

Sperm donor limits that control for the ‘relative’ risk associated with the use of open-identity donors

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The majority of countries that support the use of donor insemination (DI) in artificial reproductive technology (ART) limit the number of children born from one donor. The setting of these donor limits, though intended to control for the risk of inadvertent half-sibling unions between the offspring of anonymous donors, actually have no evidence base. Controlling for the risk of inadvertent half-sibling unions may soon become unnecessary due to the increasing world-wide use of open-identity sperm donors and the revocation of donor anonymity in many countries. With the shift from anonymous to open-identity donation, the central issue is not the risk of genetic abnormality from inadvertent half-sibling consanguinity; it is the psycho-social impact of the multiple use of open-identity sperm donors. Despite this, the jurisdictions that allow or mandate the use of open-identity donors continue to observe existing limits that do not consider nor specifically control for the psycho-social impact of the multiple use of open-identity sperm donors. It is proposed that: (i) conservative interim donor limits be placed on the multiple use of open-identity donors, while research into the psycho-social impact of disclosure is undertaken to inform the establishment of evidence-based limits; and (ii) the existing limits in jurisdictions where anonymity is still commonly practiced or protected could be raised, if an updated mathematical model was used for calculating evidence-based anonymous donor limits.

Key words: anonymous donor / open-identity donor / half-sibling union / psycho-social impact / revocation of anonymity

Introduction

Most of the countries that provide donor insemination (DI) in artificial reproductive technology (ART) treatment either specifically limit the number of DI offspring born from one donor or limit the number of families any one donor can assist. These limits are primarily intended to reduce the risk of inadvertent consanguineous unions between the children of anonymous donors—men whose identity is protected by confidentiality or is not recorded with their DI offspring (Blyth and Frith, 2008). Furthermore, in the majority of jurisdictions, these limits are not based on any empirical evidence (Sawyer and McDonald, 2008). In recent years, however, there has been a steady increase in the number of countries and jurisdictions that are revoking the use of anonymous sperm donors. Eleven jurisdictions, including many European countries, New Zealand and a number of Australian states, have mandated against the use of anonymous donors and only accept donations from open-identity donors—men who are willing to be identified (Blyth and Frith, 2009).

In the jurisdictions that have revoked the use of anonymous donors, DI children have the right to request the identity of their DI father and their parents are encouraged and supported in disclosing their donor origins. In New Zealand and New South Wales (Australia), they can also request information about their DI half-siblings (Blyth and Frith,

2009). Even if they do not have the legislated right to identifying information about their donor, DI offspring in other jurisdictions have the ability to discover the identity of their half-siblings through organizations such as the Donor Sibling Registry (DSR; Appendix 1) in the USA (Kramer, 2000; Freeman *et al.*, 2009).

Because of this increase in the use of open-identity donors and organizations that facilitate DI half-siblings making contact, it could be argued that limiting the use of sperm donors due to concerns about genetic abnormalities in the offspring resulting from inadvertent half-sibling unions will soon be unnecessary. In fact, the worry about half-siblings inadvertently meeting and forming consanguineous unions is already unnecessary in the case of single or lesbian mothers. This is because the DI child is very likely to be informed of their donor origins (Brewaeyns *et al.*, 1993; Scheib *et al.*, 2005; Janssens *et al.*, 2006) and will inquire as to a potential partner’s genetic background. This also applies to the DI children of many heterosexual couples as well. A key reason why these couples have traditionally been reticent to tell their DI children of their donor origins was due to the lack of available information about their child’s donor and concerns about not being able to answer their child’s questions (Godman *et al.*, 2006; Freeman *et al.*, 2009). Couples who use DI in jurisdictions where anonymity has been revoked, however, now have access to information about their child’s donor. They also live in a social and

political environment that is increasingly sympathetic and accepting of forming families using DI, and they are encouraged and supported in disclosing donor origins to their DI children (Daniels, 2005). As a consequence, they are increasingly more likely to do so (Godman *et al.*, 2006; Blyth and Frith, 2009) and their DI children are also in a position to inquire, at the very least, into the genetic background of a potential mate. It is the contention of this author, however, that the increasing use of open-identity donors has introduced a new and potentially far reaching concern; a concern that requires serious investigation, and far from removing the need to limit the use of donors, will demand closer monitoring and control of donor use.

This new concern relates to the fact that the psycho-social impact of the revocation of anonymity and disclosure is, as yet, unknown. In fact, many of the issues surrounding the revocation of anonymity continue to be debated and are still not clearly defined (Shenfield and Steele, 1997; Frith, 2007). For this reason, issues related to attachment security and identity, as described in adoption studies (Crawshaw, 2002; Feeney *et al.*, 2007), and the experiences and opinions of adult DI offspring (Mahlstedt *et al.*, 2009), recipient parents and donors need to be researched so that evidence-based limits—that take into account the psycho-social impact associated with the use of open-identity donors—can be established (Scheib and Ruby, 2008).

This paper outlines how the majority of jurisdictions that provide DI have existing sperm donor limits to control for the risk of inadvertent half-sibling unions and that these limits have not been established on any evidence-base. It describes how the revocation of anonymity and the increasing use of donors who are willing to be identified necessitate the consideration of sperm donor limits that specifically address the possible psychological issues connected to the use of open-identity donors. It explains why donor limits are crucial for open-identity donors; how they may need to be lower than the existing limits that are intended to control for the genetic concerns associated with using anonymous donors; and recommends that conservative interim limits be placed on the use of open-identity donors while an investigation into the establishment of evidence-based limits is undertaken. Furthermore, it proposes that sperm donor limits, in jurisdictions where anonymity is still commonly practiced and/or protected, could be raised if an evidence-based mathematical model were used to inform limits. Finally, it argues that comprehensive records regarding donors and DI outcomes are crucial, and nationally based donor registries essential, if evidence-based limits are to be determined for both anonymous and open-identity sperm donors (Sawyer, 2009a).

Existing limits

There are sperm donor limits in the majority of jurisdictions where DI is a routine procedure. Some sperm donor limits apply to the number of offspring born from one donor and other limits relate to the number of families a donor can contribute to. However, apart from the Netherlands and Taiwan (de Boer *et al.*, 1995; Wang *et al.*, 2007), these limits have not been based on empirical evidence. There has been no 'rational formula' (Blyth and Frith, 2009) or any 'meaningful guidelines' that clinicians could follow (McDonough, 1997). Limits have been reached: (i) 'arbitrarily' and relate to the avoidance of accidental incest (Janssens, 2003); (ii) using precedent

set by the practice of other clinicians; (iii) based on the argument that a sperm donor limit of 10 offspring (not families) 'approximately coincides with the number a couple could expect to have in society without contraception' (Egeland, 1997) or (iv) using estimates made by mathematicians (Eccleston, 1978) and geneticists, where at one stage, it is admitted that an 'arbitrary' figure of 0.1% was put on the 'maximum acceptable risk of additional abnormal offspring due to half sibling unions resulting from DI' (Danks, 1983).

There has been very little debate in the literature regarding what donor limits should be. There was some discussion in response to a 'letter to the editor' in which Egeland (1997) suggested a limit of 10 offspring per donor: after questioning whether the limit of 25 children in the Netherlands, advocated by de Boer *et al.* (1995) was too high. In their 'reply of the authors', de Boer *et al.* (1997) defended their recommendations and then an 'editorial comment', regarding the issues surrounding establishment of limits, completed the discussion (McDonough, 1997). A few years later concerns were raised when a sperm donor in the Netherlands developed a late-onset genetic disorder and some discussion about sperm donor limits, in the form 'commentaries' and 'rapid responses', ensued (Dutton, 2002; Gebhardt, 2002; Sheldon, 2002). In response, Janssens (2003) defended maintaining the limit of 25 DI children per donor in the Netherlands.

In justifying his defense of the limit of 25 offspring per donor in the Netherlands, Janssens (2003) point outs that existing the limits of 10, in countries such as the UK, are not only reached 'arbitrarily' but are 'more or less based on social-psychological and cultural considerations' which originate from the historical prohibition of incest in many cultures (Cahn, 2009). This ultimately translates into concerns about the risk of genetic abnormalities in the offspring of half-sibling unions (Frances and Frances, 1976). It has been argued that the risk in the population of half-siblings forming consanguineous relationships and bearing children is very small and, as previously documented by Curie-Cohen (1980), there is actually a greater risk of a child forming a consanguineous relationship with a known relative of their father, than an unknown relative. Janssens (2003) recommends that if limits were actually based on medical/genetic information limits could be increased—as in the Netherlands (de Boer *et al.*, 1995, 1997). The author suggests that this pervasive absence of evidence-based limits is partly because DI is a relatively simple ART procedure which has not been subject to the same level of scrutiny, controls and outcome surveillance as other forms of ART, which are technically, scientifically and medically more complex and expensive (Janssens, 2009).

This persistent disinclination to monitor DI outcomes or standardize supervision is further illustrated by the fact that, as we near the end of the first decade of the twenty-first century, one of the defining characteristics of DI is that there is still enormous variation between countries in regard to its administration (Jones *et al.*, 2007; Pennings, 2009). Specifically, countries have very different policies on donor anonymity and donor limits (Blyth and Frith, 2009; Janssens, 2009). DI offspring are reaching adulthood under the mandate of quite divergent regulatory and political systems: their parents may or may not have disclosed their donor origins to them; and the country or state they live in may, or may not, protect their donors' anonymity. Some countries guarantee or mandate donor anonymity (e.g. France, Belgium and Denmark); some have no specific regulation regarding anonymity (e.g. the USA); some have totally revoked donor anonymity

(e.g. the Netherlands, Sweden, Austria, Switzerland, New Zealand and the UK) and one has a combination of the above (Australia) (Janssens, 2009). This international disparity in DI supervision strongly indicates that policies with regard to DI are generally not driven by empirical evidence.

Further to this, 5 of the 11 jurisdictions that now legislate the use of open-identity sperm donors continue to use pre-existing donor limits; which were not only arbitrarily based, but originally legislated to control for the risk of half-sibling unions—when donor anonymity was protected by law (Blyth and Frith, 2009). In other words, donor limits in jurisdictions which have overturned previous legislation to protect donors' anonymity and limit their use—Norway, the UK and the Australian states of Victoria, New South Wales and Western Australia—have not been 'amended in any way' to control for the psychological and social repercussions of using open-identity donors (Blyth and Frith, 2009). This is why it is essential that research into the psycho-social impact of the revocation of anonymity is undertaken to inform the establishment of evidence-based donor limits and support mechanisms for DI families and their donors (Crawshaw, 2002; Scheib and Ruby, 2008).

Open-identity donors: considerations

The right of the DI child to have access to information about their biological heritage and the identity of their donor is now being recognized and addressed in many countries (Janssens, 2009). DI children and donors are now in a position to contact each other, if they both consent, once the DI child's parents deem it appropriate or when the child reaches maturity. By extension, it is also possible in some jurisdictions for DI offspring to make contact with their, potentially numerous, half-siblings (Blyth *et al.*, 2001; Freeman *et al.*, 2009). Of the jurisdictions that have revoked the use of anonymous donors only in Austria, Sweden and Victoria (Australia) have children reached an age where they have the right to request the identity of their donor (Blyth and Frith, 2009). Therefore, it cannot yet be determined what long-term impact this will have on donors and their DI offspring, or how the members of this new form of 'extended family' are going to manage the potentially complex psychological and social issues that could arise (Scheib and Ruby, 2009).

Psycho-social implications of donor contact

In the past, when the use of anonymous donors was 'accepted practice', the DI child most often believed that their social father was also their biological father. Even when parents chose to disclose their DI child's genetic origins, there was limited information available about the donor. Also, assuming that the child belonged to an intact nuclear family, the only male parent they knew was their social father and the genetic/social distinction was not an issue. Now, however with the use of open-identity donors, there is a 'real-life' tangible individual who is their biological father: separate from their social father. It has been suggested that this could introduce a sense of fragmentation and confusion in DI offspring (Grace *et al.*, 2008) and that 'flexible and fractured notions of paternity and identity' could be introduced (Rose, 2004). In addition, some parents have already expressed 'fear of interference' if contact with the child's donor, their biological

father, is initiated or granted (Janssens *et al.*, 2006), and these concerns have not proved unfounded in some, though isolated, cases where 'legal battles have ensued' (Janssens, 2009). Donors themselves have expressed concerns about identity disclosure and suggest the need for a 'safe legal environment', for educational material to be available for all concerned; and for an increased emphasis on cultivating an 'accepting social climate for this method of family building' (Thorn *et al.*, 2008).

Donors who are now willing to be identified are unlike previous donors who donated for financial gain (Shenfield and Steele, 1995) or were altruistically motivated (Blyth *et al.*, 2005; Daniels *et al.*, 2005). They are now more likely to be interested in procreation and in knowing outcomes (Janssens *et al.*, 2006; Thorn *et al.*, 2008). What this could mean in terms of the 'interference' feared by parents and the 'complexity' associated with multiple familial relationships is yet to be realized (Janssens *et al.*, 2006). Some researchers believe that donors do not necessarily appreciate the ramifications of their decision to become an open-identity donor and what the implications are for them, their future families and their donor inseminated offspring 16–18 years into the future (Rose, 2004; Thorn *et al.*, 2008).

With the steadily increasing number of DI children who are reaching an age where they have the right to identifying information about their donor, there is growing interest in the experience of families and children who have previously responded to, or initiated contact with either their donor or half-siblings through organizations such as the DSR. Freeman *et al.* (2009) surveyed families who have initiated contact with half-siblings and donors through the DSR and found that the majority of the contact experiences were positive. It is pointed out though that the positive results reported by this study reflect the attitudes and experiences that would be expected from those interested in initiating contact, and that it is important to remember that there is still much to be learned about the use of open-identity donation and the psycho-social impact of contact between donors and their, possibly numerous, DI offspring (Janssens, 2009). Research into the experiences of adoptees and their families has provided some insight into the issues that DI offspring may encounter with the removal of anonymity (Blyth *et al.*, 2001; Crawshaw, 2002).

Similarities between DI and adoption

Although there are a number of similarities between the families formed by adoption and donation, historically there has been one very important distinction between adoptive families and donor-assisted families: the primary focus of adoption is to provide parental care for children, whereas donor-assisted conception has been to provide children for adults; adoption has stressed social connectedness, and donation has stressed genetic connectedness (Blyth *et al.*, 2001). Nevertheless, adoption studies have provided some useful insights into the issues that DI children and their families will face when DI origins are disclosed, with some of the same issues of attachment security and identity already identified (Blyth *et al.*, 2001; Crawshaw, 2002; Feeney *et al.*, 2007). Research into the experiences of adopted children indicates that the development of positive relationships and attachment security—the ability to feel comfortable both with intimacy and independence in an adult relationship—is primarily affected by the nature of the relationships they had with their

adoptive parents, not by their adoptive status (Feeney *et al.*, 2007). Parallel findings—regarding the impact of the child/parent relationship—are reflected in a study investigating the attitudes of adolescents regarding communication about donor-assisted conception. The consensus was that the respect shown by parents, by being open and honest with their children about their DI origins, and parents' sensitivity to their individual child's needs were important determinates of how well children would react to being told about their DI origins and how they adjusted socially and emotionally to this knowledge (Kirkman *et al.*, 2007). Additionally, studies investigating the quality of child–parent relationships in DI indicate that this dynamic is the best predictor of a DI child's emotional and psychological well-being, regardless of whether donor origins are disclosed (Nachtigall *et al.*, 1997; Golombok *et al.*, 2002). In fact, some studies suggest a more positive child–parent relationship in DI families (Brewaeys, 1996; Golombok *et al.*, 2004). As with adopted individuals, DI offspring have also expressed that wanting to know more about their biological parent(s) is more about a search for identity completion—to understand where their individual genetic tendencies came from—than to form a relationship with the biological parent(s) (Blyth *et al.*, 2001; Crawshaw, 2002).

Thus, as adult DI offspring seek out and discover their genetic origins, the issues faced by DI families are becoming increasingly similar to those of adoptive families (Daniels *et al.*, 2005), except in one significant way: the number of offspring involved and the potential for multiple 'kinship connections' (Blyth *et al.*, 2001). This is an important distinction, and it is where the ability to gain insights from the experiences of adoption, in regard to the psycho-social issues facing DI families, abruptly ceases.

Psycho-social implications of multiple kinship connections

Warnings about the possible implications of multiple kinship connections due to the multiple use of sperm donors were voiced even before the revocation of anonymity was legislated in the UK. It was pointed out that 'few cultures have any concept of genetic parents having such a large number of offspring, and therefore no experience of how social relations can be carried on between a parent and children who are genetically related in this way' (Blyth *et al.*, 2001). Now, with the revocation of anonymity in many countries and the establishment of organizations such as the DSR in the USA, DI offspring have the legislated right to initiate contact with their donor and/or discover the identity of their half-siblings. The likelihood of large, possibly complex genetic DI networks being established is now a very real possibility, and how donors, their offspring and their respective families will manage these new 'extended families' is totally unknown.

The author is not implying that large extended families cannot function very well or that smaller, nuclear families are not subject to dysfunction. But, as pointed out by Blyth *et al.* (2001), this new type of 'extended family' has not been experienced before. It can be established almost instantaneously when contact is made with a donor or half-sibling. Its members do not have familial ties that have evolved slowly over time, as do other families such as nuclear families, step families or blended families. Adopted children can experience the same instantaneous extended family formation but there is one significant difference: it will most likely be with only one or two other

families (Blyth *et al.*, 2001). In a recent study investigating the similarities and differences between jurisdictions that mandate the use of open-identity donors (Blyth and Frith, 2009), sperm donors expressed concern about the psychological and social complexities of 'trying to come to grips with multiple genetically-linked siblings in a number of different families'. In addition, the psycho-social ramifications of the multiple use of open-identity donors are not only unknown, but potentially far-reaching, both geographically and temporally with 'extended family' members living in different parts of the country or world and the negative and/or positive consequences of contact potentially impacting on future generations. This is why the question has been raised as to whether, ultimately, it will be necessary to base sperm donor limits primarily on psychological factors and whether these limits need to be lower than those based on genetic considerations (Scheib and Ruby, 2009).

'All inclusive' sperm donor limits

Although the psycho-social implications of using open-identity donors are still not fully understood, it has been suggested that limiting the use of open-identity donors may well prove to be more critical than the limiting of anonymous donors; and psychological factors, rather than consanguinity risk, may need to be the primary determinant in the setting of 'all-inclusive' donor limits—limits based on both psycho-social considerations and consanguinity risk—in jurisdictions that have revoked donor anonymity or where both anonymous and open-identity donors are used (Scheib and Ruby, 2009). In fact, uneasiness about the potential for multiple 'kinship connections' and the risks of 'large and potentially complex genetic networks' was an important consideration when a fertility clinic in NZ decided to reduce the use of donor gametes from six families to four (Speirs, 1998).

In a study comparing adoption and the use of donor gametes, it was identified that it is actually the expectations of the participants (a psychological factor), and not necessarily the genetic connection, that impacts on the quality of the contact experience (MacCallum, 2009). In accordance with this observation, there is evidence to suggest that some families, who are at first eager to establish contact with half-siblings through the DSR, become overwhelmed and withdraw as more and more contacts become available (Miller, 2007; Cahn, 2009). As Scheib and Ruby (2008) point out, 'For those who seek contact with donor-linked families [through the DSR], having the possibility of meeting several families may be appealing. This number becomes daunting, however, when the number of individuals with whom one is related climbs from 5 to 30 or more'. In fact, doubts have been expressed as to how a child can be expected to 'have a meaningful connection with such "siblings" – strangers who only have in common a fraction of DNA' (Miller, 2007).

The importance of psycho-social dynamics are further highlighted in another adoption study where it was concluded that parental bonding, and a caring and open family environment (psychological dimensions), was a stronger predictor of adult attachment security than was adoptive (genetic) status (Feeney *et al.*, 2007). Furthermore, in a study investigating the views of adult DI offspring, it was determined that most of those interviewed believed that identifying information should be provided to recipients but then 'they themselves would not participate in the practice of gamete donation' (Mahlstedt *et al.*, 2009). The author believes that it is important to further investigate

and, if possible, determine why some families chose not to participate in the Freeman *et al.* study; why some families felt compelled to withdraw from established contact and, in the Mahlstedt *et al.* study, understand the reasons behind the participants' decision to not participate in gamete donation themselves. It is through examining these individuals' experiences that evidence can be gained and criteria established to best judge where 'all-inclusive' limits on the use of open-identity donors need to be placed.

Given that it remains unclear as to how many contacts would constitute 'too many contacts', the author argues that it may be that 'all-inclusive' donor limits, at least initially, will need to be lower than those based on consanguinity risk alone. This is because once children are born there is no going back; 'choices are made that cannot be reversed' (Janssens, 2009); these children exist; they have a DI father; they have the potential to make contact and establish relationships and they need to be able to manage that reality. Donor limits, such as the 10 families now current in the UK and Victoria, 'can [already] produce potentially large and complex kinship networks' (Blyth *et al.*, 2001) and existing limits may need to be initially reduced while investigations take place regarding the establishment of open-identity donor limits based on evidence-based psycho-social criteria. The author acknowledges that limiting the number of families an open-identity donor can assist could potentially disadvantage some parents who may then experience a delay in accessing DI treatment. It must be kept in mind, however, that the initial donor shortage experienced by some jurisdictions when anonymity was revoked was later reversed (Blyth and Frith, 2008) as donor recruitment targeted men who were willing to be identified.

It is, therefore, important to start investigating what limits to place on the use of open-identity donors before DI clinics (as in the USA) or governments (as in the UK and Victoria) allow these donors to be over-used; risking donors and their DI offspring being overwhelmed by the demands of overly large extended DI families and multiple contacts that could lead to 'unwelcome interference with the personal or family life of parents, offspring or donors' (Janssens, 2009). Nobody can know what will transpire and only time will tell to what extent DI offspring' interests are really being served by the removal of anonymity (Janssens *et al.*, 2006). The author maintains that if those regulated rights are ultimately going to be in the best interests of the long-term social and psychological well-being of DI children, donors and their respective families, then sperm donor limits need to be put in place sooner rather than later.

Interim donor limits

Research into the psycho-social issues related to the revocation of anonymity is essential and, as previously discussed, these issues need to be clearly understood if they are to help inform evidence-based limits for controlling the risks associated with the use of open-identity donors. This investigation will take time, however: time for the long-term legal, sociological and psychological impact of this new family dynamic to be manifest and to formulate evidence-based donor limits and protocols to manage these relationships in a manner that will optimize the quality of the relationships in these new 'families'.

In the interim therefore, it is suggested that conservative donor limits be placed on the use of open-identity donors, while evidence-based limits are determined. Moreover, it is crucial to implement these interim limits without delay because mothers are already

giving birth to DI children who have been conceived using open-identity donors. As pointed out previously, the current limit of 10 families in the UK can still produce potentially large family networks (Blyth *et al.*, 2001). The author is of the opinion that the quality of the future relationships between donors, their DI offspring and their respective families will be directly affected by the number of DI offspring each donor fathers and that the number of potential familial contacts needs to be contained, as soon as possible, to give donors and their offspring the best possible chance of having positive, sustainable and manageable relationships with their extended DI family members in the future.

Previous research has established that a child's psychological well-being is directly related to the parent-child relationship, regardless of the type of familial arrangement. Research into the emotional and psychological well-being of children in adoptive and foster care emphasizes the powerful mediating effect of the child-caregiver relationship (Feeney *et al.*, 2007; Dozier and Rutter, 2008). These findings are reflected in research investigating the experiences of children from divorced, separated and blended families: custodial parent-child relationships and stepparent-child relationships are found to be important indicators of a child's psychological well-being (Amato, 1987; Magnuson and Berger, 2009). These familial arrangements, however, do not require the male 'parent' to potentially manage relationships with 'numerous genetic children, each with different other genetic [and social] parents' (Blyth *et al.*, 2001), as will the new 'extended DI families', now possible within the DI community. Miller (2007), in discussing the extended family groups now being formed in the USA though the DSR (Freeman *et al.*, 2009), reports that some donors in the USA have over 30 offspring and questions if 'a sperm donor [could] be a father figure – or even just a sort of uncle – to, thirty-odd children'. The USA does not legislate for or against donor anonymity and does not have laws regarding donor limits (Jones *et al.*, 2007). Furthermore, because parents of donor conceived children are making contact with, '[in] some cases, large numbers of half-siblings (up to 55)' through the DSR (Freeman *et al.*, 2009), it is reasonable to suggest that some donors must have at least 30 DI offspring. Even in jurisdictions where the number of DI offspring per donor is enforced by law, it is possible for a donor to have up to 25 DI offspring (the Netherlands). Furthermore, in jurisdictions that have legislated limits on the number of families a donor can assist (e.g. 10 in the UK), it is possible—taking into account multiple births—for an open-identity donor to have up to 20 DI offspring.

To date, questions and concerns about the possible psycho-social impact of the 'large extended families', now possible with the use of open-identity donors, have been mentioned in the literature (Blyth *et al.*, 2001; Miller, 2007; Scheib and Ruby, 2008, 2009; Blyth and Frith, 2009), but the need to establish evidence-based limits in response to these psycho-social concerns has not been discussed. Similarly, although limiting the number of children born from one donor has been discussed by researchers over the past 30 years, the potential for raising anonymous donor limits by using an updated evidence-based model has not been subject to any serious discussion or consideration in the literature.

Anonymous sperm donors

In 1980, Curie-Cohen (1980) published findings from the application of a model he developed to determine the number of half-sibling

unions likely to occur as a result of the multiple use of sperm donors in the USA. Since that time, the Netherlands and Taiwan (de Boer *et al.*, 1995; Wang *et al.*, 2007) are the only countries to adapt Curie-Cohen's model for use in determining location-specific sperm donor limits in their jurisdictions. Although concerns were raised in the Netherlands at one stage, when a donor developed a late-onset hereditary brain disease (Janssens, 2003), the Netherlands continues to have the highest sperm donor limit in the world (25 children per donor) with many of other countries and jurisdictions having limits of 10 or less families and/or children per donor (Sawyer and McDonald, 2008).

A recent review of the models used for predicting the likelihood of half-sibling mating (Sawyer and McDonald, 2008) has concluded that while Curie-Cohen's original model requires updating to reflect changes in migration and marriage trends, an enhanced, internationally applicable model would prove invaluable for providing empirical evidence on which to base sperm donor limits in jurisdictions where the use of anonymous donors continues to be supported or where the majority of parents still adhere to the code of secrecy surrounding disclosure. As previously mentioned, Janssens (2003) maintains that the risk for half-siblings forming consanguineous relationships is actually very small and that limits could be high (like in the Netherlands), if they were based on medical/genetic information. Curie-Cohen (1980) states that a child is more likely to form a consanguineous relationship with a known relative of their father than an unknown relative and that the presence of DI in a population could actually reduce the average inbreeding in a population—inbreeding that occurs naturally in the population due to first and second cousin marriages and prevailing levels of unknown paternity (Curie-Cohen, 1980). It is therefore the contention of this author that anonymous sperm donor limits could be raised in jurisdictions that mandate or support donor anonymity if an evidence-based mathematical model was used to inform local sperm donor limits. To determine evidence-based anonymous donor limits, however, there is the need to closely monitor the use of donors, keep track of their offspring and record the population information needed to inform the variable values required for the implementation of a predictive model (Sawyer, 2009b).

National donor registry

Curie-Cohen's predictive model is dynamic and location specific, requiring not only knowledge regarding the average number of DI offspring per donor, but the average number of newborns per year, and the size of the recipient pool. It is very important therefore that comprehensive records be kept at the federal level, in a central register (Sawyer, 2009b), and that clinics communicate with each other through this register so donations can be monitored, donors tracked and children counted (Cahn, 2008). Some jurisdictions, as in the UK, do maintain sperm donor registers but these jurisdictions are in the minority and records are often only kept by individual DI providers (Blyth and Frith, 2009). Knowledge about the number of donors and offspring in a region, as well as other population variables is crucial if the probability of half-siblings meeting in a particular locality is to be calculated, and suitable donor limits put in place. A central register would also help prevent the overuse of popular donors from large clinics, such as in the USA (Sylvester and Burt, 2007; Cahn, 2008), and assist in preventing the overuse of a single donor, in countries

such as Australia and the USA, where sperm donors are able to donate repeatedly, and at numerous clinics (Petersen *et al.*, 2005). Comprehensive DI records are also essential for the investigation into the issues that will inform evidence-based limits on the use of open-identity donors.

Conclusions and recommendations

Many countries limit the number of children born from one donor to control for the risk of inadvertent consanguineous unions between half-siblings. However, with the increasing use of open-identity donor sperm in countries and jurisdictions that have revoked the use of anonymous donors, as in the UK; or have a growing proportion of DI recipients who are either single or lesbian, as in the USA (Scheib and Ruby, 2009), it can be argued that limiting the use of sperm donors to reduce the likelihood of half-sibling unions may no longer be necessary.

Despite this, there does remain a need to have limits on the number of children born from one donor. This is because in the jurisdictions that allow, encourage or mandate the use of open-identity donors, there is now a need to control for the psycho-social impact of the multiple use of these open-identity donors. Furthermore, some countries continue to mandate and/or protect donor anonymity and there remains a need to control for the risk of half-sibling consanguineous unions and the associated possibility of genetic abnormalities in their offspring. In both instances, it is important to establish evidence-based limits on the number of children born from one donor.

The author believes that conservative interim 'all-inclusive' donor limits should be placed on the use of donors, in jurisdictions that have mandated the use of open-identity donors, while the psycho-social impact of disclosure is investigated and evidence-based sperm donor limits established. Additionally, in jurisdictions where the use of anonymous donors remains accepted practice, the current limit of 10 or less families and/or children per donor could be raised if evidence-based sperm donor limits were introduced.

Recommendations

- (i) In jurisdictions which support or mandate the use of open-identity donors that conservative provisional limits be placed on the use of open-identity donors while the full psycho-social impact of the revocation of anonymity is investigated and evidence-based limits are determined.
- (ii) An updated predictive model, based on Curie-Cohen's model, be developed and used to inform the setting of location-specific evidence-based limits on the use of anonymous donors in jurisdictions that continue to support the use of anonymous donors.
- (iii) Adequately maintained national donor registries be established to: (a) make available the data necessary for use in a predictive model that will provide policy-makers with empirical evidence to inform the setting of anonymous sperm donor limits; (b) assist in the investigation into what management systems, including evidence-based donor limits, will be needed to support the new 'extended families' now possible with the use of open-identity donors; and (c) monitor the potentially complex family

dynamics that will continue to emerge over the coming years with the use of open-identity donors.

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Appendix

The DSR is a private organization in the USA which matches half-siblings through their sperm donor number. Although some donors have made themselves available for contact through this organization, the main purpose is to facilitate contact between half-siblings. It is not a government initiative and the US government continues to support the donors' right to anonymity (Kramer, 2000; Janssens, 2009). In comparison, some jurisdictions like the Australian state of Victoria, where the legislature has revoked the use of anonymous sperm donors, government assistance and support is provided for offspring and donors who wish to make contact and for parents who wish to disclose donor origins to their DI children (ITA News Release, 2007; Blyth and Frith, 2009).

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