cancellation	Ovarian stimulation or monitoring was commenced with the intention to treat but follicular aspiration did not occur.
Failed fertilisation	Total failure of fertilisation of all collected oocytes.
Unintended freeze all	Created embryos were cryopreserved and embryo replacement did not occur.
Failed implantation	Negative pregnancy test following embryo replacement.
Pregnancy loss	Any pregnancy that did not result in at least one live birth from all causes.
Live birth (reference)	Any pregnancy that resulted in a baby born above 24 weeks ^a of gestation with signs of life.
^a In the HFEA anonymised dataset, a live birth is one that occurred above 24 weeks of gestation.	

	Ethnic group					
	Asian	Black	Mixed	Other	White	Total
	5 501 (11.3)	1 155 (2.4)	783 (1.6)	7 746 (15.9)	33 565 (68.9)	48 750 (100.0)
Maternal age, years n. (%)						
18-34	3 076 (55.9)	454 (39.3)	358 (45.7)	3 413 (44.1)	16 734 (49.9)	24 035 (49.3)
35-37	1 115 (20.3)	221 (19.1)	189 (24.1)	1 826 (23.6)	7 691 (22.9)	11 042 (22.7)
38-39	658 (12.0)	199 (17.2)	101 (12.9)	1 186 (15.3)	4 539 (13.5)	6 683 (13.7)
40-42	492 (8.9)	170 (14.7)	106 (13.5)	968 (12.5)	3 619 (10.8)	5 355 (11.0)
43-50	160 (2.9)	111 (9.6)	29 (3.7)	353 (4.6)	982 (2.9)	1 635 (3.4)
Indication, n. (%)						
Endometriosis	349 (6.3)	56 (4.9)	52 (6.6)	477 (6.2)	2 104 (6.3)	3 038 (6.2)
Male factor	1 791 (32.6)	368 (31.9)	262 (33.5)	2 462 (31.8)	11 711 (34.9)	16 594 (34.0)
Ovulatory	835 (15.2)	88 (7.6)	92 (11.8)	785 (10.1)	3 959 (11.8)	5 759 (11.8)
Tubal factor	453 (8.2)	188 (16.3)	86 (11.0)	711 (9.2)	3 445 (10.3)	4 883 (10.0)
Oocytes collected, n. (%)						
0	351 (6.4)	108 (9.4)	39 (5.0)	430 (5.6)	1 896 (5.7)	2 824 (5.8)
1-5	1 185 (21.5)	305 (26.4)	172 (22.0)	1 623 (21.0)	7 561 (22.5)	10 846 (22.3)
6-10	1 722 (31.3)	319 (27.6)	252 (32.2)	2 353 (30.4)	10 850 (32.3)	15 496 (31.8)
11-15	1 220 (22.2)	197 (17.1)	168 (21.5)	1 743 (22.5)	7 496 (22.3)	10 824 (22.2)
>15	1 023 (18.6)	226 (19.6)	152 (19.4)	1 597 (20.6)	5 762 (17.2)	8 760 (18.0)
The indications for treatment are not mutually exclusive, except for the distinct category of unexplained subfertility.						

Potential indirect ‘effect’ of ethnic group through maternal age			
	Total RR (95% CI)	Direct RR (95% CI)	Indirect RR (95% CI)
Maternal ethnicity	Cycle cancellation		
Asian	1.32 (1.18, 1.48)	1.35 (1.20, 1.51)	0.98 (0.91, 1.05); p=0.50
Black	1.98 (1.63, 2.40)	1.64 (1.35, 1.99)	1.21 (1.13, 1.29); p=<0.001
Mixed	0.92 (0.67, 1.26)	0.91 (0.66, 1.24)	1.01 (0.95, 1.08); p=0.72
Other	1.01 (0.91, 1.12)	0.96 (0.87, 1.07)	1.05 (0.98, 1.12); p=0.29
White	1	1	-
	Failed fertilisation		
Asian	1.59 (1.41, 1.79)	1.62 (1.44, 1.82)	0.98 (0.90, 1.06); p=0.63
Black	2.07 (1.66, 2.57)	1.69 (1.26, 2.11)	1.22 (1.13, 1.33); p=<0.001
Mixed	1.23 (0.90, 1.67)	1.18 (0.87, 1.61)	1.04 (0.96, 1.12); p=0.37
Other	1.10 (0.98, 1.23)	1.04 (0.93, 1.17)	1.05 (0.97, 1.14); p=0.24
White	1	1	-
	Unintended freeze-all		
Asian	1.26 (1.14, 1.38)	1.26 (1.14, 1.38)	1.00 (0.98, 1.02); p=0.97
Black	1.70 (1.41, 2.03)	1.65 (1.38, 1.98)	1.03 (1.00, 1.05); p=0.02
Mixed	1.10 (0.87, 1.39)	1.10 (0.87, 1.39)	1.00 (0.98, 1.02); p=0.82
Other	0.87 (0.79, 0.96)	0.87 (0.79, 0.95)	1.00 (0.98, 1.02); p=0.80
White	1	1	-
	Failed implantation		
Asian	1.11 (1.07, 1.16)	1.13 (1.08, 1.18)	0.97 (0.96, 1.00); p=0.12
Black	1.22 (1.12, 1.33)	1.15 (1.05, 1.25)	1.06 (1.04, 1.09); p=<0.001
Mixed	1.03 (0.92, 1.15)	1.01 (0.90, 1.12)	1.02 (1.00, 1.04); p=0.03
Other	1.04 (1.00, 1.08)	1.02 (0.98, 1.06)	1.02 (1.00, 1.04); p=0.02
White	1	1	-
	Pregnancy loss		
Asian	1.13 (1.04, 1.23)	1.16 (1.07, 1.27)	0.97 (0.93, 1.01); p=0.12
Black	1.35 (1.13, 1.62)	1.28 (1.07, 1.52)	1.06 (1.02, 1.10); p=0.003
Mixed	0.84 (0.66, 1.07)	0.84 (0.66, 1.07)	1.00 (0.96, 1.04); p=0.95
Other	1.07 (0.99, 1.15)	1.03 (0.96, 1.11)	1.03 (0.99, 1.07); p=0.10
White	1	1	-
Total ‘effect’ is the potential effect of maternal ethnicity on outcome by any pathway. Direct ‘effect’ represents the potential effect of maternal ethnic group on outcome, excluding any mediated by maternal age. Indirect ‘effect’ represents the potential effect exerted by ethnic group through maternal age. P-values are presented for the indirect effects to aid interpretation.			

References

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Association between ethnic group and failure type					
	Cycle cancellation RR (95% CI) (n=2 822)	Failed fertilisation RR (95% CI) (n= 2 239)	Unintended freeze-all RR (95% CI) (n=3 978)	Failed implantation RR (95% CI) (n=20 343)	Pregnancy loss RR (95% CI) (n=5 551)
Maternal ethnicity					
Asian	1.31 (1.17, 1.47)	1.60 (1.42, 1.80)	1.25 (1.14, 1.38)	1.11 (1.07, 1.16)	1.13 (1.03, 1.23)
Black	2.15 (1.78, 2.62)	2.36 (1.90, 2.93)	1.71 (1.43, 2.05)	1.23 (1.12, 1.34)	1.38 (1.15, 1.64)
Mixed	0.92 (0.67, 1.26)	1.25 (0.92, 1.69)	1.10 (0.87, 1.39)	1.03 (0.92, 1.15)	0.84 (0.66, 1.07)
Other	1.02 (0.92, 1.14)	1.11 (0.99, 1.25)	0.87 (0.79, 0.96)	1.04 (1.00, 1.08)	1.07 (1.00, 1.15)
White	1	1	1	1	1
+adjustment for maternal age					
Asian	1.35 (1.20, 1.51)	1.62 (1.44, 1.82)	1.26 (1.14, 1.38)	1.13 (1.08, 1.18)	1.16 (1.07, 1.27)
Black	1.64 (1.35, 1.99)	1.69 (1.36, 2.11)	1.65 (1.38, 1.98)	1.15 (1.05, 1.25)	1.28 (1.07, 1.52)
Mixed	0.91 (0.66, 1.24)	1.18 (0.87, 1.61)	1.10 (0.87, 1.39)	1.01 (0.90, 1.12)	0.84 (0.66, 1.07)
Other	0.96 (0.87, 1.07)	1.04 (0.93, 1.17)	0.87 (0.79, 0.95)	1.02 (0.98, 1.06)	1.03 (0.96, 1.11)
White	1	1	1	1	1
+adjustment for indication for IVF					
Asian	1.35 (1.20, 1.51)	1.62 (1.43, 1.82)	1.21 (1.10, 1.33)	1.13 (1.08, 1.18)	1.16 (1.06, 1.26)
Black	1.61 (1.33, 1.96)	1.63 (1.30, 2.03)	1.64 (1.37, 1.96)	1.14 (1.04, 1.25)	1.28 (1.07, 1.53)
Mixed	0.92 (0.67, 1.26)	1.18 (0.87, 1.60)	1.09 (0.86, 1.38)	1.01 (0.90, 1.12)	0.84 (0.66, 1.07)
Other	0.99 (0.89, 1.09)	1.04 (0.93, 1.17)	0.87 (0.79, 0.95)	1.01 (0.98, 1.05)	1.03 (0.96, 1.11)
White	1	1	1	1	1

Main findings

A greater proportion of women who were Asian initiated IVF, and a lower proportion of women who were Black initiated IVF, compared with UK-wide ethnic composition⁵. Outcomes across the fertility pathway varied according to ethnic group. Women who were Asian or Black had a greater risk of cycle cancellation, failed fertilisation, unintended freeze all, implantation failure and pregnancy loss compared with White. Women who were Black initiated treatment later in life. Had women who were Black initiated treatment at the same age as women who were White, around a quarter of the difference for most outcomes may have been eliminated.

Conclusion

Women who were Black were at greatest risk of all failure types and women who were Asian were at intermediate risk, compared with White. Some of the risk among Black women may be mediated by age at initiation of treatment, a potentially modifiable risk-factor.