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ARTICLE

Public knowledge and attitudes towards non-conventional gestation in the UK: results from a cross-sectional online survey experiment



BIOGRAPHY

Lottie Park-Morton is a Senior Lecturer in Law at the University of Gloucestershire, UK. She researches in family and medical law, with a particular interest in surrogacy and parenthood. Her PhD, obtained in 2025, is a doctrinal examination of domestic surrogacy laws from a child rights perspective.

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KEY MESSAGE

In the UK, support for non-conventional gestations varies across approaches, with support highest for surrogacy and uterus transplantation and lower for artificial placentas, and declines as greater detail is provided. Knowledge and demographic characteristics shape attitudes, but their effects vary. Further research is needed to identify additional influences.

ABSTRACT

Research question: What does the British public know and think about three forms of non-conventional gestation (NCG) – surrogacy, uterus transplantation (UTx) and artificial placentas – and their variants: traditional surrogacy, gestational surrogacy and UTx from living (LUTx) versus deceased (DUTx) donors?

Design: A quota-sampled cross-sectional online survey experiment in the UK recruited 1646 adults (51% female) via a research panel. Respondents were randomly assigned to surrogacy ($n = 548$), UTx ($n = 549$) or artificial placenta ($n = 549$) conditions. Within-subject ratings assessed traditional versus gestational surrogacy and LUTx versus DUTx. Subjective knowledge and attitudes were measured before sociodemographic variables. Complete-case data were analysed using analysis of variance, correlations and linear regressions.

Results: The percentage of respondents with positive attitudes varied across surrogacy (85.9%; $n = 471/548$), UTx (82.0%; $n = 450/549$) and artificial placentas (64.8%; $n = 356/549$). Variant-specific information reduced support for surrogacy and UTx, although attitudes remained favourable. Differences in support between surrogacy/UTx, traditional/gestational surrogacy and LUTx/DUTx were not significant. Most participants (74.3–82.7%) reported low knowledge of NCG. Higher subjective knowledge predicted more positive attitudes towards UTx ($\beta = 0.11$), LUTx ($\beta = 0.13$) and artificial placentas ($\beta = 0.38$). Age negatively predicted attitudes towards UTx ($\beta = -0.20$), LUTx ($\beta = -0.14$) and artificial placentas ($\beta = -0.22$), indicating that younger respondents were more supportive of these newer NCG, while older age predicted greater support only for traditional surrogacy ($\beta = 0.11$). Religion predicted lower support for surrogacy ($\beta = -0.15$), traditional surrogacy ($\beta = -0.10$) and gestational surrogacy ($\beta = -0.10$). Political orientation predicted higher support for UTx ($\beta = 0.15$), LUTx ($\beta = 0.10$) and DUTx ($\beta = 0.09$). Other demographics had minimal effects.

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KEY WORDS

Artificial placentas
Assisted reproduction
Non-conventional gestation
Public attitudes
Surrogacy
Uterus transplantation

Conclusions: Public support for NCG is shaped by the level of detail provided as well as subjective knowledge and sociodemographic factors, although associations vary across NCG forms and variants. Further research should examine information sources and other influences on attitudes.

INTRODUCTION

Assisted reproductive technology (ART) seeks to alleviate infertility for individuals and couples. This technology often involves some form of clinical intervention, such as in IVF, enabling conception outside the body. A new branch of 'assisted gestative technologies' or 'technologies enabling gestation' extends ART beyond conception to encompass practices involving technological intervention or the delegation of gestation to another person or device (*Romanis, 2022*, *2024*).

Alongside the established practice of surrogacy, which is often enabled by ART and is therefore frequently considered part of the broader ART landscape (e.g. *Bulletti et al., 2023*), more recent (and future) developments of uterus transplantation (UTx) and artificial placentas break the traditional link between the intended parents and gestation. To delineate from a focus on technology or assistance, this article uses the term 'non-conventional gestation' (NCG) to frame these processes. These innovations prompt important societal and regulatory considerations, as their implementation and use depend not only on clinical progress, but also on public understanding and acceptance (e.g. *Krendel and Ryder, 2025*).

Surrogacy, whereby gestation takes place in a body other than that of the intended parent, is currently the most established NCG practice in the UK. Both traditional surrogacy, where the surrogate is genetically related to the child, and gestational surrogacy, where they are not, are lawful but unenforceable under the UK Surrogacy Arrangements Act 1985. While both forms are lawful in the UK, regulatory approaches to surrogacy vary considerably across jurisdictions and continue to evolve in response to shifting ethical, political, legal and social debates (e.g. *Klotz, 2026*; *Rodríguez-Jaume et al., 2021*).

UTx, an emerging technology that enables gestation in a transplanted uterus, remains in early clinical use but has recently resulted in the first UK birth (*Womb Transplant UK, 2025*). Uteruses may be sourced from living donors (LUTx) or deceased donors (DUTx), raising distinct questions about acceptability (e.g. *Williams, 2016*).

Artificial placentas seek to mimic the human placenta. Although currently being developed to improve outcomes for extremely premature infants (*Hunter, 2024*; *Partridge et al., 2017*; *Smajdor, 2007*), they have the potential to enable full artificial gestation in the future. For conceptual comparability with surrogacy and UTx, this study focuses on attitudes towards the use of artificial placentas for full gestation.

Each NCG has been subject to ethical scrutiny and cannot be regarded as ethically neutral (*O'Donovan et al., 2019*; *Werner and Mercurio, 2022*; *Writing Group on behalf of the ESHRE Ethics Committee, 2025*). Surrogacy, in particular, has become a focal point of international attention and critique (United Nations Human Rights *Council, 2025*), although many of the findings have been contested (e.g. *Horsey, 2025*; *Klotz, 2026*). These debates have been influenced by cross-border arrangements and divergent national regulations (*Deonandan, 2020*; *Horsey, 2024*; *Panerati et al., 2026*; *Petitfils et al., 2017*; *Rodríguez-Jaume, 2021*). It is increasingly contextualized in relation to broader questions of human rights, autonomy, self-determination and the protection of potentially vulnerable actors (e.g. *Bulletti et al., 2023*; *Horsey, 2025*; *Klotz, 2026*).

While surrogacy is often contested in national and international debates, it is also defended within a human rights framework, for example, as an expression of bodily autonomy and prosocial goals (e.g. *Martínez-López and Munuera-Gómez, 2024*; *Mullock et al., 2021*). This internationalization of, and international response to, surrogacy underscores the broader societal importance of how NCG forms are understood and regulated and may signal comparable patterns and trends in a global context in relation to UTx and artificial placentas. For example, *Krendel and Ryder (2025)* show how public discourse can frame emerging NCG forms, specifically artificial placentas, in ways that act as a barrier to their acceptance, thereby limiting their potential contributions to social justice and reproductive rights.

The Warnock Committee's emphasis on public consultation regarding embryo research and IVF illustrates how engagement with public views has historically shaped reproductive policy in the UK (*Hammond-Browning, 2015*), which has then influenced other jurisdictions (*Franklin and Jackson, 2024*). Public attitudes, therefore, both shape the social environment in which technological innovation occurs (*Verweij et al., 2021*) and contribute to regulatory legitimacy and policy development across borders. Understanding domestic attitudes to each NCG is therefore essential, as regulatory responses are often shaped by divergent social and ethical perspectives.

Although each NCG form has received attention in research and public debate, studies typically examine surrogacy (e.g. *Baron et al., 2024*; *Poote and van den Akker, 2009*), UTx (e.g. *Rius et al., 2025*; *Vali et al., 2023*) or artificial placentas (e.g. *Adkins, 2025*; *Romanis and Adkins, 2024*) in isolation, with only a few studies that consider multiple NCG forms together (e.g. *Mullock et al., 2021*; *Romanis, 2023*). Rodríguez-Jaume and colleagues' evidence that existing research also varies considerably in how attitudes are conceptualized and measured, limiting comparability across studies and indicating that public views differ depending on the specific technology, context and dimension under consideration (*Rodríguez-Jaume et al., 2021*). As a result, evidence remains fragmented, leaving a limited understanding of how public attitudes compare across NCG forms or how attitudinal patterns vary within and between them.

To address the gaps in existing research, this study adopts a comparative and standardized approach to measuring public attitudes across multiple forms of NCG. By applying consistent evaluative items across NCG forms and their variants, the study enables systematic comparisons both between and within NCG types while capturing different

dimensions of attitudinal responses. This design responds to prior calls for more coherent and multidimensional approaches to studying public opinion in this domain, where attitudes may vary depending on whether technologies are evaluated in normative, personal or regulatory terms (*Rodríguez-Jaume et al., 2021*).

This study, therefore, provides the first UK-based comparative assessment of public attitudes towards multiple NCG types: surrogacy (unspecified, traditional surrogacy and gestational surrogacy), UTx (unspecified, LUTx and DUTx) and full-gestation artificial placentas. Along with attitudes, the subjective knowledge of each principal NCG form was assessed. Prior research suggests that perceived knowledge can affect an individual's evaluations (*Oh and Abraham, 2016*) and that the public's understanding of ART in the UK is often limited (e.g. *Bracewell-Milnes et al., 2021*; *Vali et al., 2023*). This study also examines whether a set of demographic variables — age, gender, previous pregnancies, sexual orientation, relationship status, ethnicity, religion and political orientation — are associated with or predictive of attitudes, reflecting patterns in existing ART research (e.g. *Aurrekoetxea-Casaus and Ronda, 2024*; *Baron et al., 2024*; *Constantinidis and Cook, 2012*; *Lasker and Murray, 2001*; *Lutkiewicz et al., 2026*; *Poote and van den Akker, 2009*).

On this basis, the following hypotheses were tested:

- Hypothesis 1: Attitudes differ significantly across surrogacy, UTx and artificial placentas.
- Hypothesis 2: Attitudes differ significantly across surrogacy variants (unspecified, traditional surrogacy and gestational surrogacy).
- Hypothesis 3: Attitudes differ significantly across UTx variants (unspecified, LUTx and DUTx).
- Hypothesis 4: Subjective knowledge differs significantly across surrogacy, UTx and artificial placentas.
- Hypothesis 5: Subjective knowledge is associated with attitudes towards each NCG form and variant.
- Hypothesis 6: Subjective knowledge predicts attitudes towards each NCG form and variant.
- H7: Demographic variables are associated with attitudes towards each NCG form and variant.
- Hypothesis 8: Demographic variables predict attitudes towards each NCG form and variant.

By analysing attitudes, knowledge and demographic predictors together, this study provides an integrated understanding of how the UK public perceives current and emerging NCG, offering evidence relevant to future public engagement and regulatory decision making.

MATERIALS AND METHODS

Sample recruitment

A priori power analyses were conducted using G*Power (*Faul et al., 2009*) to determine the sample sizes required to detect small effect sizes (*Cohen, 1992*) with $\alpha = 0.05$ and a statistical power of 0.95. Calculations were performed for one-way analysis of variance (ANOVA; Hypotheses 1 and 4), repeated mixed ANOVA/general linear models (GLM; Hypotheses 2 and 3), correlation analyses (Hypotheses 5 and 7) and multiple linear regression models (Hypotheses 6 and 8). These analyses indicated a minimum required sample size of $N = 1548$.

Participants were recruited between 18 and 28 June 2025 via the online panel provider TGM Research. Comparable panel-based recruitment platforms (e.g. Qualtrics, Prolific, Dynata, Amazon Mechanical Turk) have been widely used in prior research surveying public attitudes on reproductive and bioethical issues (e.g. *Baron et al., 2024*; *Copp et al., 2024*; *Egan et al., 2022*; *Murali et al., 2025*). Participants were compensated by the market research company in line with its standard reward procedures. The panel recruitment was funded through an internal research grant from the University of Gloucestershire (grant number 2024-25-172-2).

A quota sampling approach (*Patton, 2015*) was employed to achieve a gender distribution reflective of the UK population (*Clark, 2025*) and to minimize potential gender-related effects. Specifically, TGM Research broadly invited eligible UK residents aged 18 years or older, applying gender quotas of 51% women and 49% men. These quotas were met (see Sample characteristics in the Results section). No post-stratification weighting was applied.

Several quality-control procedures were implemented by the market research company, including attention verification and bot detection. To enhance the robustness of the analyses, recruitment targets exceeded the minimum sample size determined by a priori power analyses. In total, 1646 respondents successfully completed the survey. As participants were recruited through a dynamic online panel system rather than via direct invitations to a single survey, a conventional response rate could not be calculated. A total of 1715 respondents initiated the survey and 1646 completed it, yielding a completion rate of 96%. Only fully completed questionnaires were retained for analysis. The recruitment approach and completion rate are comparable to those reported in prior public opinion research (e.g. *Miao, 2026*).

Design

Participants were randomly assigned to one of three experimental conditions: surrogacy ($n = 548$), UTx ($n = 549$) and artificial placenta ($n = 549$). This design enabled both between- and within-subject comparisons while reducing cognitive load and survey fatigue. The three NCG forms were presented between participants to avoid carry-over effects and to ensure that participants evaluated different gestational arrangements independently (*Lewis-Beck et al., 2004*). In contrast, variants within the surrogacy and UTx groups were assessed within participants to enable controlled comparisons of how specific features (e.g. genetic relatedness or donor type) influence attitudes within a given NCG form (*Constantinidis and Cook, 2012*). These variants reflect substantively distinct configurations that differ in their legal treatment and ethical framing across jurisdictions (*O'Donovan et al., 2019*; *Writing Group on behalf of the ESHRE Ethics Committee, 2025*).

Procedure

Following established procedures in public-attitude research on ART (e.g. *Constantinidis and Cook, 2012*), participants completed a brief online questionnaire with randomized items. After providing informed consent and confirming eligibility, respondents reported their subjective knowledge of the NCG form assigned to their group (surrogacy, UTx or artificial placenta). They then rated their attitudes towards the same NCG form. In the next section, respondents in the surrogacy group received definitions of traditional

surrogacy and gestational surrogacy, and respondents in the UTx group received definitions of LUTx and DUTx. No equivalent subtypes were presented for artificial placenta, given the exclusive focus on future application for full gestation. All respondents subsequently completed sociodemographic questions assessing age, gender, previous pregnancies, sexual orientation, relationship status, ethnicity, religion and political orientation.

Ethics approval

The University of Gloucestershire's Research Ethics Committee approved the study (approval number REC/25/LPM1, date of approval 12 June 2025).

Measures

All constructs were measured using established scales (TABLE 1). Attitudes towards each NCG form were measured using a validated three-item scale adapted from *Shih and Fang (2004)*. Respondents indicated agreement with three statements: 'X is an acceptable idea', 'Using X is a good idea' and 'X should be allowed', where 'X' referred to the relevant NCG form or variant. These items capture evaluative ('good idea'), normative ('acceptable') and regulatory ('should be allowed') dimensions of attitudes, enabling a multidimensional assessment of public opinion while maintaining conceptual distinction from related constructs such as attitudinal antecedents and beliefs about the outcomes of surrogacy arrangements. This approach addresses prior critiques of heterogeneous and inconsistent measurement in surrogacy research, which limit comparability while indicating that attitudes vary across dimensions and contexts (*Rodríguez-Jaume et al., 2021*). Consistent application across NCG forms allows a systematic comparison within and between technologies.

Working definitions (TABLE 2) were introduced using neutral wording following established practice (*Constantinidis and Cook, 2012*), with variant definitions presented as required. Responses were recorded on a 5-point Likert scale (1 = Strongly disagree; 5 = Strongly agree). Internal consistency was high across all NCG forms (α = 0.93–0.96), aligning closely with previous studies (e.g. *Shih and Fang, 2004*). As items were strongly correlated, they were averaged to form a single attitude score, following standard practice (*Umashankar et al., 2017*).

Subjective knowledge was measured to capture perceived familiarity, which shapes evaluations and is conceptually distinct from objective knowledge (*Flynn and Goldsmith, 1999*). In particular, subjective knowledge incorporates an individual's confidence in what they believe they know (e.g. *Dunning et al., 2003*; *Vörös et al., 2021*), thereby helping to account for how people form judgements (e.g. *Slovic et al., 2002*) when relying on perceived rather than factual knowledge (*Brucks, 1985*). This approach also enables a more parsimonious and comparable measurement across NCG forms than objective knowledge testing does. Perceived knowledge has also been of interest in previous research (e.g. *Bitou et al., 2026*), although its measurement remains unclear.

In this study, subjective knowledge was assessed using an established scale (*Flynn and Goldsmith, 1999*), adapted to each NCG context. Items (TABLE 1) included both positively and negatively worded statements (e.g. 'I know pretty much about surrogacy', 'I do not feel very knowledgeable about UTx'), with negatively phrased items reverse-coded. Responses were recorded on a 7-point Likert scale (1 = Strongly disagree; 7 = Strongly agree). Reliability was satisfactory across forms (α = 0.84–0.89), consistent with previous findings (e.g. α = 0.88; *Oh and Abraham, 2016*).

Statistical analyses

Data were analysed in SPSS (version 30; IBM, USA). Statistical significance was set at $P < 0.05$ (two-tailed). To test Hypotheses 1 and H4, ANOVA was performed using Welch's F (*Welch, 1951*) to account for potential violations of homogeneity of variance (*Delacre et al., 2019*). Games–Howell tests (*Games and Howell, 1976*) were used for post-hoc comparisons when appropriate. To test Hypotheses 2 and 3, repeated-measures GLM were used. Greenhouse–Geisser corrections were applied when the assumption of sphericity was violated, and Bonferroni-corrected pairwise comparisons were used to assess within-subject differences among the surrogacy and UTx variants. To test Hypotheses 5 and 7, Pearson correlations were computed to examine associations between subjective knowledge or demographic variables (dummy-coded where required) and attitudes. Finally, to test Hypotheses 6 and 8, multiple linear regressions were conducted to identify predictors of attitudes, consistent with established practice in reproductive research (e.g. *Bitou et al., 2026*; *Chliaoutakis et al., 2002*; *Esmaeilivand et*

TABLE 1 MEASUREMENT ITEMS AND RELIABILITIES

Construct	Items	Response scale	Reliabilities (Cronbach's α)	Adapted from
Attitudes	X is an acceptable idea	1 = Strongly disagree; 5 = Strongly agree	0.93–0.96	*Shih and Fang (2004)*
	Using X is a good idea			
	X should be allowed			
Subjective knowledge	I know pretty much about X	1 = Strongly disagree; 7 = Strongly agree	0.84–0.89	*Flynn and Goldsmith (1999)*
	I do not feel very knowledgeable about X (R)			
	Among my circle of friends, I'm one of the 'experts' on X			
	Compared with most other people, I know less about X (R)			
	When it comes to X, I really don't know a lot (R)			

R, reverse coded; X, the attitudinal object (namely, the specific non-conventional gestation form).

TABLE 2 NCG DEFINITIONS PROVIDED IN THE ONLINE SURVEY

NCG form or variant	Working definition
Surrogacy	Surrogacy is an arrangement in which a woman (the surrogate) carries and delivers a baby for someone else
Traditional surrogacy	Surrogacy can be done through 'traditional' surrogacy. This is when the surrogate's own egg is used. Therefore, the surrogate is genetically related to the child
Gestational surrogacy	Surrogacy can also be done through 'gestational' surrogacy. This is where the surrogate's own egg is not used. Therefore, the surrogate has no genetic link to the child
Uterus transplantation	A uterus transplant is a surgical procedure in which a healthy uterus is transplanted into an individual who does not have a functioning uterus. This can help them carry a pregnancy
Living uterus transplantation	Uterus transplants can be done by using a living donor. This is where the donor of the uterus is a living person
Deceased uterus transplantation	Uterus transplants can be done by using a deceased donor. This is where the donor is deceased before the transplant takes place
Artificial placenta	Artificial placentas are being developed to mimic the human placenta. Imagine a future where artificial placentas could support the development of an embryo or fetus entirely outside the human body

NCG, non-conventional gestation.

al., 2025; *Lutkiewicz et al., 2023*, *2026*). Effect sizes are reported in line with established standards (*Cohen, 1988*).

To assess group balance following random assignment to the three NCG conditions, chi-squared tests of independence were conducted for categorical demographic variables, and one-way Welch's ANOVA was conducted for age. Sensitivity analyses were subsequently performed using analyses of covariance (ANCOVA) to compare subjective knowledge and attitudes across NCG conditions while controlling for all demographic variables (namely, age, gender, previous pregnancy, relationship status, sexual orientation, religion, political orientation and ethnicity), with subjective knowledge additionally included as a covariate in the attitude models. Repeated-measures GLM, including the same set of covariates, were also estimated to assess the robustness of the findings. Finally, chi-squared goodness-of-fit tests were conducted to determine whether the observed distributions in the study sample differed significantly from the expected distributions based on available UK population data.

RESULTS

Sample characteristics

TABLE 3 outlines the sociodemographic characteristics of the sample. Consistent with prior survey research (e.g. *Bitou et al., 2026*; *Constantinidis and Cook, 2012*; *Lutkiewicz et al., 2026*; *Rodríguez-Jaume et al., 2024*), several variables were dichotomized to facilitate analysis, including previous pregnancy (yes/no), relationship status (partnered versus not), sexual orientation (LGBTQ versus non-LGBTQ), religion (any versus none) and ethnicity (white versus non-white). It is acknowledge that while analytically convenient, these classifications do not capture within-group heterogeneity.

Balance testing revealed small demographic differences between the three randomized groups. Chi-squared tests indicated significant between-group differences for several demographic variables, including previous pregnancies ($\chi^2(2, N = 1646) = 6.30$, $P = 0.043$, Cramer's $V = 0.06$), relationship status ($\chi^2(2, N = 1646) = 8.78$, $P = 0.012$, Cramer's $V = 0.07$) and religion ($\chi^2(2, N = 1646) = 29.66$, $P < 0.001$, Cramer's $V = 0.13$). One-way Welch's ANOVA indicated significant age differences across the three NCG groups: F(2, 1095.08 = 14.76, $P < 0.001$, $\eta^2 = 0.018$. Post-hoc Games–Howell tests indicated no significant age difference between the (unspecified) surrogacy group (mean [M] = 43.12 years, standard deviation [SD] = 16.61 years, 95% confidence interval [95% CI] 41.73–44.52 years) and UTx group (M = 41.03 years, SD = 16.50 years, 95% CI 39.65–42.42 years, $P = 0.092$). In contrast, respondents in the artificial placenta group were significantly older (M = 46.51 years, SD = 17.11 years, 95% CI 45.08–47.95 years) than those in both the (unspecified) surrogacy ($P = 0.003$) and UTx ($P < 0.001$) groups. However, sensitivity analyses using ANCOVA and repeated-measures GLM controlling, where appropriate, for subjective knowledge, age, gender, previous pregnancy, relationship status, sexual orientation, religion, political orientation and ethnicity yielded substantively identical patterns of results. These findings indicate that the pattern of differences in subjective knowledge and attitudes across NCG forms remained robust after controlling for all measured demographic variables and, where applicable, subjective knowledge.

Furthermore, in this section, comparisons with data from the UK Office for National Statistics and YouGov are included for context, without claiming that the study is overall representative. To further gauge similarity, chi-squared goodness-of-fit tests were performed to compare the sample distributions with available national benchmarks for specific binary variables. These tests serve to highlight general alignment or differences.

The full sample ($N = 1646$) comprised 51% ($n = 835$) women and 49% ($n = 811$) men. This distribution aligns with UK population patterns reported for 2024 (*Office for National Statistics, 2025c*) ($\chi^2(1, N = 1646) = 1.97$, $P = 0.161$). Among the female participants, 69% reported having experienced pregnancy (including live birth, stillbirth, ectopic pregnancy, miscarriage or induced abortion) (TABLE 3).

The overall age distribution of the sample reported in TABLE 3 was compared with that of the UK adult population in mid-2024 (*Office for National Statistics, 2025c*). A chi-squared goodness-of-fit test indicated a significant difference between the two distributions ($\chi^2(4, N = 1646) = 144.40$, $P < 0.001$, Cohen's $\omega = 0.30$). Examination of the residuals indicated that younger adults (aged 18–44 years) were overrepresented and older adults (45 years and older) were underrepresented relative

TABLE 3 SOCIODEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

Variable	Total		Group 1 (surrogacy)		Group 2 (UTx)		Group 3 (AP)	
	n	%	*n*	%	*n*	%	*n*	%
Age, years (mean = 43.6 years, SD = 16.88 years)								
Total	1,646		548		549		549	
18–24	209	13	74	14	89	16	46	8
25–44	723	44	242	44	261	48	220	40
45–64	475	29	159	29	135	25	181	33
65–74	169	10	54	10	40	7	75	14
≥75	70	4	19	3	24	4	27	5
Gender								
Total	1,646		548		549		549	
Female or identify female	835	51	282	51	275	50	278	51
Male or identify male	811	49	266	49	274	50	271	49
Previous pregnancies								
Total	835		282		275		278	
Yes (includes live birth, stillbirth, ectopic, miscarriage and induced abortion)	576	69	181	64	180	65	215	77
No	251	30	98	35	90	33	63	23
Prefer not to say	8	1	3	1	5	2	0	0
Relationship status								
Total	1,646		548		549		549	
Single	470	29	182	33	169	31	119	22
Married, civil-partnered or cohabiting	1,033	63	321	59	343	62	369	67
Divorced, widowed or separated	140	9	43	8	37	7	60	11
Prefer not to say	3	0	2	0	0	0	1	0
Sexual orientation								
Total	1,646		548		549		549	
Heterosexual or straight	1,512	92	505	92	494	90	513	93
Gay or lesbian	42	3	17	3	13	2	12	2
Bisexual	68	4	20	4	30	5	18	3
Other	14	1	2	0	8	1	4	1
Prefer not to say	10	1	4	1	4	1	2	0
Ethnicity								
Total	1,646		548		549		549	
Asian or Asian British	103	6	45	8	31	6	27	5
Black, African, Black British or Caribbean	210	13	65	12	70	13	75	14
Mixed or multiple ethnic groups	34	2	11	2	14	3	9	2
White	1,287	78	426	78	428	78	433	79
Another ethnic group (e.g. Arab)	7	0	1	0	4	1	2	0
Prefer not to say	5	0	0	0	2	0	3	1
Religion								
Total	1,646		548		549		549	
No religion	608	37	222	41	235	43	151	28
Christian	879	53	266	49	262	48	351	64
Any other religion (e.g. Muslim)	130	8	55	10	40	7	35	6
Prefer not to say	29	2	5	1	12	2	12	2

(continued on next page)

TABLE 3 (*Continued*)

Variable	Total		Group 1 (surrogacy)		Group 2 (UTx)		Group 3 (AP)	
	n	%	*n*	%	*n*	%	*n*	%
Political orientation								
Total	1,646		548		549		549	
Left-wing/liberal	338	21	100	18	121	22	117	21
Moderate/centrist	464	28	143	26	147	27	174	32
Right-wing/conservative	412	25	116	21	126	23	170	31
No political view	377	23	161	29	141	26	75	14
Prefer not to say	55	3	28	5	14	3	13	2

AP, artificial placenta; UTx, uterus transplantation.

to their proportions in the UK adult population.

For relationship status, 63% of participants reported being married, in a civil partnership or cohabiting. Based on chi-square testing, this proportion did not differ significantly from the national estimates (61%) for England and Wales in 2024 (*Office for National Statistics, 2025b*) ($\chi^2(1, N = 1646) = 3.51$, $P = 0.061$).

Regarding sexual orientation, most of the sample self-identified as heterosexual or straight (92%), closely mirroring national estimates, which indicate that approximately 93% of the UK population identified as heterosexual in 2024 (*Office for National Statistics, 2025d*) ($\chi^2(1, N = 1646) = 0.72$, $P = 0.396$).

Religious identification showed partial alignment with national distributions. In the 2021 UK Census, 38% of the population reported no religion and 47% identified as Christian (*Office for National Statistics, 2025a*). In the present sample, 37% reported no religious affiliation and 53% identified as Christian, indicating a modest over-representation of Christian respondents. However, chi-squared testing confirmed that the dichotomization captures broad differences between religious and non-religious participants but does not necessarily reflect variation within the religious grouping ($\chi^2(1, N = 1646) = 0.85$, $P = 0.357$).

Political orientation was assessed by whether participants identified with a political position (namely, left-wing/liberal, moderate/centrist or right-wing/conservative) or none. Accordingly, the analytic variable reflects the presence versus the absence of political identification rather than ideological placement. Approximately 74% reported a political orientation, a pattern comparable to UK survey findings (*Miao, 2026*; *YouGov, n.d.*), although detailed ideological positioning was not modelled in this study ($\chi^2(1, N = 1646) = 1.36$, $P = 0.243$).

Finally, 78% of participants self-identified as white, compared with approximately 83% in the 2021 UK Census (*Office for National Statistics, 2025a*), indicating a small but statistically significant difference ($\chi^2(1, N = 1646) = 26.99$, $P < 0.001$, Cohen's $\omega = 0.13$). For analysis, ethnicity was coded as 0 = non-white and 1 = white, acknowledging that this binary categorization does not capture heterogeneity within ethnic groups.

Hypothesis 1: Attitudes differ significantly across surrogacy, UTx and artificial placentas

Most participants expressed positive attitudes — operationalized as selecting 'agree' or 'strongly agree' on the Likert scale — towards surrogacy (unspecified type), UTx (unspecified type) and artificial placentas, with values of 85.9% ($n = 471/548$), 82.0% ($n = 450/549$) and 64.8% ($n = 356/549$), respectively. One-way Welch's ANOVA indicated significant mean differences across the three forms: $F(2, 1085.02) = 42.29$, $P < 0.001$, $\eta^2 = 0.056$. Post-hoc Games–Howell tests showed similar support for surrogacy (M = 3.88, SD = 0.91, 95% CI 3.80–3.95) and UTx (M = 3.78, SD = 0.88, 95% CI 3.71–3.86, $P = 0.185$), while both technologies were rated significantly higher than artificial placentas (M = 3.33, SD = 1.11, 95% CI 3.24–3.43, $P < 0.001$ for both comparisons). These results confirm Hypothesis 1.

Hypothesis 2: Attitudes differ significantly across surrogacy variants (unspecified, traditional surrogacy and gestational surrogacy)

High levels of acceptance were also observed for surrogacy (unspecified type), traditional surrogacy and gestational surrogacy, with 85.9% ($n = 471/548$), 76.1% ($n = 417/548$) and 69.7% ($n = 382/548$) of participants, respectively, selecting 'agree' or 'strongly agree'. A repeated-measures GLM with Greenhouse–Geisser correction identified a significant difference in attitudes across the three surrogacy types: $F(1.79, 976.36) = 21.71$, $P < 0.001$, partial $\eta^2 = 0.038$. Bonferroni-adjusted comparisons showed that attitudes towards surrogacy (unspecified type) (M = 3.88, SE = 0.04, 95% CI 3.80–3.95) were significantly more positive than attitudes towards traditional surrogacy (M = 3.68, SE = 0.04, 95% CI 3.60–3.76, $P < 0.001$) and gestational surrogacy (M = 3.66, SE = 0.04, 95% CI 3.58–3.74, $P < 0.001$). Attitudes towards traditional surrogacy and gestational surrogacy did not differ ($P = 1.00$). Hypothesis 2 is thus supported.

Hypothesis 3: Attitudes differ significantly across UTx variants (unspecified, LUTx and DUTx)

A majority of participants expressed favourable views — indicated by responses of 'agree' or 'strongly agree' — towards UTx (unspecified type), LUTx and DUTx (82.0% [$n = 450/549$], 71.2% [$n = 391/549$] and 65.2% [$n = 358/549$], respectively). A repeated-measures GLM with Greenhouse–Geisser correction showed significant differences in attitudes across the three UTx types: $F(1.65, 906.42) = 47.86$, $P < 0.001$, partial $\eta^2 = 0.080$. Bonferroni-corrected comparisons indicated that UTx (unspecified type) (M = 3.78, SE = 0.04,

95% CI 3.71–3.86) was rated more positively than LUTx (M = 3.50, SE = 0.04, 95% CI 3.41–3.58, $P < 0.001$) and DUTx (M = 3.41, SE = 0.04, 95% CI 3.32–3.49, $P < 0.001$). Attitudes towards LUTx and DUTx did not differ ($P = 0.174$). These results confirm Hypothesis 3.

Hypothesis 4: Subjective knowledge differs significantly across surrogacy, UTx and artificial placentas

One-way Welch's ANOVA showed significant differences in subjective knowledge across groups:, F(2, 1082.04) = 25.36, $P < 0.001$, $\eta^2 = 0.025$. Post-hoc Games–Howell tests showed higher knowledge in the surrogacy group (M = 3.33, SD = 1.25, 95% CI 3.23–3.44) compared with UTx (M = 2.78, SD = 1.45, 95% CI 2.66–2.90, $P < 0.001$) and artificial placentas (M = 2.91, SD = 1.64, 95% CI 2.78–3.05, $P < 0.001$). Subjective knowledge of UTx and artificial placentas did not differ ($P = 0.329$). These findings confirm Hypothesis 4.

All means were below the midpoint of the scale (specifically, 4 on a 7-point Likert scale), indicating low perceived knowledge overall. This pattern is further reflected in the high proportion of respondents who expressed disagreement on the subjective knowledge scale ('strongly disagree' to 'somewhat disagree'): 74.3% ($n = 407/548$) for surrogacy, 82.7% ($n = 454/549$) for UTx and 76.5% ($n = 420/549$) for artificial placentas.

Hypotheses 5 and 7: Subjective knowledge and demographic variables are associated with attitudes towards each NCG form and variant

Pearson correlations (TABLE 4) showed distinct patterns of association, providing partial support for Hypotheses 5 and 7. Attitudes towards traditional surrogacy ($r = 0.66$, 95% CI 0.61–0.71, $P < 0.001$) and gestational surrogacy ($r = 0.65$, 95% CI 0.60–0.70, $P < 0.001$) correlated strongly with attitudes towards surrogacy (unspecified type), suggesting that responses to a general surrogacy question are closely aligned with attitudes towards both forms of surrogacy. The near-identical correlation coefficients indicate that respondents did not systematically differentiate between traditional surrogacy and gestational surrogacy when evaluating surrogacy in the abstract, consistent with the findings for Hypothesis 2.

Similarly, attitudes towards LUTx ($r = 0.68$, 95% CI 0.63–0.72, $P < 0.001$) and DUTx

TABLE 4 PEARSON'S CORRELATIONS BETWEEN ATTITUDES TOWARDS NCG FORMS/VARIANTS AND SUBJECTIVE KNOWLEDGE, DEMOGRAPHIC VARIABLES AND ATTITUDES TOWARD OTHER NCG FORMS/VARIANTS

Variable	Group 1 (*N* = 548) *r* [95% CI], *P*-value			Group 2 (*N* = 549) *r* [95% CI], *P*-value			Group 3 (*N* = 549) *r* [95% CI], *P*-value
	Surrogacy (unspecified type)	TS	GS	UTx (unspecified type)	LUTx	DUTx	AP
Attitudes							
Surrogacy (unspecified type)	–	–	–	–	–	–	–
TS	0.66 [0.61, 0.71], $P < 0.001$	–	–	–	–	–	–
GS	0.65 [0.60, 0.70], $P < 0.001$	0.47 [0.40, 0.53], $P < 0.001$	–	–	–	–	–
UTx	–	–	–	–	–	–	–
LUTx	–	–	–	0.68 [0.63, 0.72], $P < 0.001$	–	–	–
DUTx	–	–	–	0.56 [0.50, 0.62], $P < 0.001$	0.39 [0.32, 0.46], $P < 0.001$	–	–
AP	–	–	–	–	–	–	–
Subjective knowledge towards NCG forms/variants	0.05 [−0.03, 0.14], $P = 0.225$	−0.01 [−0.10, 0.07], $P = 0.754$	0.07 [−0.01, 0.15], $P = 0.094$	0.18 [0.10, 0.26], $P < 0.001$	0.17 [0.09, 0.25], $P < 0.001$	0.08 [−0.01, 0.16], $P = 0.067$	0.48 [0.42, 0.54], $P < 0.001$
Demographics[a]							
Age	−0.06 [−0.14, 0.03], $P = 0.179$	0.11 [0.03, 0.19], $P = 0.011$	−0.09 [−0.17, −0.01], $P = 0.032$	−0.16 [−0.24, −0.07], $P < 0.001$	−0.13 [−0.21, −0.05], $P = 0.002$	0.01 [−0.08, 0.09], $P = 0.843$	−0.38 [−0.45, −0.31], $P < 0.001$
Gender	0.07 [−0.02, 0.15], $P = 0.114$	−0.06 [−0.14, 0.03], $P = 0.195$	0.11 [0.02, 0.19], $P = 0.014$	−0.04 [−0.12, 0.05], $P = 0.399$	−0.10 [−0.19, −0.02], $P = 0.015$	−0.10 [−0.18, −0.01], $P = 0.025$	−0.02 [−0.11, 0.06], $P = 0.603$
Previous pregnancies	0.05 [−0.03, 0.13], $P = 0.243$	−0.03 [−0.11, 0.06], $P = 0.529$	0.04 [−0.04, 0.12], $P = 0.360$	0.03 [−0.06, 0.11], $P = 0.514$	−0.06 [−0.14, 0.03], $P = 0.193$	−0.06 [−0.14, 0.03], $P = 0.184$	−0.01 [−0.09, 0.07], $P = 0.807$
Relationship status	0.00 [−0.08, 0.09], $P = 0.951$	0.00 [−0.08, 0.09], $P = 0.911$	−0.01 [−0.09, 0.07], $P = 0.823$	0.14 [0.05, 0.22], $P = 0.001$	0.09 [0.01, 0.18], $P = 0.027$	0.06 [−0.02, 0.15], $P = 0.134$	0.07 [−0.01, 0.15], $P = 0.096$
Sexual orientation	0.10 [0.02, 0.18], $P = 0.016$	0.06 [−0.02, 0.15], $P = 0.143$	0.07 [−0.01, 0.15], $P = 0.098$	0.01 [−0.07, 0.09], $P = 0.808$	0.04 [−0.05, 0.12], $P = 0.368$	−0.01 [−0.10, 0.07], $P = 0.778$	0.01 [−0.07, 0.09], $P = 0.835$
Religion	−0.19 [−0.27, −0.10], $P < 0.001$	−0.10 [−0.19, −0.02], $P = 0.016$	−0.13 [−0.21, −0.05], $P = 0.002$	0.00 [−0.09, 0.08], $P = 0.907$	−0.02 [−0.11, 0.06], $P = 0.578$	−0.05 [−0.13, 0.04], $P = 0.284$	0.07 [−0.01, 0.16], $P = 0.082$
Political orientation	−0.03 [−0.12, 0.05], $P = 0.431$	0.07 [−0.01, 0.16], $P = 0.080$	0.02 [−0.07, 0.10], $P = 0.674$	0.17 [0.08, 0.25], $P < 0.001$	0.13 [0.05, 0.21], $P = 0.002$	0.12 [0.03, 0.20], $P = 0.006$	0.09 [0.00, 0.17], $P = 0.039$
Ethnicity	−0.11 [−0.19, −0.03], $P = 0.011$	−0.12 [−0.20, −0.03], $P = 0.006$	−0.06 [−0.14, 0.02], $P = 0.166$	−0.03 [−0.11, 0.06], $P = 0.504$	−0.01 [−0.10, 0.07], $P = 0.744$	−0.03 [−0.11, 0.05], $P = 0.489$	0.19 [0.10, 0.26], $P < 0.001$

Dummy variables were computed for gender (0 = male, 1 = female); previous pregnancies (0 = no, 1 = yes); relationship status (0 = not partnered, 1 = partnered [married, civil-partnered or cohabiting]); sexual orientation (0 = non-LGBTQ, 1 = LGBTQ); religion (0 = no religion, 1 = any religion); political orientation (0 = none, 1 = any political orientation); ethnicity (0 = non-white, 1 = white).

AP, artificial placenta; DUTx, uterus transplant from deceased donor; GS, gestational surrogacy; LUTx, uterus transplant from living donor; NCG, non-conventional gestation; TS, traditional surrogacy; UTx, uterus transplant.

($r = 0.56$, 95% CI 0.50–0.62, $P < 0.001$) correlated with attitudes towards UTx (unspecified type). Unlike surrogacy, however, the stronger association between attitudes towards UTx and LUTx suggests that respondents may have been somewhat more likely to envisage LUTx than DUTx when considering UTx in general. Given the outcomes of testing for Hypothesis 3, which did not find a significant difference in attitudes towards LUTx and DUTx, this pattern should be interpreted as indicative of a trend rather than a significant difference.

Subjective knowledge correlated significantly with attitudes towards UTx (unspecified type) ($r = 0.18$, 95% CI 0.10–0.26, $P < 0.001$), LUTx ($r = 0.17$, 95% CI 0.09–0.25, $P < 0.001$) and artificial placentas ($r = 0.48$, 95% CI 0.42–0.54, $P < 0.001$), but not with attitudes towards surrogacy. Associations were strongest for artificial placentas. Age correlated negatively with attitudes towards gestational surrogacy ($r = -0.09$, 95% CI −0.17 to −0.01, $P = 0.032$), UTx (unspecified type) ($r = -0.16$, 95% CI −0.24 to −0.07, $P < 0.001$) and LUTx ($r = -0.13$, 95% CI −0.21 to −0.05, $P = 0.002$), and strongest with artificial placentas (−0.38, 95% CI −0.45 to −0.31, $P < 0.001$). A positive correlation emerged for traditional surrogacy ($r = 0.11$, 95% CI 0.03–0.19, $P = 0.011$).

Gender correlated positively with attitudes towards gestational surrogacy ($r = 0.11$, 95% CI 0.02–0.19, $P = 0.014$), and negatively with attitudes towards LUTx ($r = -0.10$, 95% CI −0.19 to −0.02, $P = 0.015$) and DUTx ($r = -0.10$, 95% CI −0.18 to −0.01, $P = 0.025$). No other associations were observed. Previous pregnancies were not significantly associated with attitudes. Relationship status correlated positively with attitudes towards UTx (unspecified type) ($r = 0.14$, 95% CI 0.05–0.22, $P = 0.001$) and LUTx ($r = 0.09$, 95% CI 0.01–0.18, $P = 0.027$). Only attitudes towards surrogacy (unspecified type) showed a significant positive correlation ($r = 0.10$, 95% CI 0.02–0.18, $P = 0.016$) with sexual orientation. Religion correlated negatively with attitudes towards surrogacy (unspecified type) (−0.19, 95% CI −0.27 to −0.10, $P < 0.001$), traditional surrogacy ($r = -0.10$, 95% CI −0.19 to −0.02, $P = 0.016$) and gestational surrogacy ($r = -0.13$, 95% CI −0.21 to −0.05, $P = 0.002$).

In terms of political orientation, positive correlations emerged for attitudes towards UTx (unspecified type) ($r = 0.17$, 95% CI 0.08–0.25, $P < 0.001$), LUTx ($r = 0.13$, 95% CI 0.05–0.21, $P = 0.002$), DUTx ($r = 0.12$, 95% CI 0.03–0.20, $P = 0.006$) and artificial placentas ($r = 0.09$, 95% CI 0.00–0.17, $P = 0.039$). Finally, ethnicity was negatively associated with attitudes towards surrogacy (unspecified type) ($r = -0.11$, 95% CI −0.19 to −0.03, $P = 0.011$) and traditional surrogacy ($r = -0.12$, 95% CI −0.20 to −0.03, $P = 0.006$), and positively associated with attitudes towards artificial placentas ($r = 0.19$, 95% CI 0.10–0.26, $P < 0.001$).

Hypotheses 6 and 8: Subjective knowledge and demographic variables predict attitudes towards each NCG form and variant

All multiple linear regression models were significant (TABLE 5) and indicated no evidence of multicollinearity, with all variance inflation factors below 3.3 (Supplementary Table 1). Significant predictors (standardized beta coefficients) are summarized below. For unstandardized beta coefficients and related 95% CI values, see TABLE 5.

Subjective knowledge predicted more positive attitudes towards UTx (unspecified type) ($\beta = 0.11$, $P = 0.018$), LUTx ($\beta = 0.13$, $P = 0.005$) and artificial placentas ($\beta = 0.38$, $P < 0.001$); no other effects were observed. Age negatively predicted attitudes towards UTx (unspecified type) ($\beta = -0.20$, $P < 0.001$), LUTx ($\beta = -0.14$, $P = 0.003$) and artificial placentas ($\beta = -0.22$, $P < 0.001$). Age was a positive predictor of attitudes towards traditional surrogacy ($\beta = 0.11$, $P = 0.031$); no other effects emerged. Gender was a negative predictor of attitudes towards LUTx ($\beta = -0.14$, $P = 0.028$); no other gender effects emerged. Previous pregnancies had no significant effect on attitudes towards any NCG form/variant. Relationship status predicted more positive attitudes towards UTx (unspecified type) ($\beta = 0.09$, $P = 0.030$); no other relationship effects emerged. Sexual orientation had no significant effect on attitudes towards any NCG form/variant.

Religion negatively predicted attitudes towards surrogacy (unspecified type) ($\beta = -0.15$, $P = 0.002$), traditional surrogacy ($\beta = -0.10$, $P = 0.029$) and gestational surrogacy ($\beta = -0.10$, $P = 0.032$); no other effects of religious beliefs emerged. Political orientation positively predicted attitudes towards UTx (unspecified type) ($\beta = 0.15$, $P < 0.001$), LUTx ($\beta = 0.10$, $P = 0.020$) and DUTx ($\beta = 0.09$, $P = 0.041$); no other effects of political orientation emerged. Ethnicity was a significant negative predictor of attitudes towards UTx (unspecified type) ($\beta = -0.09$, $P = 0.038$); no other effects of ethnicity emerged.

DISCUSSION

This study aimed to systematically compare public attitudes towards different forms of NCG in the UK and to assess how these attitudes vary across their variants and individual characteristics. In doing so, it provides the first comparative assessment across seven distinct NCG forms within a single, standardized design. This contribution addresses a key limitation in existing research, which has typically examined technologies in isolation or undertaken more limited comparisons. By integrating multiple NCG forms within a single analytical framework, the study moves beyond fragmented approaches and offers a more systematic understanding of how public attitudes are structured across NCG forms.

Results in this study show that support for artificial placentas was lower than for surrogacy and UTx in the present sample, although attitudes remained overall favourable (64.8% of respondents expressed positive attitudes towards artificial placentas). The study demonstrates that subjective knowledge is modest overall and only weakly predictive of attitudes (positively for UTx, LUTx and artificial placentas, otherwise negligible). Across the NCG forms studied, a recurring pattern emerged: support diminishes when more specific procedural details are introduced (e.g. distinguishing gestational surrogacy/traditional surrogacy or LUTx/DUTx). Further understanding of how information is received by the public and how this impacts attitudes will be necessary to shape future public consultation and regulation.

Although demographic characteristics predicted attitudes, the patterns and strengths of associations differed across NCG forms and variants, indicating that a substantial proportion of variation in public attitudes remains unexplained. This suggests that additional factors may influence individuals' attitudes, such as the legislative and societal contexts within

TABLE 5 RESULTS OF MULTIPLE LINEAR REGRESSION MODELS EXAMINING THE RELATIONSHIPS OF MULTIPLE PREDICTORS WITH ATTITUDES TOWARDS NCG FORMS/VARIANTS

Predictor and R^2-value	Surrogacy (unspecified type)	TS	GS	UTx (unspecified type)	LUTx	DUTx	AP
	β (B, [95% CI]), *P*-value	β (B, [95% CI]), *P*-value	β (B, [95% CI]), *P*-value	β (B, [95% CI]), *P*-value	β (B, [95% CI]), *P*-value	β (B, [95% CI]), *P*-value	β (B, [95% CI]), *P*-value
Predictor							
Subjective knowledge towards NCG forms/variants	0.07 (0.05, [−0.01, 0.12]), $P = 0.112$	0.04 (0.03, [−0.04, 0.10]), $P = 0.344$	0.07 (0.05, [−0.02, 0.12]), $P = 0.143$	0.11 (0.06, [0.01, 0.12]), $P = 0.018$	0.13 (0.09, [0.03, 0.15]), $P = 0.005$	0.08 (0.06, [−0.01, 0.12]), $P = 0.103$	0.38 (0.26, [0.20, 0.32]), $P < 0.001$
Age	−0.04 (0.00, [−0.01, 0.00]), $P = 0.451$	0.11 (0.01, [0.00, 0.01]), $P = 0.031$	−0.07 (0.00, [−0.01, 0.00]), $P = 0.196$	−0.20 (−0.01, [−0.02, −0.01]), $P < 0.001$	−0.14 (−0.01, [−0.01, 0.00]), $P = 0.003$	0.01 (0.00, [−0.01, 0.01]), $P = 0.906$	−0.22 (−0.01, [−0.02, −0.01]), $P < 0.001$
Gender	0.01 (0.01, [−0.21, 0.24]), $P = 0.922$	−0.04 (−0.08, [−0.32, 0.16]), $P = 0.522$	0.12 (0.22, [−0.02, 0.47]), $P = 0.069$	−0.11 (−0.20, [−0.41, 0.01]), $P = 0.060$	−0.14 (−0.27, [−0.50, −0.03]), $P = 0.028$	−0.09 (−0.18, [−0.44, 0.08]), $P = 0.175$	−0.02 (−0.04, [−0.33, 0.24]), $P = 0.764$
Previous regnancies	0.04 (0.07, [−0.17, 0.31]), $P = 0.566$	0.00 (−0.01, [−0.26, 0.24]), $P = 0.938$	−0.04 (−0.08, [−0.33, 0.18]), $P = 0.557$	0.12 (0.22, [0.00, 0.45]), $P = 0.054$	0.05 (0.10, [−0.16, 0.35]), $P = 0.456$	0.00 (0.00, [−0.28, 0.28]), $P = 0.996$	0.00 (0.01, [−0.29, 0.31]), $P = 0.948$
Relationship status	0.03 (0.05, [−0.11, 0.22]), $P = 0.511$	−0.01 (−0.02, [−0.20, 0.15]), $P = 0.780$	0.03 (0.06, [−0.12, 0.23]), $P = 0.520$	0.09 (0.17, [0.02, 0.33]), $P = 0.030$	0.07 (0.15, [−0.03, 0.32]), $P = 0.103$	0.04 (0.09, [−0.10, 0.28]), $P = 0.359$	0.01 (0.01, [−0.18, 0.20]), $P = 0.889$
Sexual orientation	0.07 (0.26, [−0.05, 0.56]), $P = 0.100$	0.05 (0.18, [−0.15, 0.50]), $P = 0.288$	0.03 (0.13, [−0.20, 0.45]), $P = 0.451$	0.03 (0.08, [−0.17, 0.33]), $P = 0.553$	0.05 (0.16, [−0.12, 0.44]), $P = 0.266$	0.00 (0.00, [−0.31, 0.31]), $P = 0.994$	0.02 (0.10, [−0.24, 0.44]), $P = 0.562$
Religion	−0.15 (−0.28, [−0.44, −0.11]), $P = 0.002$	−0.10 (−0.20, [−0.38, −0.02]), $P = 0.029$	−0.10 (−0.20, [−0.38, −0.02]), $P = 0.032$	−0.02 (−0.04, [−0.19, 0.11]), $P = 0.615$	−0.05 (−0.10, [−0.27, 0.08]), $P = 0.278$	−0.07 (−0.16, [−0.35, 0.03]), $P = 0.107$	−0.05 (−0.11, [−0.30, 0.08]), $P = 0.242$
Political orientation	−0.02 (−0.04, [−0.20, 0.13]), $P = 0.675$	0.05 (0.09, [−0.09, 0.27]), $P = 0.311$	0.06 (0.11, [−0.07, 0.29]), $P = 0.214$	0.15 (0.29, [0.13, 0.45]), $P < 0.001$	0.10 (0.22, [0.03, 0.40]), $P = 0.020$	0.09 (0.21, [0.01, 0.41]), $P = 0.041$	0.05 (0.16, [−0.06, 0.39]), $P = 0.159$
Ethnicity	−0.08 (−0.17, [−0.39, 0.04]), $P = 0.113$	−0.05 (−0.13, [−0.35, 0.10]), $P = 0.275$	−0.05 (−0.13, [−0.36, 0.10]), $P = 0.274$	−0.09 (−0.20, [−0.39, −0.01]), $P = 0.038$	−0.07 (−0.16, [−0.38, 0.05]), $P = 0.131$	−0.02 (−0.06, [−0.30, 0.17]), $P = 0.603$	0.00 (−0.01, [−0.23, 0.21]), $P = 0.933$
Adjusted R^2 (*P*-value)	0.04 ($P < 0.001$)	0.02 ($P = 0.015$)	0.03 ($P = 0.006$)	0.08 ($P < 0.001$)	0.06 ($P < 0.001$)	0.02 ($P = 0.043$)	0.26 ($P < 0.001$)

$N = 1646$; β, standardized beta coefficient; B, unstandardized beta coefficient; CI, confidence interval for B.

Dummy variables were computed for gender (0 = male, 1 = female); previous pregnancies (0 = no, 1 = yes); relationship status (0 = not partnered, 1 = partnered [married, civil-partnered or cohabiting]); sexual orientation (0 = non-LGBTQ, 1 = LGBTQ); religion (0 = no religion, 1 = any religion); political orientation (0 = none, 1 = any political orientation); ethnicity (0 = non-white, 1 = white).

AP, artificial placenta; DUTx, uterus transplant from deceased donor; GS, gestational surrogacy; LUTx, uterus transplant from living donor; NCG, non-conventional gestation; TS, traditional surrogacy; UTx, uterus transplant.

which these NCGs are practised and might be explored further in future research.

This study demonstrated similarly high positive attitudes towards surrogacy (85.9%) and UTx (82.0%), both of which were rated significantly more positively than artificial placentas (64.8%). In a UK context, the findings would suggest that approval of surrogacy has increased over time: a YouGov study found that 59% of British adults approved of (gestational) surrogacy in 2014 (*Jordan, 2014*), although such top-level statistics need to be interpreted cautiously given the measurement differences and variations in how attitudes are conceptualized.

The current study confirms previous findings indicating that public knowledge of NCG forms is generally limited (e.g. *Bitou et al., 2026*, gestational surrogacy in Greece; *Farkas et al., 2025*, UTx in Hungary; *Vali et al., 2023*, UTx in the UK). Perceived knowledge is highest for surrogacy among the forms of NCG but remains modest (M = 3.33), with insignificant mean differences in knowledge for UTx (M = 2.78) and artificial placenta (M = 2.91).

The fact that surrogacy has the highest mean knowledge levels and percentage of respondents with positive attitudes may be attributed to the length of time that surrogacy has been practised, the public discourse and its established legal regulation in the UK. Recent public consultations and reform proposals in England, Wales and Scotland (*Law Commissions, 2023*) have increased its visibility at a domestic level. Its visibility is further enhanced by prominent media coverage and disclosures by celebrity figures, such as Khloe Kardashian and Tom Daly, allowing it to enter mainstream public discourse.

Comparative evidence also suggests that the regulatory context may play an important role in determining public attitudes. For example, in jurisdictions where surrogacy is prohibited, such as Sweden and Japan, public attitudes tend to be less favourable (*Nakazawa et al., 2019*; *Wennberg et al., 2016*). However, in Spain, where surrogacy is also illegal, there is a high level of public support for the legalization of the practice (*Rius et al., 2025*; *Rodríguez-Jaume et al., 2024*),

suggesting that attitudes can differ from the legal positioning of the practice.

Turning to UTx, a relatively high proportion of respondents reported low knowledge (82.7%). While some evidence suggests that individuals considering uterine donation report higher awareness (*Jones et al., 2021*), population-level studies consistently find low familiarity (*Pittman et al., 2025*; *Vali et al., 2023*). This suggests that personal investment may increase familiarity, although this remains speculative as the current study did not measure personal relevance.

In contrast to surrogacy, a lower level of knowledge of UTx was expected, particularly given Vali and colleagues' finding that 71% of participants had never heard of it (*Vali et al., 2023*). It was also assumed that attitudes towards UTx would be less positive than towards surrogacy, given its novelty. The finding that attitudes towards surrogacy and UTx were similarly positive suggests that knowledge of a form of NCG alone does not shape public attitudes. Although still limited to clinical trials, UTx, like surrogacy, is a permitted form of NCG in the UK. It is therefore plausible that regulatory frameworks may exert greater influence on public exposure to and perceptions of reproductive options. This would also align with the relatively lower support observed for artificial placentas than for surrogacy or UTx, particularly for their use during full gestation, although the present study cannot determine whether this reflects the lack of clinical implementation of artificial placentas, the absence of approved regulation or other factors.

The absence of a significant difference in knowledge between UTx and artificial placentas was unexpected and may reflect first-exposure effects, whereby participants encountered both technologies for the first time in the study. Approval of these NCG forms may also be influenced by media representations. For example, there has been more prominent media coverage of UTx than of artificial placentas, given that artificial placentas are not yet at the stage of clinical trials. UK coverage of UTx has included positive, donor-centric narratives: for example, ' "A little miracle": First baby born in UK to woman with transplanted womb' (*Walsh, 2025*), whereas coverage of artificial placentas has often been cautious and interrogative, for example, 'This machine could keep a baby alive outside the womb. How will the world decide to use it?' (*Tu, 2025*). Although media effects were not measured in this study, these contrasting tones illustrate how media framing may plausibly shape public attitudes.

Additional explanations for the findings related to artificial placenta are also plausible. Participants may have conflated partial and full ectogestation, overestimated their subjective knowledge, or relied on familiar cultural narratives when evaluating an unfamiliar technology. Science fiction and dystopian imagery, for example, may provide accessible interpretive frames (*Krendel and Ryder, 2025*), meaning responses are guided more by analogy than by substantive understanding. As *Krendel and Ryder (2025)* argue, therefore, public engagement should focus on explaining the need for and feasibility of emerging technologies, normalizing their use and users, and demonstrating their societal and individual benefits. However, it is acknowledged that the present study was not designed to identify the reasons for the lower support for one NCG form compared with other NCG forms, and that these explanations should therefore be regarded as speculative.

Overall, the findings of this study, when considered alongside existing evidence, suggest that external factors may play a distinct role in shaping knowledge and attitudes towards NCGs. While comparisons with other studies suggest regulatory frameworks, media portrayals and broader public discourse may be key examples of such external factors, and more research on sources of knowledge are needed to substantiate this link.

Within the surrogacy group, respondents were more positive towards surrogacy (unspecified) than towards traditional surrogacy or gestational surrogacy, and did not significantly differentiate between traditional surrogacy and gestational surrogacy. The findings of this study would therefore indicate that the UK public does not necessarily equate surrogacy (unspecified type) with either gestational surrogacy or traditional surrogacy. Minai and collaborators reported a similar finding in Japan, although Constantinidis and Cook found that respondents equated 'surrogacy' without a definition with gestational surrogacy rather than traditional surrogacy (*Constantinidis and Cook, 2012*; *Minai et al., 2007*).

The difference between gestational surrogacy and traditional surrogacy is the existence (or non-existence) of a genetic link between the surrogate and the child. Several jurisdictions permit gestational surrogacy while prohibiting traditional surrogacy (e.g. India, Portugal and various US states). Conversely, both forms of surrogacy are permitted in the UK and regulated in the same way, which may help explain the current results. Given that no significant difference in attitudes towards gestational surrogacy and traditional surrogacy was evident within the study sample, the findings would indicate that the (sometimes) legal and academic distinction between gestational surrogacy and traditional surrogacy is not reflected as concerns among the UK population.

For UTx, the pattern is parallel: general UTx elicited higher support than either LUTx or DUTx, yet respondents did not significantly distinguish between donor types. However, correlation analyses indicate that attitudes towards UTx (unspecified type) were more strongly associated with attitudes towards LUTx ($r = 0.68$, 95% CI 0.63–0.72, $P < 0.001$) than with attitudes towards DUTx ($r = 0.56$, 95% CI 0.50–0.62, $P < 0.001$). This may indicate that LUTx is more salient in public perception, potentially reflecting greater familiarity with living donor models in other medical contexts, or that gestation is not readily perceived as feasible using organs from deceased donors. However, both interpretations remain speculative. In contrast to previous research favouring DUTx over LUTx (*Kisu et al., 2016*; *Hariton et al., 2018*), the current findings indicate a relative preference for LUTx (71.2%) over DUTx (65.2%); however, the mean differences were not statistically significant.

Taken together, these results indicate that increasing specificity reduces public support for NCG types relative to the abstract level. Detail is important, and qualitative research may better elucidate what drives attitudes and how these intersect with legal distinctions.

As many commentators note, modern reproductive practices increasingly involve multiple actors and raise complex public, legal and ethical questions, with regulatory approaches varying widely across jurisdictions and influenced by cultural and religious values (e.g. *Deonandan, 2020*; *Klotz, 2026*; *Rodríguez-Jaume et al., 2021*). In this context, attitudes towards NCG types are not formed in isolation but are

shaped by broader ideological and normative frameworks within and across national boundaries. This is reflected in research showing that religious values associated with traditional family models and related political orientations can negatively influence the acceptance of reproductive technologies (e.g. *Aurrekoetxea-Casaus and Ronda, 2024*).

Consequently, it is not surprising that religion (for all surrogacy forms) and political orientation (for all UTx forms) emerged as the most consistent predictors in this study. This finding aligns with evidence from Italy (*Panerati et al., 2026*), Poland (*Lutkiewicz et al., 2023*, *2026*), Spain (*Rodríguez-Jaume et al., 2024*) and the UK (*Baron et al., 2024*), as well as broader cross-national patterns (*Yıldız et al., 2023*), reinforcing the argument that attitudes towards NCG forms are embedded within wider sociocultural and ideological frameworks (*Klotz, 2026*). Given, for example, the Pope's condemnation of surrogacy (*Hansen, 2024*), the influence of religion on attitudes towards the practice may be anticipated. Religious emphases on lineage and procreation within marriage, which may be particularly salient where third parties are involved (*Farid and Tasnim, 2023*; *Muaygil, 2017*), may be the cause of this restrictive view. Again, such speculation needs to be interrogated further to understand where knowledge of NCG derives from.

However, it is notable that religion had no significant effect on attitudes towards UTx and artificial placentas, and that political beliefs did not significantly affect attitudes towards surrogacy or artificial placenta ratings. One explanation could be that binary coding, while analytically convenient, remains a coarse indicator for capturing variation within groups, as highlighted in more focused studies (e.g. *Deonandan, 2020*; *Yıldız et al., 2023*), although it still provides a useful starting point for population-level analyses (see also *Lutkiewicz, 2023*, *2026*).

Age also appeared to influence attitudes, with younger respondents expressing greater support for newer technologies (UTx, LUTx and artificial placentas). This pattern aligns with findings that younger cohorts are more optimistic about artificial placentas and that older respondents and those with prior parenting experience report greater concerns (*Viviani, 2025*). One possible explanation is that younger individuals, having grown up with a wider range of reproductive options, may be more open to novel or emerging technologies. In contrast, older participants were more positive towards traditional surrogacy, which may reflect its perceived alignment with more 'natural' or traditional forms of reproduction, as the surrogate is both the genetic and gestational parent. However, further qualitative research is needed to understand the rationale for the perspectives of different age groups. The inconsistent role of age across NCG forms reflects broader patterns in the literature, where findings vary across contexts, ART approaches and NCG forms (e.g. *Bitou et al., 2026*; *Esmaeilivand et al., 2025*; *Farkas et al., 2025*; *Lutkiewicz et al., 2023*, *2026*; *Nakazawa et al., 2019*). While some studies report similar age-related patterns, evidence overall remains mixed, suggesting that these associations are context-dependent rather than stable across settings.

Several sociodemographic variables showed limited or inconsistent associations with attitudes, including gender, ethnicity, relationship status and prior pregnancy experience. This pattern is consistent with prior research, which frequently reports weak, non-significant or context-dependent effects for these variables (e.g. *Bitou et al., 2026*; *Constantinidis and Cook, 2012*; *Esmaeilivand et al., 2025*; *Farkas et al., 2025*; *Lutkiewicz et al., 2023*, *2026*; *Rodríguez-Jaume et al., 2024*; *Suzuki et al., 2006*; *Yıldız et al., 2023*). Where associations do emerge, they tend to be sensitive to contextual, cultural and measurement-related factors. For example, sexual orientation was not a significant predictor for any NCG form in the current study, although it has been found to be a statistically significant predictor in more religious contexts such as Italy (*Panerati et al., 2026*), Spain (*Rodríguez-Jaume et al., 2024*) and Poland (*Lutkiewicz et al., 2026*). Together, these findings suggest that demographic characteristics may help explain variation in attitudes, but their effects may be neither uniform nor sufficient on their own.

Overall, the present study's findings suggest that attitudes towards NCG forms may be influenced by other extraneous considerations, which warrants further investigation. These findings also resonate with research on reproductive decision making more broadly, which shows that attitudes towards pregnancy-related choices are shaped not only by demographic characteristics, but also by ethical and biomedical considerations, perceived risks and costs, social norms and the broader institutional and cultural contexts in which such decisions are made (e.g. *Azhar et al., 2015*; *Bracewell-Milnes et al., 2021*; *Chliaoutakis, 2002*; *Lasker and Murray, 2001*; *Murali, 2025*; *Petitfils et al., 2017*; *Purewal and van den Akker, 2006*). The findings also align with Smietana and co-workers' argument that ethical evaluations of reproductive practices are embedded within locally situated 'repro-regional moral frameworks', and that moral and regulatory positions may therefore vary across social and geographical contexts, highlighting the importance of considering such contextual differences in international policy and regulatory development (*Smietana et al., 2021*).

Going forward, it is important that regulation and policy align with public support. There is a need to reconsider how public opinion and regulation interact in emerging forms of NCG. Although this study suggests that knowledge and demographic factors can predict attitudes, relationship patterns and association strengths vary across NCG forms and variants, suggesting that other factors also influence public attitudes. For example, regulatory frameworks may themselves shape public views by signalling legitimacy, necessity and acceptability.

Policymakers should therefore engage closely with the evolving evidence base and draw on diverse methodological approaches to better understand public perspectives. In doing so, they must address key issues relating to human rights, reproductive autonomy and cross-border legal variation across both established (e.g. surrogacy) and emerging (e.g. artificial placenta) areas. Rather than instrumentalizing knowledge, practitioners and stakeholders should focus on providing nuanced, context-sensitive information that enables informed, rather than polarized, decision making. Understanding where the public sources information about NCGs, and how different framings shape attitudes across jurisdictions, is a crucial next step for research.

Although knowledge alone does not determine public attitudes, the *type* and *amount* of information provided clearly

have influence. As technologies such as UTx and artificial placentas move further into the public domain, it will be essential that information is accessible and responsive to ethical concerns, perceived risks and broader social narratives alongside factual understanding. Further research is therefore needed to identify which aspects of information most strongly shape attitudes and how communication strategies can be tailored to meet public need.

The limitations of this study must, however, be acknowledged. Although the cross-sectional design provides a useful snapshot across NCG forms and variants within a single study, it does not capture how attitudes may evolve over time as technologies develop. Reliance on self-reported subjective knowledge is also a limitation, as participants may overestimate or underestimate their understanding of NCGs. In addition, the fact that some respondents may have been encountering certain technologies for the first time may have influenced their immediate responses. Furthermore, a large number of statistical tests introduces a potential risk of type I error. Moreover, binary coding of demographic variables reduces nuance and masks within-group variation. Finally, the use of quota-sampled panel data and associated self-selection may limit generalizability.

CONCLUSION

This study enabled the collation and comparison of public attitudes towards NCG forms and types. Public support for different types of NCG in the UK exhibits a consistent pattern of higher support for surrogacy and UTx than for artificial placentas (surrogacy ≈ UTx > artificial placentas) but declines when respondents receive more detailed information. Subjective knowledge is low and only weakly predictive of attitudes (positively for UTx [unspecified], LUTx and artificial placentas), while age (across most forms of NCG), religiosity (for surrogacy) and political orientation (for UTx) emerged as the most consistent demographic predictors. Other demographic characteristics showed less consistent and more context-dependent effects.

Legal frameworks and cultural narratives may be key determinants of attitudes, warranting further research into these broader influences. Regardless of the factors that influence attitudes, it is essential to increase public knowledge to enable meaningful public engagement with the current and future regulation of all forms of NCG. Ultimately, it is imperative that societal views be considered as technologies develop and regulations are shaped, taking account of diverse and competing perspectives across both domestic and international contexts.

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DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE MANUSCRIPT PREPARATION PROCESS

During the preparation of this work, the authors used Grammarly (Grammarly, USA) and Microsoft Copilot (Microsoft, USA) to improve language and readability. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.rbmo.2026.105983.

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