

UK pregnancy in orthopaedics (UK-POP): a cross-sectional study of UK female trauma and orthopaedic surgeons and their experiences of pregnancy

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Aims

The number of females within the speciality of trauma and orthopaedics (T&O) is increasing. The aim of this study was to identify: 1) current attitudes and behaviours of UK female T&O surgeons towards pregnancy; 2) any barriers faced towards pregnancy with a career in T&O surgery; and 3) areas for improvement.

Methods

This is a cross-sectional study using an anonymous 13-section web-based survey distributed to female-identifying T&O trainees, speciality and associate specialist surgeons (SAs) and locally employed doctors (LEDs), fellows, and consultants in the UK. Demographic data was collected as well as closed and open questions with adaptive answering relating to attitudes towards childbearing and experiences of fertility and complications associated with pregnancy. A descriptive data analysis was carried out.

Results

A total of 226 UK female T&O surgeons completed the survey. All regions of the UK were represented. Overall, 99/226 (44%) of respondents had at least one child, while 21/226 (9.3%) did not want children. Median age at first child was 33 years (interquartile range 32 to 36). Two-thirds (149/226; 66%) of respondents delayed childbearing due to a career in T&O and 140/226 (69%) of respondents had experienced bias from colleagues directed at female T&O surgeons having children during training. Nearly 24/121 (20%) of respondents required fertility assistance, 35/121 (28.9%) had experienced a miscarriage, and 53/121 (43.8%) had experienced obstetric complications.

Conclusion

A large proportion of female T&O surgeons have and want children. T&O surgeons in the UK delay childbearing, have experienced bias and have high rates of infertility and obstetric complications. The information from this study will support female T&O surgeons with decision making and assist employers with workforce planning. Further steps are necessary in order to support female T&O surgeons having families.

Take home message

- A large proportion of female T&O surgeons have and want children. T&O

surgeons in the UK delay childbearing, have experienced bias, and have high

rates of infertility and obstetric complications.

- Further steps are necessary in order to support female T&O surgeons having families.

Introduction

The number of females within the speciality of trauma and orthopaedics (T&O) is increasing.¹ They comprise 20% of UK T&O surgeons in training; however, at consultant level only 7.8% of T&O surgeons are females.² In the USA, females have been shown to have a higher attrition rate (5.96%) from T&O training in comparison to males (2.79%).³ Studies in the USA of female general surgeons who had children during training demonstrated 52% career dissatisfaction and 39% considered dropping out.⁴ Reported barriers included difficulty arranging maternity leave, problems with flexible training, and stigma associated with pregnancy.⁴

In the UK, the British Orthopaedic Association (BOA) has published guidelines for educational supervisors and trainers supporting T&O trainees through pregnancy and is one of only two societies in the world to do so.⁵ There is also guidance from the Royal College of Surgeons (RCS) and Joint Committee on Surgical Training (JCST).^{6,7} Pregnant T&O surgeons are faced with additional occupational hazards, including ionising radiation, cement exposure, and long periods of standing, combined with the routine on-call commitments.

Studies conducted outside the UK have demonstrated that surgeons experience higher rates of infertility and obstetric complications when compared to the general population, as well as voluntarily delaying childbearing.⁸ However, there is no comparable UK study assessing this disparity particularly in the field of T&O. The aim of this cross-sectional study was to identify: 1) current attitudes and behaviours of UK female T&O surgeons towards pregnancy; 2) any barriers faced towards pregnancy with a career in T&O surgery; and 3) areas for improvement.

Methods

An anonymous 13-section online survey with adaptive answering, based on a survey by Mulcahey et al,⁹ was created using GoogleForms (Google, USA). The survey has been reported in accordance with the CHERRIES guidelines for reporting web-based surveys.¹⁰ Inclusion criteria were UK female-identifying T&O surgeons, including trainees, speciality, and associate specialist surgeons (SASs) and locally employed doctors (LEDs), fellows, and consultants (Figure 1). The survey was open (not password protected and no cookies used), and voluntary and no incentives were offered for completion. The survey was disseminated to members of the BOA and British Orthopaedic Trainees Association (BOTA) via email and promoted on social media platforms, including Instagram and Twitter. All UK training programme directors (TPDs) were contacted and asked to disseminate the survey to their female trainees. It was also shared in UK T&O WhatsApp groups. The survey was open for four weeks.

The survey design was tested and approved by all authors prior to dissemination. Information describing the scope and relevance of the study was available at the start of the survey. A factsheet was provided on submission of the survey. No personally identifiable data was collected or stored. Demographic data, including age, career stage, and location of work were collected. Data in relation to delaying

childbearing, attitudes, and timing of children in relation to T&O training was collected from all participants. Open-text questions explored the opinions and barriers perceived by female T&O surgeons. Further questions were then asked to those survey participants that had children which focused on fertility, pregnancy complications, timing of children in relation to exams, maternity leave, occupational hazards, return to work, and childcare. Only completed surveys could be submitted and subsequently analyzed. Respondents were given an email address to contact for any further discussion.

Statistical analysis

As this is a descriptive analysis of survey findings, there was no null hypothesis and no power calculations were carried out. Categorical data is presented in frequencies and percentages; continuous data is reported as mean and standard deviation. Age is reported as median and interquartile range (IQR). Data analysis was performed using Excel (Microsoft, USA).

Results

Demographics

A total of 226 UK female-identifying T&O surgeons responded to the survey. All UK regions were represented (Table I). Median age of respondents was 36 years (IQR 32 to 41). Over half of the respondents were speciality registrars (SpRs) (58%; $n = 131$), followed by consultants (34.5%; $n = 78$). Table II shows the stage of training of all respondents. Nearly two-thirds (63.4%) of deaneries had only one to two female T&O trainees per year, however, up to 40.5% of hospitals that respondents worked in had four or more female consultants. For SpRs, they reported that there was a mean of nine females per rotation (standard deviation (SD 4.6)) out of an average total of 41 trainees (SD 22.8).

Having children

A total of 99/226 (44%) respondents had at least one child, while 21/226 (9.3%) responded that they did not want children. Of those who had at least one child or were currently pregnant, 24/121 (20%) required fertility assistance, 35/121 (28.9%) had experienced a miscarriage, and 53/121 (43.8%) had experienced obstetric complications, as described in Table III. For respondents with children who were peri- or post-fellowship, having children or a desire to have children influenced fellowship choice in 41/66 (62%) of cases. A third of all respondents (75/226; 33.2%) said they would choose to have their first child during specialist training, before undertaking the FRCS exam. Fewest people would choose to have children during medical school (2/226; 0.9%) or foundation training (3/226; 1.3%). In relation to career progression specifically, 72/226 (31.9%) felt that the best time to have children was once appointed to a substantive consultant post. Only one person (0.4%) felt that fellowship was the best time to have children and three respondents (1.3%) during a locum consultant post (1.3%).

The median age for female T&O surgeons having their first child was 33 years (IQR 32 to 36; mean 33.6 (SD 3.14)). Figure 2 shows the stage of career for respondents having their first and subsequent children, and Table IV shows average length of maternity leave taken and percentage of full time equivalent when returning to work. Average length of

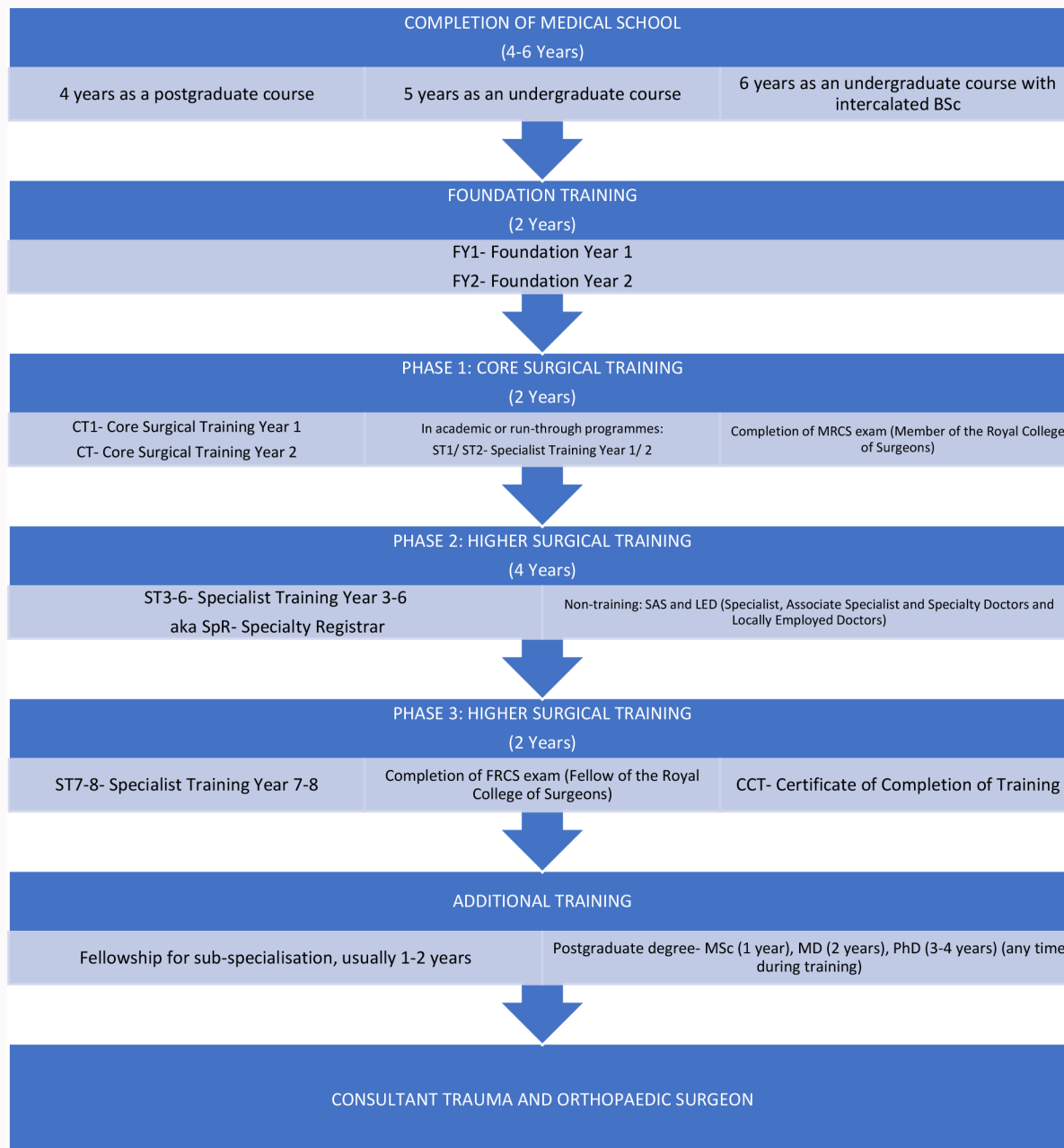


Fig. 1

Overview of typical training pathway from medical school graduation and grades of surgeons in trauma and orthopaedics in the UK. This includes two years of foundation training, two years of core surgical training, and six years of higher speciality training (FRCS exam typically taken during ST7 and ST8), although out of programme (OOP) years are not depicted in this figure.

maternity leave taken at SpR level was 8.9 months (SD 4.72) compared to 6.3 months (SD 2.52) at consultant level.

Overall, 63/226 (38%) of respondents had more than one child. Median age at second child was 35 years (IQR 34 to 37). In addition, 16/226 (7.0%) had more than two children, and median age at third child was 35 years (IQR 33.5 to 36.5). Only 6/226 (2.7%) of respondents had more than three children, with median age at fourth child being 37 years (IQR 35 to 38). One respondent had adopted a child.

A total of 86/94 (92%) respondents who had a child during specialist training would recommend having children at this stage to other colleagues, compared to 29/43 (6.7%) of respondents who had children as a consultant. When respondents with children were asked if they would change

the timing of their first child, 68/121 (56.2%) would not, 44/121 (36.4%) would have children earlier in their career, and 9/121 (7.4%) would have them later.

The reasons for these responses are shown in [Table V](#).

Priorities and perceptions

Over one-third (87/226; 38.5%) of respondents were not aware that female T&O surgeons faced increased complications during pregnancy when compared to the general population.

Nearly two-thirds (140/226; 61.9%) of respondents had experienced bias from colleagues against female T&O surgeons having children during training, from colleagues of all sexes ([Figure 3](#), [Table VI](#)).

Table I. Training programme regions of survey respondents.

Region	N (%)
East Midlands	10 (4.4)
East of England	6 (2.7)
Kent, Surrey, and Sussex	8 (3.5)
London	45 (19.9)
North East	7 (3.1)
North West	22 (9.7)
Northern Ireland	8 (3.5)
Peninsula	16 (7.1)
Scotland	27 (11.9)
Severn	13 (5.8)
Thames Valley	3 (1.3)
Wales	11 (4.9)
Wessex	9 (4)
West Midlands	12 (5.3)
Yorkshire	16 (7.1)
Not specified	12 (5.3)
No response	1 (0.4)
Total	226 (100)

Table II. Practice level of respondents.

Grade	N (%)
ST1	7 (3.1)
ST2	1 (0.4)
ST3	16 (7.1)
ST4	32 (14.2)
ST5	17 (7.5)
ST6	23 (10.2)
ST7	15 (6.6)
ST8	20 (8.8)
Fellow	13 (5.8)
Speciality and associate specialist surgeon	4 (1.8)
Consultant	78 (34.5)
Total	226 (100)

Respondents were asked to rank their current priorities in order of importance; 144/226 (64%) prioritized family (including children); career progression was ranked second by 108/226 (48%), and outside life (e.g. travel) was ranked third by 90/226 (40%).

In all, 149/226 (66%) of respondents had delayed childbearing due to a career in T&O. [Figure 4](#) shows the reasons for delaying childbearing, ranked in order of importance.

Table III. Obstetric complications reported by respondents.

Reported obstetric complications
Bleeding/haemorrhage (pre- and post-partum)
Chorioamnionitis
Chorionic haematoma
Emergency caesarean section
Fetal malposition
Gestational diabetes mellitus
Gestational hypertension
Hyperemesis gravidarum
Intrauterine growth restriction
Iron deficiency anaemia
Miscarriage
Obstetric cholestasis
Placenta previa
Placental abruption
Polyhydramnios
Preeclampsia
Preterm labour
Preterm premature rupture of membranes
Proteinuria
Shoulder dystocia
Supraventricular tachycardia
Thrombocytopenia

Working while pregnant

In total, 69/121 (57%) of respondents had their first child before taking the FRCS exam. Overall, 68/84 (81%) who had taken their FRCS part 1 and 69/78 (88%) who had completed FRCS part 2 passed at the first attempt. A total of 83/121 (69%) came off the on-call rota prior to maternity leave, but nearly a third (40/121; 33.1%) were not aware that pregnant trainees can come off the on-call rota from 28 weeks of pregnancy onwards. The majority of respondents continued to be involved in T&O operations involving ionising radiation during pregnancy; 86/121 (71.1%) made adaptations, 26/121 (21.5%) made no adaptations, and 9/121 (7.4%) chose not to participate in operations involving radiation. Only 19/121 (15.7%) chose to unscrub during the cementing stage of an arthroplasty case.

Overall, two-thirds of respondents with children felt their TPD/employer had been very (39/121; 32.2%) or somewhat (41/121; 33.9%) supportive of their pregnancy; 16/121 (13.2%) and 4/121 (3.3%) felt they were somewhat or very unsupported, respectively; and 21/121 (16.4%) were neutral.

Childcare

Half of respondents with children (61/121) used a nursery or day-care for childcare and 25/121 (20.7%) had a nanny. Help

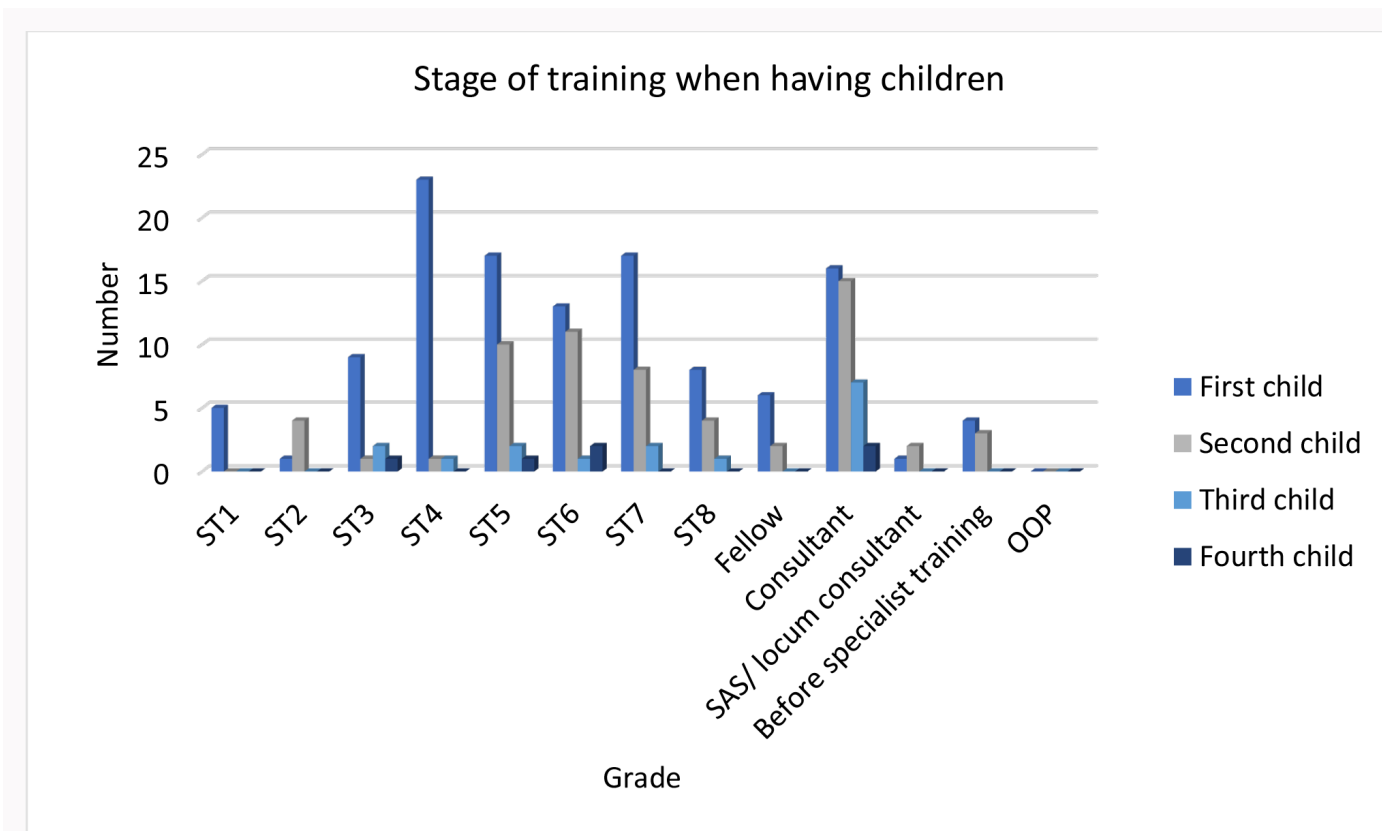


Fig. 2 Stage of training when having children. Specialist training (ST levels 1 to 8), fellow, consultant, associate specialist surgeon doctor, before specialist training, and out of programme (OOP).

Table IV. Number of respondents returning less than full-time (LTFT), mean maternity leave taken, and median percentage of full time equivalent for those returning LTFT.

Child no.	Mean maternity leave, months (SD)	Return to LTFT, n (%)	Median return to FTE, % (IQR)
1	8.5 (4.6)	48 (39.7)	80 (60 to 80)
2	N/A	24 (38.1)	80 (60 to 80)
3	7.8 (3.7)	7 (43.8)	75 (60 to 80)
4	7.3 (4.6)	2 (33.3)	70 (60 to 80)

FTE, full-time equivalent; IQR, interquartile range; LTFT, less than full-time; N/A, not applicable; SD, standard deviation.

from family (12/121; 9.9%) or partner (11/121; 9.1%) were less frequent childcare options. Only 28/121 (23.1%) of workplaces definitely provided on-site childcare for surgeons (24/121 (19.8%) were unsure), and 69/121 (57%) did not have childcare options at work. In all, 69/121 (57.0%) responded that they would use childcare at work if it existed.

Discussion

In May 2021, there were a total of 593 female T&O surgeons at SpR level and above (including SAS and LED grades) in the UK.² This survey had 226 respondents, which is an estimated 38.1% of the female headcount in T&O and the largest number

of respondents for a survey on this topic in the UK, covering all grades and regions (deaneries). Female T&O surgeons make up only a fraction (18%) of the T&O workforce in the UK and < 10% worldwide.^{2,11} Our findings of nine female SpRs on average in each deanery of about 41 trainees are in keeping with national data that 20% of T&O SpRs in the UK are female.²

Having children influenced fellowship choice for 62% of the respondents. Many trainees apply for competitive fellowships abroad, often two to three years in advance; international centres (e.g. in Australia and Canada) are popular amongst UK trainees, with a survey in 2019 finding that up to 69% of respondents were planning an international fellowship.¹² Fellowship decisions are influenced by children/family for both male and female trainees; however, as females are often the primary caregivers, they may be less likely to leave their children for prolonged periods of time or consider relocating abroad or within the UK.¹³ In addition, a female trainee planning or experiencing pregnancy during fellowship would have to consider the impact on maternity pay and childcare if travelling abroad.

There was a discrepancy in timing between desired ideal stage to have children (specialist training, pre-FRCS) and perceived ideal stage in relation to career progression (during a substantive consultant post).

The FRCS exam is taken during phase 3 of training or at ST7 and above.¹⁴ Although most trainees passed their exams first time after having children, the additional responsibility of childcare during this period could cause trainees to delay having children until their exams

Table V. Pros and cons to having children during speciality registrar versus consultant stages, reported by respondents.

SpR	Consultant
Pros	
More support at work	No delay to training
Less responsibility at work	No exams to prepare for
Job protection (training number)	More established in career
Younger age- more energy	Job security
Secure income, maternity pay	Higher pay
Fewer obstetric complications	More autonomy/flexibility with job plan
Easier to find job cover	Less commuting
Can go less than full-time	More certainty with schedule, easier to plan
Increased fertility	
Cons	
Planning fellowship difficult	Infertility
Preparing for FRCS difficult	Feeling guilty (patients, colleagues)
Disruption to training	More responsibility (in theatre, for patients)
Difficult to regain surgical skills	First few years as consultant are difficult
Difficult to carry out on-calls	
Impact on career progression	
Extending training	
SpR, speciality registrar.	

were completed, at which stage fertility has already begun to decline significantly.¹⁵

There was a lack of knowledge surrounding increased risk of pregnancy-related complications, despite documentation in the literature.¹⁶⁻¹⁸ The high prevalence of bias towards female T&O trainees having children has also been discussed in the literature.¹ In already over-stretched systems and short-staffed departments, a female trainee taking time out for maternity leave and potentially subsequent return less than full time (LTFT) for both parents can put extra strain on a department. Their posts are often unfilled on the rota and require other doctors to provide cover on an ad-hoc basis. Often, there are negative perceptions of trainees who choose not to stay past their shift time or to take up extra sessions, despite having a family life to manage as well as a demanding career.¹⁹ A third of respondents had not felt supported by their TPD or employer during their pregnancy.

Although nearly two-thirds of respondents prioritized their family life overall, almost two-thirds had delayed childbearing and this was mostly due to personal circumstances and concerns regarding career progression. This is similar to findings by Poon et al¹⁷ from their study of 801 female T&O surgeons, showing that 53% had intentionally delayed childbearing and 52% waited until completing their

training before conceiving their first child. In the USA, there is no uniform paid parental leave guidance and an average duration of paid maternity leave for residents is 6.6 weeks.²⁰ In comparison, NHS doctors are entitled to 52 weeks of maternity leave, 39 of which are paid to some extent.²¹

Specialist training programmes often require trainees to travel to different hospitals in different directions throughout their training, which may involve long commutes or moving house. The uncertainty regarding location can be a barrier to starting a family. Long work hours and after work activities (engagement in research, teaching, and professional development) also take time away from building relationships and being in a position to start a family. The UK has one of the longest training programmes and the minimum time to complete T&O specialist training is ten years.²² Extending this by having children, going on maternity leave and potentially returning LTFT can be a significant concern for some trainees; this could be in addition to time out for research.

Nearly half of respondents had children and less than 10% did not want children; 20% required fertility assistance. The UK infertility rate is 14%, and a study in the USA of 223 female T&O surgeons found an infertility rate of 18%.^{23,24} Of our respondents, 28.9% had experienced a miscarriage, which is a higher proportion than the 20% quoted for the general population in the UK, but lower than the 38% miscarriage rate previously reported for female T&O surgeons in the literature.^{17,25} Over 40% had experienced complications with their pregnancy, in keeping with Hamilton et al's¹⁶ findings that T&O surgeons working long hours had increased risk of pre-term labour.

Not all trainees were aware of when they could stop on-call shifts during pregnancy, and a large number continued to operate during procedures with potential hazard exposure. The employer is legally required to undertake a risk assessment with pregnant doctors to reduce identified risks. In reality, the pregnant surgeon often suggests how they manage their work during pregnancy and many pregnant surgeons will continue to work until the end of their pregnancy to maximize financial gain and time off after the birth of their child. Risks of ionizing radiation for surgeons have not been well documented, but the BOA has recently published new guidance with the aim of improving overall awareness of this topic.^{26,27}

Having children

The mean age of the respondents having their first child was 33.6 years, which is higher in comparison to the general population average of 31 years.²⁸ Female T&O surgeons are starting families during a wide range of stages (Figure 2). Early stages, before training, during fellowship, and during locum consultant posts are the least popular times to have children. This can be attributed to having less stability in terms of location and job security particularly with respect to maternity pay. The duration of maternity leave taken did vary but seven to nine months was most common across all grades (Table IV). Over 50% of respondents returned to work full-time after their maternity leave (Table IV). More SpRs were happy with the timing of having their children than consultants, and more respondents would have chosen to have children earlier rather than later. There are advantages and disadvantages to both, including fertility, flexibility, stability, income and

Bias from colleagues

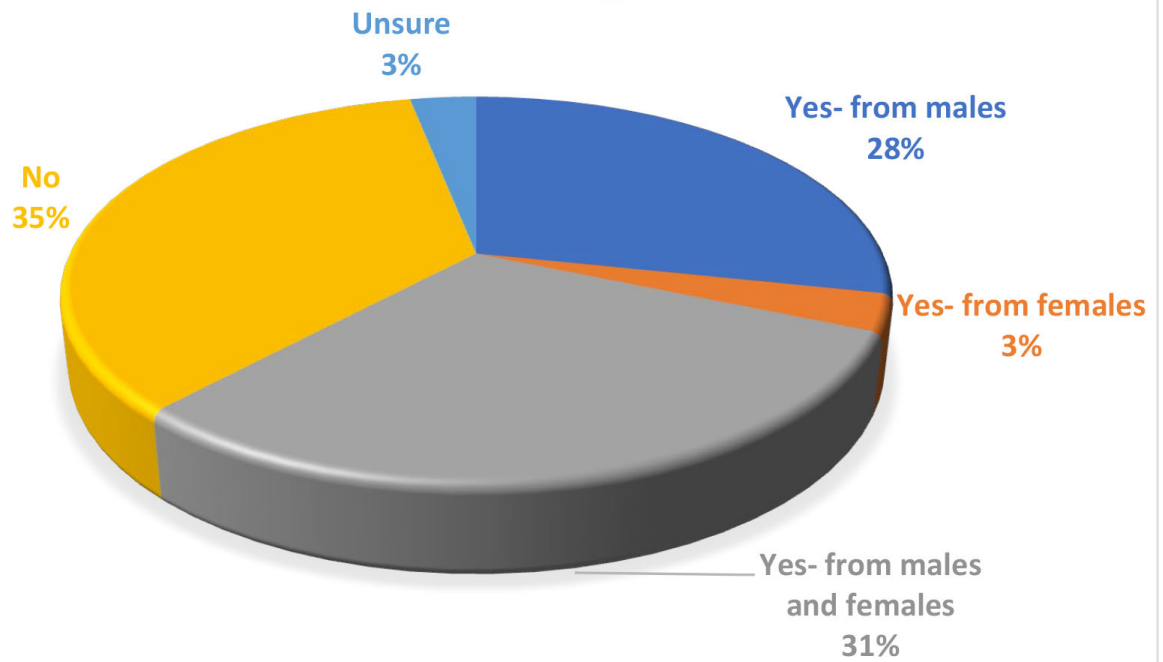


Fig. 3

Responses to question: 'Have you felt any bias from your colleagues against female orthopaedic surgeons having children during training?' Only 35% had not experienced any bias; 28% had experienced bias from males only, 3% from females only and 31% from both male and female colleagues; 3% were unsure.

Table VI. Bias experienced from colleagues towards female T&O surgeons having children during training.

Bias experienced (conscious and unconscious)	Solution
Onus on maternity leave	Actively encourage and promote shared parental leave
LTFT training childcare days are wrongly considered as 'flexible days off'	Better understanding and awareness in the workplace of parental responsibilities
Incorrect monthly pay due to lack of knowledge on working LTFT by administrators	Better understanding and awareness on LTFT for administrators
Negative perceptions around flexible working	Better understanding and awareness in the workplace of parental responsibilities; job sharing contracts
Perceived lack of commitment to role	Better understanding and awareness in the workplace of parental struggles and responsibilities
Lack of support when returning to work	Better planning and discussion for tailored return to work advice; continued support on return
Lack of time to complete research and projects	Build administration and research/ professional development time into rotas so that surgeons are not expected to complete these in their free time
Timing of FRCS exam	Allow trainees to sit the exam earlier in their career so that it does not conflict with childcare responsibilities
Lack of childcare support	Offer on-site/ flexible childcare options to allow a more flexible return to work

LTFT, less than full time; T&O, trauma and orthopaedics.

level of responsibility at work (Table V). During time out, for example for maternity leave, training is paused at that stage and restarts on return to work; i.e. training time is prolonged.

Returning to training in a less than full time capacity further prolongs training.

Reasons to delay childbearing

- Concerned about negative perceptions
- Concerned about occupational hazards
- Concerned about prolonging training
- Personal circumstances

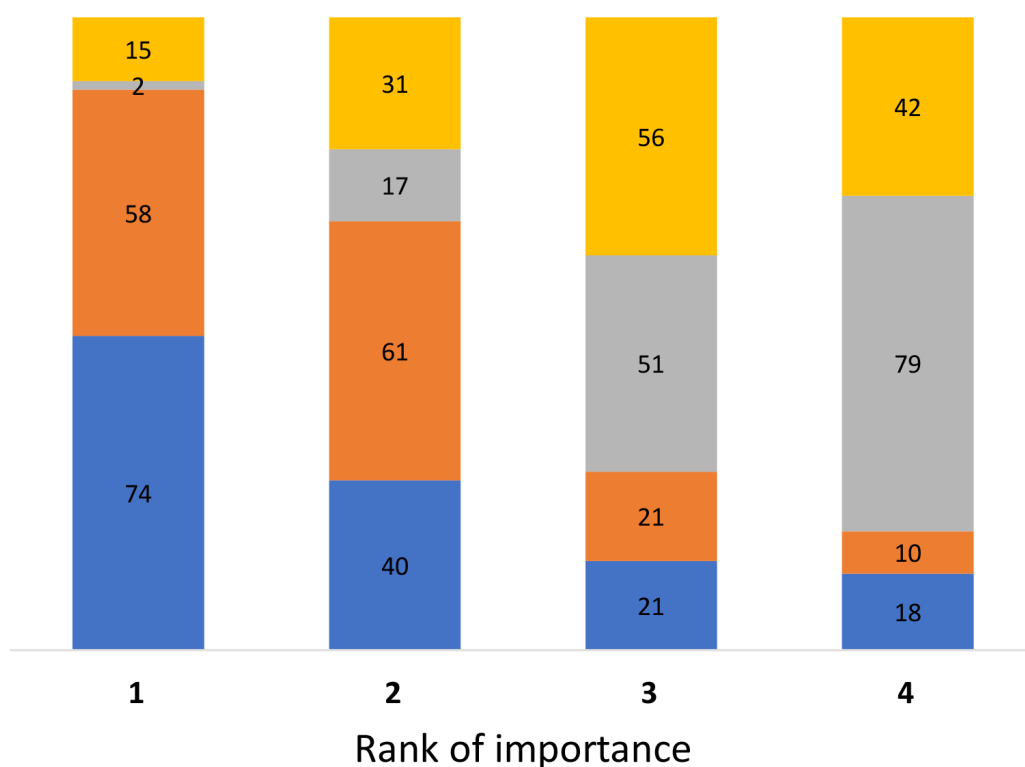


Fig. 4

Figure showing rank of importance for reasons to delay childbearing, '1' being most important and '4' least important. Reasons include personal circumstances, and concerns about prolonging training, occupational hazards, and negative perceptions.

Most respondents used nursery/day-care or a nanny for childcare. Over half of workplaces did not provide childcare options, despite 57% of respondents stating they would use it if it existed. Childcare is a personal preference, but is also dependent on support network and available funds. Due to the nature of competitive training programmes, historical training post allocations and a large service commitment within training posts, trainees often move away from their parental home and therefore have less family around for childcare support. Early starts and late finishes at work mean that any day-care options need to be flexible for drop-off and collection times. Childcare is consistently raised as a challenge for doctors working in surgical specialties.²⁹ Childcare at work can provide an element of convenience for surgeons for whom other options are not accessible; this option may also help with childcare costs if salary sacrifice schemes are offered.

Strengths and limitations

This survey is the first of its kind covering the subject of pregnancy among female T&O surgeons in the UK and the response rate of 226 is comparable to similar studies in other countries.^{16,23,30} The survey utilizes the responses of the participants to draw conclusions. Some regions or hospitals may not be represented by the study, introducing bias. As with all surveys, those who responded may have had especially positive or negative experiences which they wished to convey. Cookies and passwords were not used for responses; therefore, there is no way to validate that the respondent was a female UK T&O surgeon. One question regarding length of maternity leave after having a second child was missed out of the survey and could not be reported in the results (Table IV).

A large quantity of qualitative data has been collected from this survey which has not been analyzed extensively in

this report. Further qualitative analysis of the responses and further guided discussions and forums would be valuable for guiding change in this area.

In conclusion, a large proportion of female T&O surgeons want and indeed have children. T&O surgeons in the UK delay childbearing, have experienced bias, have children later, and have high rates of infertility and miscarriage when compared to the general population. The information from this study can help support female T&O surgeons with decision-making, as well as raising awareness of pregnancy/parental leave/childcare for TPDs and employers. It should be used to assist with workforce planning.

Further necessary steps to support female T&O surgeons having families include:

1. Increased education on fertility, safety in pregnancy during surgery and workplace adaptations available (stopping on-calls, maternity leave, childcare) for female surgeons and TPDs.
2. Improving the culture to create an environment that empowers and supports the female orthopaedic surgeon through pregnancy and parenthood.
3. Highlighting the potential benefits of shared parental leave.
4. Improved flexible working options and better organization of rotas for LTFT colleagues/parental leave.
5. Realistic workforce planning, including increasing training post numbers and reducing the size of geographical rotations. This would acknowledge that maternity leave, shared parental leave, and LTFT effectively reduce the number of trainees available to deliver service.
6. Recognition of the negative impact of lengthy commutes on both parents.

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