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LAY SUMMARY

When a person is diagnosed with cancer, they may wish to consider undergoing fertility preservation procedures. These procedures give patients a chance to have their own biological child after completing cancer treatment. However, research suggests that cancer patients who have a poor prognosis are less likely to be offered fertility preservation treatment. In this paper, we consider the ethical implications of offering (or not) fertility preservation to this patient group, including using their sperm or eggs to reproduce after their death. We conclude that fertility preservation treatments should be offered to all cancer patients who might benefit from it, and we outline the many ways that benefit from this treatment can be gained. The decision to withhold the offer of fertility preservation treatment should be made between the patient's clinician and their wider care team. They must be able to provide good reasons to explain why it was withheld.

Reproduction in life and death: should cancer patients with a poor prognosis be offered fertility preservation interventions?

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ABSTRACT

In the context of a cancer diagnosis, fertility preservation interventions are used to mitigate the potential impact of gonadotoxic cancer treatment upon fertility. They provide patients with cancer the option to freeze their reproductive material to have their own biological child following treatment. The evidence suggests some clinicians are less likely to have fertility preservation discussions with patients who have an aggressive or metastatic cancer which has a poor prognosis. Although this is contrary to current policy recommendations, there is a lack of guidance relating to offering fertility preservation in the context of a poor prognosis to support clinicians. Controversy surrounds posthumous reproduction, and whether the wishes of the cancer patient, when living and deceased should take precedence over others' wellbeing. We consider the question of whether cancer patients with a poor prognosis should be offered fertility preservation from an ethics perspective. We structure the paper around key arguments to which multiple ethical principles might pertain, first establishing a central argument in favour of offering fertility preservation based on respect for autonomy, before exploring counterarguments. We conclude by proposing that a defeasible assumption should be adopted in favour of offering fertility preservation to *all* cancer patients who might benefit from it. It is important to recognise that patients could benefit from fertility preservation in many ways, and these are not limited to having a parenting experience. The burden of proof rests on the clinician in collaboration with their multi-disciplinary team, to show that there are good grounds for withholding the offer.

LAY SUMMARY

When a person is diagnosed with cancer, they may wish to consider undergoing fertility preservation procedures. These procedures give patients a chance to have their own biological child after completing cancer treatment. However, research suggests that cancer patients who have a poor prognosis are less likely to be offered fertility preservation treatment. In this paper, we consider the ethical implications of offering (or not) fertility preservation to this patient group, including using their sperm or eggs to reproduce after their death. We conclude that fertility preservation treatments should be offered to all cancer patients who might benefit from it, and we outline the many ways that benefit from this treatment can be gained. The decision to withhold the offer of fertility preservation treatment should be made between the patient's

clinician and their wider care team. They must be able to provide good reasons to explain why it was withheld.

Key words

fertility preservation, poor prognosis, cancer, posthumous, ethics, reproduction

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INTRODUCTION

Cancer treatments (e.g., chemotherapy, radiotherapy and some surgery) can result in loss of fertility - denying cancer patients the opportunity to have their own biological child in the future. Loss of fertility does not affect all patients treated for cancer (ESHRE, 2020), but predicting who will be affected is challenging because cancer treatments variably affect reproductive function depending on the patient's age, cancer diagnosis, and specific treatment regimen.

Procedures are now available which, if undertaken before cancer treatment, may preserve fertility (such as egg, embryo, sperm and ovarian/testicular tissue cryopreservation). Given that loss of fertility is often reported by cancer patients to be one of the most distressing side-effects of cancer treatment (Peate et al., 2009), fertility preservation (FP) options can provide much needed hope at a time when they are coping with significant uncertainty.

Crucially, the value of FP procedures lies in their ability to preserve the opportunity to have, and to then parent, genetically related children, and the best chances of success for these procedures are when they are offered prior to commencing cancer treatment. Consequently, at cancer diagnosis, international guidelines recommend that cancer teams should discuss the impact of cancer treatment on future fertility with the patient (National Institute of Health and Care Excellence 2017; ESHRE, 2020; Loren et al., 2013; Lambertini et al., 2020; Yasmin et al., 2018). Ensuring that patients are supported to make the right FP decision for them is essential, because patients surviving cancer will live with the consequences of the choices made about their fertility for the rest of their lives, so it is vital that they are supported to make the right FP decision for them.

Some cancer patients will have a poor prognosis, perhaps the result of a cancer which responds poorly to treatment, or one with widespread metastasises to other parts of the body, and there is little chance of cure. In these circumstances, the requirement to discuss FP options seems less clear, as patients in this position are very unlikely to be able to use their stored material to have and raise children.

Instead, it may be possible to use posthumous assisted reproduction (PAR), whereby cryopreserved eggs, embryos or sperm are used after the death of an individual for the purpose of expanding a family (Lawson et al., 2016). The notion of posthumous reproduction was first proposed by Montegazza in 1866, who first discovered that sperm could be frozen and suggested that women whose husbands may have died during war could benefit from this discovery (Elliot, 2004).

In these circumstances, where posthumous reproduction is the only likely option, we consider the question of whether a FP discussion should take place and whether cancer patients with a very poor prognosis should be offered fertility preservation.

Current available guidance for clinical teams is unclear on this question. Whilst there appears to be a consensus that cancer teams should discuss the impact of cancer treatment on future fertility with the patient at diagnosis, some professional and regulatory bodies such as The American Society of Clinical Oncology (Lee et al., 2006) and the American Society for Reproductive Medicine (2005) state that this should also apply to those with a poor prognosis, and discussion should take place irrespective of prognosis in female cancer patients of reproductive age (Munoz et al., 2016, Loren et al., 2013, Peccatori et al., 2013, Lambertini et al., 2016). Others such as the NICE Clinical guideline [CG156] in the UK and ESHRE recommendations (2020) do not. However, the NICE guideline does state that when deciding to *offer* FP to people diagnosed with cancer, cancer teams should take into account factors including diagnosis and prognosis, and the viability of stored or post-thawed material. This distinction might reflect differences between publicly vs self-funded health systems rather than different ethical commitments, but it nonetheless provides evidence of varied positions and practices that warrant ethical scrutiny.

To provide that ethical scrutiny, we first consider what the *purpose* of FP is, which we then use as backdrop against which to consider various arguments for or against offering FP to late stage or prognostically poor cancer patients.

What is the purpose and process of fertility preservation?

It is important, at the outset, to consider what the purpose of FP treatment in the context of a cancer diagnosis is, because this allows us to clearly articulate the goods that purportedly flow from it. Whilst our aim is not to undertake a simple consequentialist analysis that balances goods against harms, it is nonetheless important to have a clear sense of how people benefit from FP and why it is valuable to them.

It seems that there are two kinds of goods that can flow from FP. The first is the good of being able to reproduce genetically, and the second is the ability to be a parent to those genetically related children. The former is independent of the latter, by which we mean it is possible to reproduce genetically without having the experience of parenting the resulting children. In contrast, the latter is dependent on the former. One cannot have the good of parenting genetically related children without first reproducing genetically.

We contend that the purpose of FP, in the context of cancer treatment, is to allow people to experience the second good. The benefit derived from offering FP to patients undergoing cancer treatment is that it leaves open a future where they could be a parent to their genetic offspring. This seems clear for two reasons. First, if we were not concerned with preserving the opportunity to parent *genetic* offspring specifically, we would not be concerned about fertility preservation at all. We would simply reassure patients that notwithstanding the likely loss of fertility, they will have the opportunity to parent non-genetically related children through gamete donation or adoption. Second, although it is possible to simply preserve reproductive material so that it might be used at some point in the future by *someone,* which would be enough to actuate the first good, the fact that people tend to want to preserve their material for their *own* use, rather than to donate, suggests that they do not simply want to reproduce, but that they are looking for a parenting experience. That said, we feel it is reasonable to say that the primary aim of FP is to preserve a patient's ability to experience being a parent to their genetically related child, as opposed to merely being a genetic progenitor in the absence of a parenting experience. Thus this includes the possibility of using surrogacy where, while another person carries the pregnancy, the original patient has both a genetically related child and a parenting experience.

Of course, in the context of an adult patient with a partner, the aim of FP can also be to preserve the opportunity for that partner to have the experience of being a parent to children genetically related to the patient and the surviving partner. Consistent with what we have said above, we contend that the good derived from this is that of enabling the surviving partner to have a parenting relationship in a way that connects them to the deceased patient, rather than the good of simply having genetically reproduced (which could be achieved by donation to a stranger).

Having now established that the purpose of FP is not simply to facilitate genetic reproduction *qua* genetic reproduction, but rather to preserve the option of having a parenting experience with one's genetic progeny for either oneself or one's partner, we will go on to consider arguments for and against routinely offering FP.

Respecting autonomy

Respecting autonomy is a cornerstone of Western medical ethics, and this requires us to respect a person's right to make decisions for themselves, including about their medical care. Respect for autonomy does not mean we must do whatever people want, but that we take their wishes seriously and allow them to choose when a choice is available. In order to act autonomously, people need to be sufficiently informed about what their options are and the likely consequences of decision options - a fundamental prerequisite for ensuring informed consent.

Increasingly, patients (including cancer patients) expect to participate and be involved in their treatment decisions (Brietsameter, 2010; Siminoff and Thomson, 2010). Shared decision-making is a process whereby clinicians share information about treatment options, empowering the patient to actively decide based on their preferences (Elwyn et al., 2012) and this process is considered a quality benchmark for the delivery of dignified care (Department of Health, 2012; Coulter and Collins, 2011).

As such, in order to respect autonomy, a high-quality fertility discussion in oncology is critical to ensure that cancer patients are sufficiently informed about the potential impact of cancer upon fertility. This will support them to make autonomous, fully informed decisions that give them control over their reproductive future, before giving consent to any subsequent intervention.

Hudson et al. (2016) have noted that the need to respect patient's freedom of thought, intention and action while delivering healthcare, seems to suggest that everyone should be offered FP. This seems plausible. An autonomy-based argument can clearly be made for having a FP conversation with every patient or the patient's proxy decision maker (i.e. a parent) if they are not able to make a decision by virtue of their age, or a best interest decision made in accordance with the Mental Capacity Act (2005) if they are an adult who is otherwise incapacitous. Not to raise the issue of fertility loss, and inform patients of FP options, would be a *de facto* deception by omission and this is an insult to autonomy.

Hudson et al. (2016) do sound word of caution about drawing this conclusion, however, asking whether cancer patients with a poor prognosis are really able to make autonomous decisions? For example, the extent to which cancer patients can actually make informed decisions regarding post-humous reproduction PAR has been debated, as a result of the time pressure needed to make a FP decision and emotional and cognitive factors which may inhibit the ability to retain information (Lawson et al., 2015). In our view, whilst it is of course possible that some patients in this position will not have the capacity to make a complex future looking decision about their fertility, capacity is person and decision specific, and no blanket assumption can be made.

That said, although there is a strong prima facie argument for respecting autonomy by giving (capacitous) patients the option of FP, various studies suggest that doctors aren't providing all patients with information about FP (Meyer and Farrell, 2015). Many healthcare professionals report a decreased likelihood of initiating discussions related to FP with patients who have a poor prognosis. Poor prognosis has been cited as a major barrier for talking about FP with patients by 66.9% of oncologists (Zhang et al., 2020), with other studies citing that over 50% of oncologists state that a patient's poor prognosis may dissuade them from discussing FP (Sallem et al., 2018; Forman et al., 2009). Comparable findings have been reported in other studies, with 41%-88% of clinicians citing poor prognosis as a factor that would either influence FP discussions or lead them to not offer the option to patients (Chung et al., 2017; Adams et al., 2013; Louwé et al., 2013; Collins et al., 2011). Similarly, a survey of paediatric oncologists' attitudes and practices toward FP in adolescents reported that a patient having a poor survival prognosis was one of three most likely reasons for the physician to not recommend sperm banking (Köhler et al., 2011).

Quinn et al. (2009) reported that the majority of oncologists included in their research do not discuss FP with patients with a poor prognosis. One oncologist reported that they experienced discomfort at the thought of talking about "future babies" with a patient that is unlikely to be alive within months. The authors concluded that although guidelines suggest healthcare professionals should discuss FP with all patients, the majority appear to not follow these guidelines. Takeuchi et al. (2017) observed an internal conflict in clinicians regarding whether, and when, it was appropriate to discuss FP with patients with a poor prognosis.

This evidence about clinician practice tallies with studies reporting patient experience, with Jones et al. (2022) reporting patients saying they were not informed about or offered FP at cancer diagnosis. One explanation for this may be that clinician preferences can be limited by 'implicit persuasion'. This is a process whereby clinicians subconsciously place greater emphasis on the treatment options they consider to be better suited to the patient, a phenomenon frequently observed in oncology settings (Englehardt et al., 2016). When an oncologist's goal is to save lives and treat the cancer, they may see that as taking precedence and discussion about FP a distraction that could delay treatment and thus worsen prognosis at the detriment to the patient (Hudson et al., 2016). This may be a conscious omission (e.g. due to the pressure to initiate cancer treatment), or an unconscious bias. The former could be either an unethical insult to autonomy or an act of beneficent paternalism, whereas the latter would seem to be a form of negligent or unprincipled omission.

Whilst some clinicians may take a conscious position against offering FP, or simply not think to mention it, a number of studies have reported that many healthcare professionals take a neutral stance or have a mixed responses to fertility issues in cancer patients with a poor prognosis. Quinn et al. (2012)'s findings revealed that 45.2% of oncologists had a neutral stance on the issue of patients with a poor prognosis pursuing FP. When questioned about posthumous parenting, 16.2% of oncologists expressed their support of this, whilst the majority (51.5%) did not have an opinion on the matter. Oncologists who were aware of the American Society of Clinical Oncology guidelines (which highlight the importance of patient education and acknowledge the need for oncologists to provide fertility-related information) were more likely to discuss fertility issues with patients with a poor prognosis. Rosenberg et al. (2017) found that 58% of oncologists believed that patients with a poor prognosis should not pursue FP. However, overall, this belief did not appear to dissuade the majority of oncologists from discussing fertility issues with this patient group. When asked whether they discuss fertility issues with this patient group, 84% of oncologists reported that they either always, or usually, had these discussions (43% and 41%, respectively), whilst 15% rarely did and 1% never had these discussions.

Some studies suggest that nurses may be more inclined to discuss FP with all patients, regardless of prognosis. In a study by Vadaparampil et al. (2007), paediatric oncology nurses were asked about discussing FP options with patients. The majority (68%) of nurses stated that a patient's poor prognosis would not affect the discussion being carried out. Just over one quarter (28%) of nurses stated that they would be less likely to discuss FP options with this group of patients, and 4% stated that a patient's poor prognosis would make them more likely to discuss FP options. Comparable findings were observed by Krouwel et al. (2017), who carried out a survey study with 421 oncology nurses to investigate their knowledge about FP and possible barriers to discussions of this topic. When asked to rate their agreement with the statement: *"I would tend not to discuss FP with a patient because the patient has poor prognosis"*, over half of nurses (55.2%) strongly disagreed with this statement. Over a quarter (28.4%) of participants stated that they neither agreed nor disagreed with this statement, with 16.4% strongly agreeing with the statement. Similarly, in a study comparing nurses' views on FP in patients with a poor prognosis between 2006 and 2005 (Clayton et al., 2008), regardless of the survey year, the majority of nurses reported that a poor prognosis would not affect the likelihood of FP discussions. The number of nurses reporting that FP discussions were more likely for patients with a poor prognosis also increased from 2005 (5%) to 2006 (22%), in addition to a slight decrease in the number of nurses reporting that they would be less likely to discuss FP with patients with a poor prognosis (this figure was 27% in 2006 and 28% in 2005). However, King et al. (2008) reported that the odds of a patient surviving was a factor that determined whether nurses discussed FP with their patients.

What we can take from this is that there is mixed practice, but whereas the clinicians who always offer FP will always be respecting autonomy, those who never or only sometimes do seem to be acting, at least *prima facie*, unethically, in light of the strong autonomy argument outlined above. The question, then, is whether these data evidence an ethical failure on the part of many clinicians, or whether this variation in practice should give us pause to ask whether there are valid reasons that override the *prima facie* autonomy argument. It is the latter possibility that we will now explore.

Justice and Opportunity Cost

The argument from justice and opportunity cost is concerned with resource prioritisation, and might contend that FP, in cases where it will not lead to a parenting experience, is futile and therefore not a good use of resource. Crystalising this more generally for a publicly funded health system, where treatment prioritisation decisions will be based on cost-effectiveness metrics, this is because the decision to fund FP where the prognosis is poor cannot be justified at a societal level as a reasonable distribution of scare resources. It can also plausibly be argued that having genetically related children, whilst very important to many people, is not a need but rather a desire (McTernan, 2015). Even without taking a position on that, however, it seems that FP cannot achieve its aims unless it has a chance of resulting in a parenting experience -

which it does not if the prognosis is very poor, and the patient is unlikely to survive to be a parent. This argument would, then, suggest that FP should not be offered to patients where FP will not result in a meaningful parenting experience for either them or their partner – and so would rule out FP for children and single adults who are unlikely to survive to become parents.

This perhaps gives us reason to revisit our previous claims about the purpose of FP. If we are going to rule out FP for some patients on the basis of futility, we ought to be sure that there are not other reasons that might justify providing it, even when a parenting experience cannot be achieved.

Hope and Imagined Futures

There are two linked arguments to consider here, one centred around FP providing hope for a future, and the other around an imagined future as a parent.

Hope for a future

It is well evidenced that the experience of infertility can lead to distress which can influence the individual emotionally in the short-term, and also their sense of identity and expectations for the future (Letherby, 1999). Franklin (2022) has suggested that IVF and its related technologies are ‘hope technologies’, because they offer a seductive techno-solution to the enigmatic problem of infertility, and in this context, clinicians become providers of hope. It can be argued that for cancer patients with a poor prognosis, FP treatments, which will often involve assisted reproduction techniques, are also hope technologies. Hope has also been conceptualised and operationalised by Snyder (1995), who contends that its existence is essential as a psychological coping strategy, and it could be argued that everything that can be done to better support poor prognosis patients at this time should be done. However, cognitive rules which govern the appropriateness of hope include such criteria as the goal being under some control and at the mid-range in terms of probability (Averill et al., 2012).

When the prognosis is good, it is not contentious to assume that offering FP treatment is appropriate because it is nurturing realistic hope of future parenthood. In contrast, where patients have a poor prognosis, where even the probability of using the stored material is low (yet alone success rates from any subsequent IVF/surgery), it may be deemed that nurturing hope by offering procedures, in these circumstances, is considered inappropriate.

Furthermore, the act of offering FP to a patient with a very poor prognosis might itself offer unrealistic hope of survival, and may be interpreted as saying that there is good chance of living to become a parent – because why offer it otherwise? Indeed, Vadaparampil et al. (2008) found in their qualitative study that many of the 24 paediatric oncologists described how just mentioning the need for FP was seen as a sign of hope for patients and families.

The offer of FP, then, essentially becomes an offer of hope for a future which is false hope. It may be that in some cases hope, false or not, can provide benefit, and so becomes a benevolent lie – but in other cases giving false hope will be harmful, leading to a loss of trust and increased trauma when the falsehood becomes apparent. The potential harm arising from false hope exposed might be amplified if the retrieval intervention was burdensome to the patient, and the wrong amplified if it was costly to the health service or patient (if self-funded).

As such, we feel that offering FP to provide false hope as a therapeutic intervention is highly problematic, akin to a lie. Such a benevolent lie might on occasion be justified but would be the exception rather than the norm. However, it may be possible for a patient to benefit from an imagined future as a parent, even in the knowledge that they will never become one.

There is one further important argument to make here. It could be argued that the speed of medical progress is high; so that what is an incurable cancer today may be treatable tomorrow. Furthermore, clinical judgement is fallible and patients who are believed to be terminal may not be. This could lead to the argument that we should offer FP treatment to everyone because a) the terminal diagnosis may be wrong, and b) the currently terminally ill patients may end up surviving due to advances in medical treatments. In both cases, the surviving patients will lose their ability to reproduce if not offered FP. Therefore, not offering FP to a patient due to their poor prognosis may not be justified. Some patients may survive and deeply regret their lost fertility, while those who do not survive and have their fertility preserved are no worse off.

This argument has some merit, but it is grounded in the assumption that it is preferable to provide a costly service to ensure that no-one might miss an opportunity to parent, and it is not clear that this is a proportionate or justifiable response, especially when the potential benefit of a live birth is not guaranteed. The possibility of diagnostic error, or the possibility that cure may be around the corner, is not, in our opinion, enough to offset entirely the problems we have outlined. Rather, the possibility and likelihood of both would (and we suggest usually would) be routinely factored into prognostication and therefore into the decision about whether to offer FP.

Imagined future as a parent

One reason sometimes cited for pursuing FP when diagnosed with a cancer with a poor prognosis, is the desire for a ‘genetic legacy’ (Hudson et al., 2016). As mentioned above, FP can result in the production of an offspring that can continue the cancer patient’s bloodline through the process of post-humous reproduction (Quinn et al., 2012). There is some evidence to suggest that the public view PAR favourably (Barton et al., 2012; Hans and Dooley, 2014), although PAR may be viewed negatively by oncologists when it comes to teenage and young adult and paediatric cancer patients (Quinn and Vadaparampil, 2011) and a therefore a barrier to a FP discussion.

The argument from imagined futures is different to an argument from genetic legacy. As mentioned above, there is reason to be sceptical about a genetic legacy motivation purely because people exploring FP do not tend to do so with the aim of donating their material for just anyone to reproduce with (which would satisfy the need for genetic legacy), but for either their own use or the use of someone they already have a relationship with. The argument from imagined futures, instead, is based on the good that might come from the dying cancer patient, who knows they will never have a parenting experience, taking comfort in imagining their future child. For those patients where future parenthood had always been part of their sense of identity and long-term goals and, then the comfort gained from taking concrete steps that allow them to vividly imagine the existence of their child, and a parent-child relationship, may in itself be enough to justify offering FP even to patients who know and understand they will certainly not survive to parent.

This imagining might also include imagining a future in which their partner and child are flourishing and getting comfort from each other, which leads to the argument from gifting.

Gifting

Here, a cancer patient might see FP as a way to gift the opportunity to become a parent to the partner who will survive them, and with whom they may have planned to have children. This may be linked to the argument from imagined futures, but it need not be. It may simply be an act of generosity, where they wish to gift something to someone they love, even though they will never see or experience the result – and there seems little to object to ethically in such an act.

Something that ought to be considered in light of both of these arguments however, is the pressure that cancer patients may feel under to act as though they value reproduction, and engage with FP simply to please others because they feel it is expected of them. We live in a pronatalist society, where reproduction is the norm (Greil et al., 2011), and in which people are more often required to explain their decision not to have children than their decision to have them. Indeed, the act of simply offering FP is enough to suggest that it is important to preserve fertility. In this context, where people may feel under pressure to 'gift' their reproductive tissue or act as if the thought of having children brings them comfort, it is important that if and when FP is raised, it is presented as a genuinely neutral choice.

So far, we have considered the argument from autonomy, which gives us good reason to offer FP to everyone, followed by the argument from justice and opportunity cost that suggests it would be justifiable to not offer FP to patients with poor prognosis because they would never experience the goods of being a parent. We then considered two arguments, the argument from imagined futures (including hope) and the argument from gifting, which support the idea that patients may nonetheless wish to consider FP for reasons other than having a parenting experience themselves. These latter two argument do, however, appear to limit the scope of to whom FP should be offered, to include cancer patients who have a partner to whom they wish to give the gift of becoming a parent, or anyone who would be comforted by imagining a relationship with their future children (even if they will not experience it). This would seem to exclude, however, in all cases, child patients, who would not have a partner to gift to, and seem very unlikely to be able to imagine a parental relationship and gain comfort from it.

This exclusion of children with poor prognosis from FP might be supported by other arguments, notably the need to protect them from undergoing interventions that will not benefit them, and which they might consent to undertake in order to please others, because they think they ought to do it (see above comment about pronatalism).

Essentially, there are good reasons to think that FP can and should be offered to patients with poor prognosis, but only when they have the capacity to benefit in some way. In the absence of that capacity to benefit, there is little justification for offering FP and indeed given the risk of the offer itself being pressuring there are prima facie reasons not to offer it.

So far, the arguments we have considered have been patient focussed, and it is worth briefly considering some wider arguments that could impact on the summary conclusion outlined above.

The welfare of the subsequent child

Arguments based on the welfare of the child are sometimes made to either support or oppose FP in this context. We do not find any of them convincing, and so will outline them only briefly for completeness.

First, it might be argued that FP should not be offered to any patient with a poor prognosis because any resultant child will be harmed by not having one of its parents. This argument can be expressed in different ways. Hudson et al. (2016) and Quinn et al. (2012) note that there could be economic and social harms to a child raised without one parent. Taking a different line, Lawson et al. (2016) have suggested children conceived via posthumous reproduction can be compared to 'replacement children', a term used by researchers to describe children who are born following the death of an older sibling and may therefore be placed under unreasonable pressure to be a good replacement.

We would resist these arguments. First, they speculate about necessary harm to children raised in one parent families, which is not corroborated by evidence. Studies have highlighted that children raised to single mothers through donor insemination display fewer emotional and behavioural difficulties than those raised by married couples who have used donor insemination (Murray and Golombok, 2005), in addition to solo women reporting higher education levels, higher income professions, and equally or higher perceived social support from friends and family in comparison to cohabiting women awaiting fertility treatment (Pettersson et al., 2023). Second, it problematically assumes that the surviving partner would never find another partner who would be a step-parent or that they will themselves be an unfit parent. Third, it assumes that a life with only one parent is not only sub-optimal but is a life not worth living – which seems very problematic and would be contested by many people so raised. A longitudinal study exploring changing family dynamics in over 27,800 single parent households reported no evidence of a negative impact from living in a one parent household on children's wellbeing, with children reporting equally high, or higher, scores in various measures of wellbeing compared to those who have always lived in a two parent household (Rabindrakumar, 2018). Furthermore, if there is genuine concern about child welfare linked to financial and home situations, then there should be financial and welfare thresholds for all people having children – not only where assistance is needed. We therefore dismiss this concern, and note that the ASRM guidelines state that concerns about the welfare of the offspring are not sufficient cause for denying FP (The Ethics Committee of the American Society for Reproductive Medicine, 2005).

Second, it might be argued that by not offering FP, possible children are harmed by not being brought into existence. We raise this only to dismiss it quickly, as it does not seem feasible that we could consider harm being affected to those who are never brought into existence, as there is no subject that could be harmed.

The welfare of the partner

Tremellen and Savulescu (2015) note that, in the context of posthumous reproduction, there could be implications for the welfare and quality of life of the partner, specifically in terms of raising a child in grief. Hudson et al. (2016) also consider this, noting that:

> *"...research is needed to explore the long-term impact on widowed partners and their offspring. Partners in this precarious position should receive counselling and support during this decision-making process."*

There are also the general and ubiquitous challenges, both financial and emotional issues of single parenting. One immediate response is to note that a surviving partner is under no obligation to use the preserved material. But it is plausible to think that they may feel under pressure to use it *because it is there*. There may also be a financial cost of continuing storage. That said, this does not, in our view provide reason to not offer FP at all, but rather (as noted by Hudson et al., 2016) to ensure that a surviving partner is appropriately supported, and enters into, or chooses not to enter into, a posthumous parenting project autonomously.

Concluding argument

In the discussion above we have considered a range of arguments both for and against routinely offering fertility preservation to patients with poor prognosis. It is clear that there is a strong *pro tanto* argument, grounded in respect for autonomy, that supports routinely offering to all patients. We have, however, also shown that there are good reasons to sometimes be cautious about making this offer, not least because there are some situations in which fertility preservation would be futile and as such cannot be considered a good use of resource.

The way forward is not absolutely clear; however, we propose that we should adopt a defeasible assumption in favour of offering fertility preservation to all patients who might benefit from it, with the burden of proof on the clinician to show that there are good grounds for withholding the offer. Given that the main argument in favour of routinely offering FP is found in a patient's autonomous choice to benefit from the intervention, the most appropriate grounds for withholding the offer (outside of lack of resource) is if a patient cannot benefit from the intervention.

We must, however, recognise that there are many ways a patient could benefit from fertility preservation, and these are not limited to having a parenting experience. Becoming a parent is arguably the primary goal of fertility preservation, and is one clear benefit, but a patient may also benefit from FP therapeutically in the form of gaining significant comfort from an imagined future, or knowing they have gifted something precious to their partner. That said, the criteria for withholding the offer would hold if and only if FP could not achieve the benefit that is sought. This would make FP a futile treatment, and therefore one which there is no obligation to offer.

The challenge here, of course, is that a decision about futility that rests on a clinician's understanding of the patient's ability to benefit assumes that a clinician is able to correctly identify all the benefits that a patient might seek to achieve (requiring an intimate and accurate knowledge of the patient and of their partner where present), and accurately predict that these benefits cannot, or are very unlikely to, be achieved. The former would normally be difficult to do without having had a specific conversation with the patient about FP and the reasons why they might want it, and the latter would require great deal of prognostic certainty.

For this reason, we suggest that the presumption in favour of having a conversation with all patients, including those with very poor prognosis is strong, and can and should only be defeated when there is clear evidence, agreed by a multidisciplinary team, that no benefit is possible. In practice, this might describe a relatively rare situation. One obvious example might be a young child with a negligible to zero chance of survival, who lacks the capacity to benefit from an imagined future, and who is not in a position to want to make a gift to a partner. This describes a patient who cannot themselves benefit from FP, and therefore should not be offered it. This would hold true regardless of whether the child's parents wanted FP, because we assume - we think reasonably - that the justification for fertility treatment lies in the benefit to the patient and not to others, and a child in this position should not be used as a means to achieve a good for their parents. (Note that in the gifting argument FP is justified by the benefit to the patient of giving the gift of parenting to their surviving partner, not by the benefit that may accrue to the surviving partner - although they will certainly benefit as well).

Given that we are making an argument in favour of a strong presumption of offering FP, one might ask why we do not go so far as to make an argument for it being obligatory. Such an argument might be grounded both in respect for autonomy and a legitimate concern that allowing clinicians any discretion in whether to offer the treatment opens up the possibility of inconsistency and a postcode lottery, where access to treatment depends on the particular views of the clinician in charge. The best way to combat this would be to ensure that every patient, regardless of prognosis, is given equal access. The reason we do not adopt this position is simply that we are more concerned with equity then equality. Nedha (2011, as cited in Paul, 2019) defines equality as treating each person the same, regardless of needs and requirements (e.g., in this scenario, providing all patients with the option of FP, regardless of prognosis), whereas equity can be described as treating each individual fairly depending on their needs. Removing clinical discretion and making the offer of FP mandatory in all cases, would ensure every patient is treated equally at a cost of the harms that can follow when the treatment offers false hope, leads to a foreseeable waste of resource, or risks a vulnerable patient feeling pressured into undertaking procedures from which they cannot benefit.

Our position does potentially place a great deal of power in the hands of the clinician as gatekeeper, but this is mitigated by our requirement that the offer of treatment is a defeasible presumption with the requirement of the MDT agreement if it is withheld. Placing the burden of proof on the clinical team to show, and agree, that there is no possible benefit to the patient protects the autonomous patient’s right to make their own choices in very large part, whilst permitting discretion in a few cases where it might be necessary and correct. In adopting this position, we concur with Hudson et al. (2016) regarding the need to provide cancer and fertility healthcare professionals with appropriate resources and training packages for addressing the ethical and decision-making implications that arise in these scenarios, and to ensure that informed consent processes are high quality and robust. For those patients who wish to proceed, ongoing care should include appropriate counselling in relation to the possibility, or even probability, of posthumous reproduction. It must be assumed that most patients in this position will not survive, and their preferences for using their frozen gametes or embryos must be clearly documented in line with relevant legislation and local regulations.

In outlining our arguments, we try to find an appropriate balance between ensuring equity of opportunity to beneficial treatment, whilst allowing for the fact that in some cases FP will be a waste of resource for no patient benefit.

Declaration of interest

GLJ, AMJ, BP and RAA declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the opinions reported. JI is member of the NICE Highly Specialised Technology Evaluation Panel. He has not been involved in any NICE discussions involving fertility or fertility preservation, and the views expressed and endorsed here are his and do not represent NICE.

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Author contribution statement

GLJ conceived the manuscript, preparing the initial draft. GLJ, AMF and JI critically developed this further, producing the first version, with additional contributions from BP and RAA. All authors edited, reviewed and approved the final manuscript.

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