

Psychological adjustment in adolescents conceived by assisted reproduction techniques: A systematic review

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Table of Contents

Introduction

Aims and Objectives

Methods

Search Strategy

Study Selection

Screening and Quality Assessment

Results

Parent-Adolescent Relationships in IVF Families

Parent-Adolescent Relationships in Reproductive Donation Families

Adolescent Psychological Adjustment in IVF Families

Adolescent Psychological Adjustment in Reproductive Donation Families

Discussion

Conclusion

ABSTRACT

Background: Adolescence is a transitional time for identity formation and relationships with parents. While people born through assisted reproduction techniques (ART) appear to be well adjusted in childhood, it is unclear whether these findings carry into adolescence, and whether diverse ART have different psychological outcomes. This review summarizes what is known about the psychological adjustment and family relationships of the growing number of children born through ART who are reaching adolescence.

Methods: The Pubmed, Web of Knowledge, PsycINFO, and Scopus databases were searched systematically for peer reviewed papers focusing on adolescent psychological adjustment and parent-adolescent relationships in families created by ART. Key search inclusion criteria included all papers published in English relating to adolescents aged between 11 and 18 years.

Results: Seventeen publications with varied methodologies were identified by this review. Only papers relating to in vitro fertilization (IVF), egg donation and donor insemination were identified. Results were categorized according to ART that used the parents' own gametes (IVF) and those that involved reproductive donation (egg donation, and donor insemination). Compared to naturally conceived adolescents and standardized normative samples, adolescents born through all ARTs seemed to be equally well adjusted, and to have positive parent-adolescent relationships. Some differences were however identified based on the type of ART used. In particular, the sex of the parent and child, along with age and process of disclosure of the adolescent's conception were identified as key mediators of parent-adolescent relationships in families created by donor insemination.

Conclusions: The studies in this review indicate that children born through ART have positive parent-adolescent relationships and are well adjusted, with some slight differences based on different ART. **The generalizability of findings may be limited by the general low level of disclosure to adolescents in some of the publications, the small sample sizes of studies in the field, along with the large age range that encompasses adolescence. Findings should also be interpreted in light of many publications' focus on singleton births.** Future studies should also focus on egg donation, surrogacy and embryo donation, as well as the disclosure processes, and adolescents born into non-traditional families (same-sex or single parents) or those born using different types of donor (anonymous, identity-release or known).

Key Words: IVF/ICSI outcome/ psychology/ child follow-up/ assisted reproduction/ gamete donation

256 **INTRODUCTION**

257 Assisted reproduction techniques (ART) have been increasingly used to help
258 infertile couples conceive. ARTs encompass a variety of treatments including IVF (when
259 the egg and sperm are fertilized in a petri dish), ICSI (when a single sperm is injected
260 directly into an egg), donor insemination (DI, when donor sperm is used), egg donation
261 (ED, when a donor egg is used), embryo donation (when both donor egg and sperm are
262 used) and surrogacy (when another woman carries the pregnancy). The past few decades
263 have seen a growing body of research on the medical outcomes of children born through
264 ARTs. Some studies have also examined the psychological effects of ARTs on parents
265 and children. However, very little data have been gathered beyond childhood. While
266 multiple investigations have shown that people born through ARTs function well in
267 childhood (for reviews see: Basatemur and Sutcliffe, 2008; Hahn, 2001; Wagenaar et al.,
268 2008a), little is known about whether these findings carry over into adolescence and
269 whether different types of ARTs have different psychological outcomes at adolescence.

270 Adolescent psychological adjustment refers to the mental health of the young
271 person, and includes conduct and school problems, peer relationships and general social
272 and emotional functioning. One reason why different ARTs might have different impacts
273 on psychological adjustment and parent-adolescent relationships is the potential shock of
274 finding out about the absence of a genetic relationship to one or both parents. In IVF and
275 ICSI, the child is genetically related to both parents. However, in DI the child is
276 genetically related to mother but not the father. In ED, the child is genetically related to
277 the father, but not the mother, although the mother carries the pregnancy and so the child
278 has a gestational link with her. Depending on the arrangement, children born through

279 surrogacy can either be genetically related to only one parent, both parents, or neither
280 parent. In embryo donation, the child is not related to either parent but (unless surrogacy
281 is used) has a gestational link with the mother. In cases where the child is genetically
282 related to only one parent, it is important to establish how that information impacts upon
283 the psychological well-being of the adolescent and the quality of the relationship between
284 the adolescent and both the genetic and the social parent. This is especially important as
285 adolescence is a time when issues to do with identity come to the fore and when parent-
286 child disagreements are more likely to surface (Brown and Wright, 2001; Paikoff and
287 Brooks-Gunn, 1991; Smetana, 1995; Steinberg, 1990; Steinberg and Silk, 2002).

288 The manner in which knowledge about genetic relatedness impacts upon
289 psychological adjustment and parent-child relationships depends on how or whether this
290 information is communicated. Previous studies have examined the process of disclosure
291 in childhood but not how disclosure may affect adolescence (Daniels, 1997; Lycett et al.,
292 2004; Lycett et al., 2005; McGee et al., 2001). These studies have looked at the effects of
293 secrecy as well as early versus late disclosure on family functioning and psychological
294 adjustment. It is vital to gather empirical data about adolescents' understanding and
295 feelings about their ART conception, as it is a time when understanding of conception
296 and biological inheritance becomes more complex.

297 Adolescence is also a critical time for identity formation and the development of
298 autonomy from parents (Erikson, 1968). Identity formation is a normal stage of
299 development that concerns how an individual constructs meaning about their life
300 (Erikson, 1968) and involves addressing the question, "Who am I?" (Grotevant and Von
301 Korff, 2011). This process synthesizes information that includes self-definition, a sense

302 of coherence and a sense of continuity and may be different for adolescents who were
303 adopted or conceived through reproductive donation because they might not have access
304 to all of this information. In relation to adoption, which is in some ways similar to
305 reproductive donation in that children are raised apart from one or both genetic parents,
306 Grotevant et al. (2000) have argued that different levels of openness provide different
307 opportunities or resources to adopted persons and may necessitate different types of
308 interactions as they construct their adoptive identities. For adolescents born through
309 reproductive donation, the question of identity becomes similarly complex because they
310 may or may not have access to some knowledge they may want from their donor.

311 It is important to note that identity development occurs in a broader context and is
312 largely influenced by relationships, particularly a negotiation of relationships within the
313 family (Grotevant et al., 2000; Phinney and Goossens, 1996). More specifically, during
314 the process of autonomy and identity development, adolescence can signify a transition
315 from a hierarchal parent-child relationship to one that is more egalitarian (Erikson, 1968;
316 Smetana, 1994). Is this transition different for adolescents who are genetically related to
317 only one of their parents, and is this influenced by whether and when they were told
318 about their conception? Reproductive donation, like adoption (Grotevant, 2000), varies in
319 the amount of openness about where the child comes from as well as the amount of
320 potential contact with the donor. The different ages at which parents provide information
321 to adolescents about their conception, and the amount of information they choose or are
322 able to provide create different contexts in which adolescents negotiate their identity.
323 Hence, the amount and manner in which parents communicate the story of a child's
324 conception is likely to have an influence on the development of identity. Furthermore, a

325 late or accidental disclosure of the way they were conceived could greatly influence the
326 identity coherence of an adolescent conceived through reproductive donation and may in
327 turn impact upon parent-adolescent relationships.

328 Another factor thought to influence parent-child relationships in the case of ARTs
329 is the experience of infertility. It has previously been speculated that parents who have
330 used ARTs may be overprotective of their children because of the emotional, financial,
331 and psychical obstacles they had to overcome in order to conceive (Hahn and DiPietro,
332 2001; Weaver et al., 1993). Does fertility treatment really lead to overprotective parents
333 who hinder the emotional development of their children at adolescence? Or will the
334 overcoming of infertility produce parents who are more resilient and who pass this along
335 to their children at a time when they are becoming more autonomous? In order to answer
336 these questions it is important to study these families at adolescence.

337 Different family types can also influence parent-adolescent relationships and
338 psychological adjustment. In particular, ARTs may not be used solely by infertile
339 couples, but also by either same-sex couples or single people. This may present different
340 contexts for understanding the importance of conception through ARTs on identity. For
341 example, are adolescents born through DI to single women affected by their lack of a
342 father figure, or do they have an especially good relationship with their mothers because
343 they know they were really wanted? Same-sex and single parent families are more likely
344 to be open about the use of fertility treatments, which may influence psychological
345 adjustment and parent-adolescent relationships. Given that the majority of heterosexual
346 coupled families that use ARTs still choose not to be open about their use of reproductive
347 donation (Readings et al., 2011), it is important to examine how being open from an early

348 age impacts upon adolescent psychological adjustment and parent-adolescent
349 relationships in same-sex and single parent families. Furthermore, it is important to
350 examine how the potential stigma of same-sex or single parenting affects adolescents
351 conceived through ARTs.

352 Previous reviews of families conceived through ARTs have mainly examined
353 outcomes at childhood. Moreover, the majority of these have focused mainly on medical
354 outcomes (Alukal and Lipshultz, 2008; Basatemur and Sutcliffe, 2008; Ceelen et al.,
355 2008b; Hart and Norman, 2012; Kamphuis et al., 2014; Middelburg et al., 2008;
356 Wagenaar et al., 2008a; Steel and Stutcliffe, 2009; Sutcliff, 2009; Wennerholm et al.,
357 2009). Of the reviews that have focused on psychosocial adjustment, the majority of the
358 findings show that children conceived by ARTs have comparable family functioning, and
359 cognitive and behavioural development, to naturally conceived children. However, given
360 the unique developmental stage presented by adolescence and the increasing population
361 of people born through ARTs that are now reaching adolescence, it is important to
362 establish whether these findings carry over into later stages of life.

363 The review by Hart and Norman (2012) includes some papers that examine
364 medical and psychological outcomes of adolescents born through IVF, alongside studies
365 of young children and is thus not specific to the unique psychological changes at
366 adolescence. Only one systematic review has focused specifically on outcomes of ARTs
367 at adolescence but this comprehensive review had a large focus on physical rather than
368 psychological outcomes (Wilson et al., 2011). Ten publications on the psychological
369 adjustment of ART adolescents were identified, and it was concluded that there were no
370 differences in adjustment between ART and naturally conceived adolescents (Wilson et

371 al., 2011). However, while it did focus specifically on adolescence, this review did not
372 differentiate between different types of ARTs or different family types (heterosexual
373 coupled, same-sex coupled, or single parents) and donor type (known, anonymous, or
374 identity-release) in the case of reproductive donation. Furthermore, it did not address
375 whether the adolescents in these studies had been told of their conception. As disclosure
376 has been increasingly encouraged in several countries, it is important to elucidate the
377 consequences for psychological adjustment and relationships with parents. The present
378 review builds on that of Wilson et al., (2011) by addressing these issues. It is also the first
379 review to assess adolescent psychological adjustment in the context of parent-adolescent
380 relationships in families that have used ARTs.

381

382 ***Aims and Objectives:***

383 The current paper aims to provide an updated systematic review of published
384 studies of parent-adolescent relationships, and the psychological adjustment of
385 adolescents who were born using ARTs. Synthesizing the literature on the topic will help
386 summarize what is known about the well-being of adolescents in these families and the
387 quality of their relationships with their parents, while also identifying gaps in the
388 literature for future research. It will focus specifically on differences between families
389 that used their own gametes and those that used donor gametes in order to examine the
390 role of genetic relatedness and the role of disclosure in mediating psychological
391 adjustment and family relationships

392

393

394

395 **METHODS**

396 An updated systematic review of 1) parent-adolescents relationships, and 2) the
397 psychological adjustment of adolescents in families created by ARTs, was carried out.

398

399 *Search Strategy*

400 The systematic search followed PRISMA guidelines (Moher, 2009). A literature
401 search was conducted in PubMed 2.0 (National Library of Medicine), Web of
402 KnowledgeSM version 4.7 (©Thomson Reuters 2009), PsycINFO and SciVerse Scopus in
403 May of 2014 (see Table 1). Search terms were updated from the Wilson et al. (2011)
404 review and included all potential key words relating to assisted reproduction
405 technologies, and psychological adjustment and family relationships. The search terms
406 are listed in Table 1 and MeSH terms were used where applicable.

407

408 *Study Selection*

409 Given that reproductive donation (the donation of a gamete or embryo, or
410 surrogacy) is a fairly recent practice, no filters were used to limit the search by
411 publication dates. Only papers in English were included. In line with the aim of this
412 search to synthesize all available data on the topic, no results were excluded on the basis
413 of study design. An understanding of the psychological adjustment of adolescents also
414 depends on the psychological well-being of the parents and the family as a whole so
415 papers that focused on these topics were not excluded. The definition of adolescence was
416 the same as in the previous review, which identified the period as 11 to 18 years of age
417 (Wilson et al., 2011). Papers that only focused on fertility, pregnancy, or younger

418 children were outside the scope of this review and were accordingly excluded. Additional
419 exclusion criteria are summarized in Table 1.

420
421 ***Screening and Quality Assessment***

422 All results (n= 1042) were reviewed based on the inclusion and exclusion criteria.
423 Following an initial screening, 958 papers were excluded based on the title alone (see
424 Figure 1). After applying the exclusion criteria to these abstracts, 20 studies were further
425 evaluated for inclusion (see Figure 1). Additional studies were included from snowballing
426 the references of studies found through the review. A total of 17 studies were included in
427 the present review.

428 The studies judged to be irrelevant included studies that focused only on ethics or
429 legislation, pregnancy and fertility, or medical conditions of these children (as opposed to
430 psychological state). Evidence from experimental and exploratory studies was included to
431 obtain a comprehensive review of adolescents born using ART. ART were defined as
432 IVF, ICSI, donor insemination, egg donation, embryo donation and surrogacy.

433

434 **RESULTS**

435 Study design, measures and main outcomes of the results are outlined in Tables 2
436 and 3. Publications largely came from different phases of five longitudinal studies and
437 two cross-sectional studies. Table 2 is organized to include the longitudinal studies by
438 first author and year of publication, with alternating shading to indicate different
439 longitudinal studies. Only the phases of the study that involved adolescent children were
440 included. The two cross-sectional studies are presented following the longitudinal studies
441 (Table 3). Measures included face-to-face interviews, standardized questionnaires, and

442 open response questionnaires. Data were generally collected from parents, adolescents
443 and occasionally from teachers. Participants were often recruited from fertility clinics, or
444 online websites for donor conceived children. Comparison groups for the studies were
445 usually couples that had experienced a period of infertility before natural conception
446 (NC), or from normative national samples. The following section summarizes the results
447 obtained by this review.

448 The results presented below are separated into ARTs where the child is
449 genetically related to both parents (IVF), and ARTs that involve reproductive donation
450 (DI, ED, and surrogacy). As no results relating to ICSI, surrogacy or embryo donation
451 were found, the first section refers solely to IVF and the second to ED and DI. It is of
452 note that all of the findings related to IVF families only refer to adolescents born from a
453 singleton birth. Four of the papers that include families born through reproductive
454 donation include one set of twins (Bos and Gartrell, 2011; Gartrell and Bos, 2010;
455 Gartrell et al., 2012; van Gelderen et al., 2012), and two of the papers focused on DI do
456 not specify whether the study was restricted to singletons (Jadva et al., 2009; Scheib et
457 al., 2005). The following results should be interpreted in light of these sample criteria.

458
459 ***Parent-Adolescent Relationships in IVF Families***

460 The majority of the studies showed that parent-adolescent relationships in IVF
461 families did not differ from NC families in terms of parental control (Golombok et al.,
462 2001), warmth and conflict (Golombok et al., 2002b; Golombok et al., 2009), or parental
463 dependability and sensitivity towards the child (Golombok et al., 2002b). More
464 specifically, IVF adolescents reported high levels of warmth and low levels of conflict in
465 their relationships with their parents, and this level was no different from adolescents in

466 naturally conceived families. In addition, longitudinal findings from early adolescence
467 carried over to age 18 years (Golombok et al., 2009; Owen and Golombok, 2009). These
468 findings were supported by a different study of 15 to 16 year olds (Colpin and Bossaert,
469 2008). Additionally, no differences were found in parental self-reports, or adolescent
470 reports of parenting style or stress between IVF and natural conception parents (Colpin
471 and Bossaert, 2008). These findings suggest that the positive relationships between
472 parents who used IVF and their children persist into adolescence.

473 While parent-adolescent relationships in IVF families are generally comparable to
474 NC families, some slight differences were found. Adolescents from IVF families reported
475 that their parents reasoned with them less than adolescents in NC families although the
476 parents reports did not differ, indicating that parents perceived themselves to reason the
477 same amount (Golombok et al., 2001). One study did however report increased
478 disciplinary indulgence (Owen and Golombok, 2009), and another reported less sensitive
479 responding by mothers who conceived through IVF (Golomobok et al., 2001). However,
480 more often than not, differences between IVF and NC families actually reflected a
481 particularly warm relationship between parents and adolescents following IVF
482 (Golombok et al., 2001). Examples of these differences indicate greater overt affection of
483 parents towards their adolescents and IVF adolescents' perceptions of their mothers as
484 more dependable than **naturally conceived** adolescents (Golombok et al., 2001).
485 Additionally, both mothers and fathers who used IVF to conceive showed greater
486 emotional involvement with their adolescent child and reported that they enjoyed
487 parenthood more than parents who conceived naturally (Golombok et al., 2002b).

488 Overall, 6 out of 9 papers reported no differences in parent-adolescent

489 relationships between families that conceived through IVF and those who conceived
490 naturally. When differences were reported, they tended to be positive, indicating more
491 enjoyment of parenting by IVF parents and more warmth in their relationships with their
492 adolescent children (Golombok et al., 2001; Golombok et al., 2002b). While these
493 findings warrant further investigation, in most cases multiple respondents do not confirm
494 these findings. In general, the results indicate that adolescents born through IVF have a
495 good relationship with their parents that, for the most part, does not differ from that of
496 adopted or naturally conceived adolescents.

497
498 ***Parent-Adolescent Relationships in Reproductive Donation Families***

499 All but one of the papers relating to reproductive donation focus on DI. Papers
500 identified by this review indicate that families that used DI were functioning well at
501 adolescence with positive parent-adolescent relationships that did not differ from NC
502 families in terms of parental warmth and control (Golombok et al., 2002a; Owen and
503 Golombok, 2009). Additionally, one longitudinal study reported no differences in
504 parental dependability, disputes, disciplinary control and parental sensitivity in DI
505 families when compared to **families who have naturally conceived** (Golombok et al.,
506 2002b; Owen and Golombok, 2009).

507 Similar to parent-adolescent relationships in IVF families, the only differences
508 found between DI and NC parent-adolescent relationships tended to reflect more positive
509 relationships in DI families, such as increased warmth and emotional involvement
510 (Golombok et al., 2002a; Golombok et al., 2002b; Owen and Golombok, 2009), greater
511 enjoyment of parenthood (Golombok et al., 2002b), and parents who are seen by their
512 adolescent children as more dependable, more lenient and less critical (Golombok et al.,

513 2002a). These findings were also true for lesbian coupled and single mothers (Gartrell et
514 al., 2012). The only potentially negative findings were greater emotional over
515 involvement with their children among DI parents, a higher level of disciplinary
516 aggression shown by DI mothers, and less disciplinary involvement shown by DI fathers,
517 when compared to NC families (Golombok et al., 2002b; Owen and Golombok, 2009).
518 While there is reason to think that differences may exist between parent-adolescent
519 relationships in ED and DI families because children in ED families share a gestational
520 connection with their genetically-unrelated mother whereas children in DI families have
521 no genetic link with their father, only one study comparing these two reproductive
522 donation groups was identified. When comparing DI and ED families, the only difference
523 found was a tendency towards lower levels of sensitive responding from ED mothers
524 towards their children (Murray et al., 2006), suggesting that for mothers the absence of a
525 genetic link to their child may be more significant than is the absence of a genetic link for
526 fathers.

527 It is, however, of note that less than 10% of the children in the majority of these
528 studies with heterosexual coupled parents were aware of their donor conception. Thus, it
529 is important to investigate how these findings may vary in families that have told their
530 child about their conception. Nevertheless, the existing studies reported no difficulties in
531 mother-adolescent relationships in families that had not disclosed (Owen and Golombok,
532 2009). Of the two adolescents who had been told about their donor conception, both were
533 told in middle school (Owen and Golombok, 2009). While they reported feeling upset at
534 the time of disclosure, neither of them was distressed about it at age 18 years (Owen and
535 Golombok, 2009). Additionally neither felt that their relationship with their mother or

536 father had been affected by knowledge of their donor conception (Owen and Golombok,
537 2009).

538 Recently, openness about donor conception has been increasingly recommended.
539 One study found that families who were open about DI conception reported lower levels
540 of conflict between mothers and adolescent sons when compared to mothers and
541 adolescent daughters (Freeman and Golombok, 2012). The link between disclosure and
542 lower levels of mother-child conflict was also found at earlier phases of this longitudinal
543 study as well as in other studies (Golombok et al., 2002a; Lycett et al., 2004). However,
544 at adolescence, this difference is specific to the relationship between mothers and sons.
545 Additionally, in this same study, adolescents who knew about their donor conception
546 reported less warm father-adolescent interactions than those in families that had not
547 disclosed (Freeman and Golombok, 2012). Sex specific findings like these suggest that
548 the sex of the adolescent and the parent are important mediators when examining the
549 effect of disclosure on parent-adolescent relationships (Freeman and Golombok, 2012).
550 In relation to the finding that father-adolescent relationships were less warm in disclosed
551 families, this may indicate the possibility that adolescents who are aware that their father
552 is not their genetic parent may distance themselves at adolescence. Alternatively, it is
553 also possible that fathers may distance themselves at adolescence, a finding that might be
554 corroborated by the lower disciplinary involvement of DI fathers in a different study
555 (Golombok et al., 2002a). However, it must be emphasized that these studies still have a
556 small sample size and that the findings have not yet been replicated.

557 Disclosure may also have different outcomes for parent-adolescent relationships
558 in different family types. For example, single mothers and lesbian couples are more likely

559 to disclose their use of reproductive donation than heterosexual couples who do not have
560 to explain the lack of a father. The timing of disclosure may also affect adolescents'
561 feelings towards their parents, with disclosure earlier in life associated with less distress
562 for (Scheib et al., 2005). Adolescents with identity-release donors who were told about
563 their conception early in life reported that learning about their conception had a neutral to
564 positive impact on their relationship with their parents (Scheib et al., 2005). Adolescents
565 from heterosexual-coupled families also appear to feel angry at being lied to by their
566 mothers rather than by their fathers, reflecting another sex-specific difference in parent-
567 adolescent relationships in families that are open about their use of reproductive donation
568 (Jadva et al., 2009). In this study, the general feeling of adolescents conceived through DI
569 towards their fathers was sympathetic (Jadva et al., 2009).

570 The current findings indicate the quality of parent-adolescent relationships in
571 families that used reproductive donation, albeit mainly DI, is similar to that of naturally
572 conceived families. However, there appears to be greater warmth in DI families.
573 Furthermore, whether, how and when families disclose their use of ARTs seem to be
574 important factors in how adolescents interact with their parents. Some exploratory
575 findings indicate there may be a sex-specific difference in parent-adolescent relationships
576 at adolescence and these findings warrant further investigation.

577

578 *Adolescent Psychological Adjustment in IVF Families*

579 Nine studies relating to IVF and adolescent psychological adjustment were
580 identified by this review. Despite concerns that parents who underwent fertility treatment
581 might have a negative influence on the development of their children because of over
582 involvement (Burns, 1990; Covington and Burns, 2006), most of the studies showed that

583 IVF adolescents did not differ in measures of psychological adjustment when compared
584 to naturally conceived or adopted controls (Colpin and Bossaert, 2008; Golombok et al,
585 2001; Golombok et al., 2002b; Golombok, 2009; Murray et al., 2006; Wagenaar et al.,
586 2008b; Wagenaar et al., 2009; Wagenaar et al., 2011). Both parental and adolescent self-
587 reports found no differences in behavioral problems (Colpin and Bossaert, 2008), peer
588 problems (Golombok et al., 2009), emotional functioning (Wagenaar et al., 2009), or
589 school performance (Wagenaar et al., 2008b).

590 One exception is a longitudinal study that found 18-year old adolescents born
591 through IVF to show more physical aggression and school problems than a naturally
592 conceived comparison group but these findings reflected two extreme outliers and
593 disappeared when the outliers were removed from the analysis (Golombok et al., 2009).
594 Another study using parent and teacher assessments found fewer externalizing behaviours
595 and more withdrawn and depressive behaviours in IVF adolescents (mean age 13.6 years)
596 when compared to naturally conceived adolescents (Wagenaar et al., 2011). These
597 findings were, however, not supported by the adolescents' self-reports and were not
598 present at later ages (15 years) indicating that any problems were transient in nature. This
599 is supported by another study that found no behavioural differences between IVF
600 adolescents and a natural conception control group at ages 15-16 years (Colpin and
601 Bossaert, 2008).

602 When looking at peer relationships, the IVF adolescents at age 18 years reported
603 greater confidence in their relationships when compared to naturally conceived
604 adolescents (Golombok et al., 2009). In regards to disclosure of how they were
605 conceived, the same study showed that no adolescent aged 18 years reported any distress

606 about being conceived through IVF (Golombok et al., 2009). All of the data came from
607 heterosexual coupled families and no data were available on differences in functioning
608 based on family type.

609 Overall, these findings indicate that adolescents conceived through IVF do not
610 show any greater difficulties in psychological adjustment when compared to naturally
611 conceived adolescents. Only two studies reported some differences in behaviour of
612 adolescents conceived through IVF but these differences were either the result of outliers,
613 not confirmed by multiple observers, or did not appear at other phases of the longitudinal
614 studies indicating that they were transient in nature. While no differences are apparent
615 between IVF adolescents and comparison groups, it is important to note that all of these
616 adolescents were genetically related to both of their parents so it is unclear whether these
617 findings can be generalized to children born through reproductive donation.

618
619

620 *Adolescent Psychological Adjustment in Reproductive Donation Families*

621 Eleven studies looking at ARTs involving reproductive donation and adolescent
622 psychological adjustment were included in this review. Of these, three included IVF
623 adolescents in addition to naturally conceived adolescents as a comparison group
624 (Golombok et al., 2002b; Murray et al., 2006; Owen and Golombok, 2009). Only one
625 study involved adolescents conceived by ED (Murray et al., 2006). No differences in
626 psychological adjustment were found between DI and either IVF or NC, suggesting that
627 the absence of a genetic link between fathers and their children does not interfere with
628 adolescent psychological adjustment (Gartrell et al., 2012; Golombok et al., 2002a;
629 Golombok et al., 2002b; Murray et al., 2006). Additionally, the only study of ED

630 adolescents found them to be well adjusted in terms of social and emotional development
631 (Murray et al., 2006). As previously mentioned, less than 10% of heterosexual coupled
632 families in most of these studies had disclosed donor conception to their children. Despite
633 concerns about the effects of secrecy, no negative outcomes were identified in the
634 psychological adjustment of these DI and ED adolescents (Murray et al., 2006). These
635 findings should be interpreted with caution as many of the parents in this study had told
636 other people about their child's donor conception, and accidental disclosure could later
637 have a negative effect (Golombok et al., 1996; Jadva et al., 2009).

638 Is the psychological adjustment of adolescents different when they do know about
639 the use of donated gametes in their conception? One study found that disclosure of
640 conception through DI did not affect the psychological adjustment of adolescents
641 (Freeman and Golombok, 2012). Some studies have reported that adolescents who were
642 told about their DI conception earlier in life had a more positive reaction than people who
643 were told about their conception in adolescence or adulthood (Jadva et al., 2009; Scheib
644 et al., 2005). Data in support of this comes from a questionnaire study of 29 DI
645 adolescents who were told about their conception early in life and who were comfortable
646 with the way they were conceived (Scheib et al., 2005). Conversely, there is some
647 evidence that people who found out about their donor conception later in life reported
648 feeling shocked and betrayed (Turner and Coyle, 2000).

649 Further data comes from same-sex and single parents who are more likely to
650 disclose their use of reproductive donation (Jadva et al., 2009). Adolescents born through
651 DI to lesbian coupled mothers are well adjusted psychologically, with mothers' and
652 adolescents' scores reflecting higher social, academic and total competence when

653 compared to a normative sample (Gartrell and Bos, 2010). While all of these adolescents
654 knew about their donor conception, psychological adjustment did not seem to be
655 negatively affected by this knowledge (Bos and Gartrell, 2011; Gartrell and Bos, 2010,
656 Gartrell et al, 2012). Furthermore no differences in psychological stability and
657 development were found between adolescents conceived by a not-yet-known donor
658 (anonymous and identity-release), and a known donor (Bos and Gartrell, 2011). In the
659 Scheib et al. (2005) study, all of the adolescents had an identity-release donor, a factor
660 that may relieve some of the feelings of frustration adolescents with anonymous donors
661 may have when trying to gain information about their biological background.

662 Taken together, these studies indicate that adolescents born through DI and ED
663 are well adjusted psychologically. Age and process of disclosure are likely to impact
664 upon the psychological adjustment of adolescents, with disclosure earlier in life
665 associated with more neutral or positive reactions (Jadva et al., 2009). Donor status and
666 knowledge about conception does not seem to affect the adjustment of adolescents born
667 to same-sex couples, who are also functioning well (Gartrell and Bos, 2011).

668 669 **DISCUSSION**

670 The studies identified by this review indicate that adolescents conceived through
671 different ARTs (IVF, DI, and ED) are in general psychologically well adjusted. This
672 review was unique in separating out the effects of different forms of ARTs on parent-
673 adolescent relationships and adolescent psychological adjustment. At the time of this
674 review there were only two other reviews (Hart and Norman, 2012; Wilson et al., 2011)
675 of the effects of ARTs on the medical and psychosocial development of adolescents,
676 although one of these reviews did not focus solely on adolescents (Hart and Norman,

677 2012). However, both of these reviews treated all ARTs as one category rather than
678 acknowledging differences between ARTs where children share a genetic link with one
679 or both parents, and those where they do not. Examining differences based on different
680 ARTs did indeed bring to light variations in psychological well-being and parent-
681 adolescent relationships based on the specific fertility treatment used.

682 In IVF families, adolescents showed no differences in emotional, behavioural or
683 conduct problems compared to naturally conceived adolescents (Colpin and Bossaert,
684 2008; Wagenaar et al., 2011). Adolescents born through IVF seem to be well adjusted
685 and to have good relationships with both parents (Golombok et al., 2002b). These
686 findings indicate that the stress or stigma of infertility do not negatively impact family
687 functioning in IVF families with an adolescent child. It has been suggested that the
688 increasing use of IVF likely removes the early stigma associated with the procedure and
689 normalizes it (Colpin and Bossaert, 2008). Congruent with previous findings, it seems
690 that adolescents conceived by IVF can integrate knowledge of their conception without
691 much difficulty (Siegel et al., 2008).

692 In reproductive donation (DI and ED) families, it has been thought that the
693 absence of genetic relatedness between one parent and the child may have differential
694 effects on psychological adjustment of adolescents and on parent-adolescent
695 relationships. Although the data on ED are much more limited than those on DI, studies
696 identified by this review indicated that adolescents born through DI and ED are
697 psychologically well adjusted and that they have positive relationships with their parents.
698 Although very few studies included single parent families, family type (heterosexual
699 coupled, same-sex coupled or single parent families) did not seem to affect adolescent

700 psychological adjustment or parent-adolescent relationships.

701 While all the results were within the normal range, some factors that were
702 identified as impacting the parent-adolescent relationship in reproductive donation
703 families are the sex of the parents and the child, and the age and process of disclosure of
704 the method of their conception. The findings of lower father-adolescent warmth in DI
705 families may indicate that knowledge about the absence of a genetic link may become
706 more important in parent-child relationships at adolescence (Freeman and Golombok,
707 2012). This finding is supported by data that DI fathers are less involved in discipline at
708 adolescence (Golombok et al., 2002b), however the sample sizes of these studies are still
709 small and these findings have yet to be replicated or investigated in ED families. It is also
710 of note that adolescence is a time during which parent-child conflict tends to increase
711 regardless, and that these differences may return to normal levels later in life. Increasing
712 the sample sizes and the number of studies that follow up parent-child relationships in
713 disclosed families is important in determining whether these are genuine effects. It is also
714 of interest to examine whether this finding is seen in regards to the social parent in
715 families with same-sex partnered parents.

716 This review also identified age of disclosure as an important factor mediating the
717 effect of disclosure on the well-being of adolescents conceived through reproductive
718 donation. Disclosure is a complex ongoing process and as more data become available, it
719 is important to further clarify its differential impacts throughout the life course. Two
720 studies in this review suggested that openness about the use of reproductive donation
721 from an early age may allow an adolescent to incorporate their conception into their
722 identity formation and hence lead to a more accepting and positive attitude (Jadva et al.,

723 2009; Rumball and Adair, 1999; Scheib et al., 2005). Indeed, adolescents who found out
724 about their conception earlier in life seemed to have a less negative reaction to the
725 information (Jadva et al., 2009; Scheib et al., 2005). Furthermore, early disclosure may
726 support healthy parent-adolescent relationships by fostering trust in the relationship. It is
727 also possible that the positive parent-adolescent relationships seen in families that have
728 disclosed their use of reproductive donation may result from a more open communication
729 style in the family. To further elucidate this, the process of disclosure should be studied
730 within the greater context of family communication. While families that had not
731 disclosed their use of reproductive donation also had positive parent-adolescent
732 relationships, it is important to remember that disclosure prevents the risk of unintended
733 disclosure, which may have more negative consequences (Freeman and Golombok,
734 2012).

735 Despite the few differences outlined above, families that have used ARTs have
736 largely comparable levels of psychological adjustment and parent-adolescent
737 relationships. There are many possible reasons to explain the lack of difficulties predicted
738 for ART families. One suggested interpretation is that the gap previously thought to exist
739 between ART and NC families has been lessened in recent years due to more planning of
740 naturally conceived children (Colpin, 2002). It has also been postulated that after a period
741 of infertility parents might appreciate the value of their child, and parent more
742 consciously (Colpin, 2002). In addition, parents who use ARTs are on average older than
743 parents who conceive naturally, allowing them time to fulfill personal ambitions and
744 develop more of a foundation for their relationships – all factors that may overshadow the
745 stresses of infertility (Colpin, 2002).

746 As of now however, comparison studies between ART and NC families tend to
747 have small sample sizes that are possibly biased to include people who are functioning
748 well. Additionally, differences in measures, recruitment, sample inclusion and exclusion
749 criteria, and theoretical concepts are an impediment to drawing conclusions across studies
750 (Colpin, 2002; Hammarberg et al., 2008). Future studies would benefit from larger, more
751 inclusive samples with more interview data from multiple informants including the
752 adolescents themselves. It would also be beneficial to gather more data from adolescents
753 conceived through ARTs in different family types, particularly single parents. Four
754 publications did look at families with same-sex parents, but all of these publications came
755 from one longitudinal study with lesbian mothers so the findings may not be
756 generalizable to same-sex male parents (Bos and Gartrell, 2011; Gartrell and Bos, 2010;
757 Gartrell et al., 2012; van Geleren et al., 2012). The same longitudinal study also included
758 data from single lesbian mothers with adolescents conceived through DI, although the
759 sample sizes were small. The large age range that encompasses adolescence further
760 complicates the current review due to the variation individual children have in
761 undergoing puberty and maturation. As more data become available, it may be useful to
762 compare early versus late adolescence.

763 Most of the studies in this review have also restricted their samples to
764 singleton births (Colpin and Bossaert, 2008; Freeman and Golombok, 2012;
765 Golombok et al., 2001; Golombok et al., 2002a; Golombok et al., 2002b; Golombok et
766 al., 2009; Murray et al., 2006; Owen and Golombok, 2009; Wagenaar et al., 2008;
767 Wagenaar et al., 2009; Wagenaar et al., 2011). Of the remaining six papers, four of
768 them include only one set of twins (Bos and Gartrell, 2011; Gartrell and Bos, 2010;

769 Gartrell et al., 2012; van Gelderen et al., 2012) and two of the papers do not mention
770 whether or not the participants were singletons (Jadva et al., 2009; Scheib et al.,
771 2005). Despite the focus of many of these studies on singleton births, the current
772 rate for multiple births following the use of ARTs is about 24% (Murray and
773 Norman, 2014). Along with multiple pregnancies there is an increase in intrapartum
774 and postpartum complications for both mother and child (Murray and Norman,
775 2014). Accordingly, the findings of this review may not be generalizable to
776 adolescents born through ARTs from multiple pregnancies. New single embryo
777 transfer policies in Europe have, however, restricted the number of twin rates,
778 which will continue to decline. As the number of multiple pregnancies continues to
779 decline and the number of singletons rises, the findings of this review will be
780 increasingly relevant and valid.

781 One limitation to take into account while interpreting the findings of this
782 review is the complexity of calculating retention rates for longitudinal studies. Some
783 of the studies report multiple retention rates based on people that could not be
784 traced, and those that actively declined to participate, while other papers do not
785 make this distinction. It is important for future papers to note these differences in
786 order to make biases in the samples apparent. Another limitation of the findings of
787 this review is the varied participation of fathers across different comparison groups and
788 studies. The only study that reported the participation rates of fathers in different groups
789 indicated that a lower number of fathers participated in the DI group (23%) when
790 compared to IVF (83%), adoptive (81%) and NC (81%) fathers (Owen and Golombok,
791 2009). While none of the other studies report participation rates for fathers between

792 groups, Golombok et al. (2001) do report that only 67% of fathers were interviewed.
793 Without this information from the remaining papers, it is possible that the findings related
794 to father-child relationships may be systematically impaired due to lower participation of
795 fathers in these studies. In order to examine these potential biases, future publications
796 should report both participation rates for fathers, and how retention rates are calculated.

797 If possible, future studies should also examine differences based on adolescents
798 who have a known, anonymous, or identity-release donor. It is conceivable that
799 adolescents with an identity-release donor would have a less negative reaction to finding
800 out about their conception than those with an anonymous donor because they would have
801 the possibility to find out more information about their biological background at a time
802 when genetic knowledge is becoming increasingly important. Additionally, it would be
803 informative to gain more data from adolescents that found out about their conception at
804 different time points to examine the long-term effects of disclosure at different ages.
805 More in-depth exploratory research on how the process of disclosure occurs and what the
806 adolescents themselves understand is also important for informing future families created
807 through IVF. Lastly, this review included only one family that used ED, and no families
808 that used ICSI, embryo donation or surrogacy. It is important to conduct studies on how
809 these families are doing psychologically as children go through adolescence, especially as
810 some of these ARTs are becoming increasingly popular.

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815 **CONCLUSION**

816 This is the first review of adolescent psychological adjustment and parent-
817 adolescent relationships to examine outcomes based on different ARTs. The findings
818 have implications for policy related to children born through ARTs, and single or same-
819 sex parenting, by showing that adolescents born through different ARTs into different
820 family types are generally psychologically well adjusted. While some differences in
821 family functioning were identified in relation to the type of ART, the disclosure process,
822 and the sex of both parent and adolescent, it is important to note that despite some
823 variation all of the families were functioning within the normal range and the differences
824 indicated variations within a continuum of positive psychological adjustment. The
825 follow-up of people conceived using ARTs as they progress through adolescence and into
826 adulthood would further elucidate what factors affect the psychological adjustment of
827 families created through fertility treatment.

828

829 **Authors' roles:**

830

831 All authors meet the following qualifications:

832

833 1) substantial contributions to conception and design, or acquisition of data, or analysis
834 and interpretation of data,

835 2) drafting the article or revising it critically for important intellectual content, and

836 3) final approval of the version to be published.

837

838 ECI and SG contributed significantly to all stages of the preparation of this manuscript.

839 ECI designed and conducted the literature search. SG and ECI both contributed to
840 preparation, editing and reviewing of the manuscript. SG is the principal investigator.

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844

845 **Conflict of Interest**

846 None declared.

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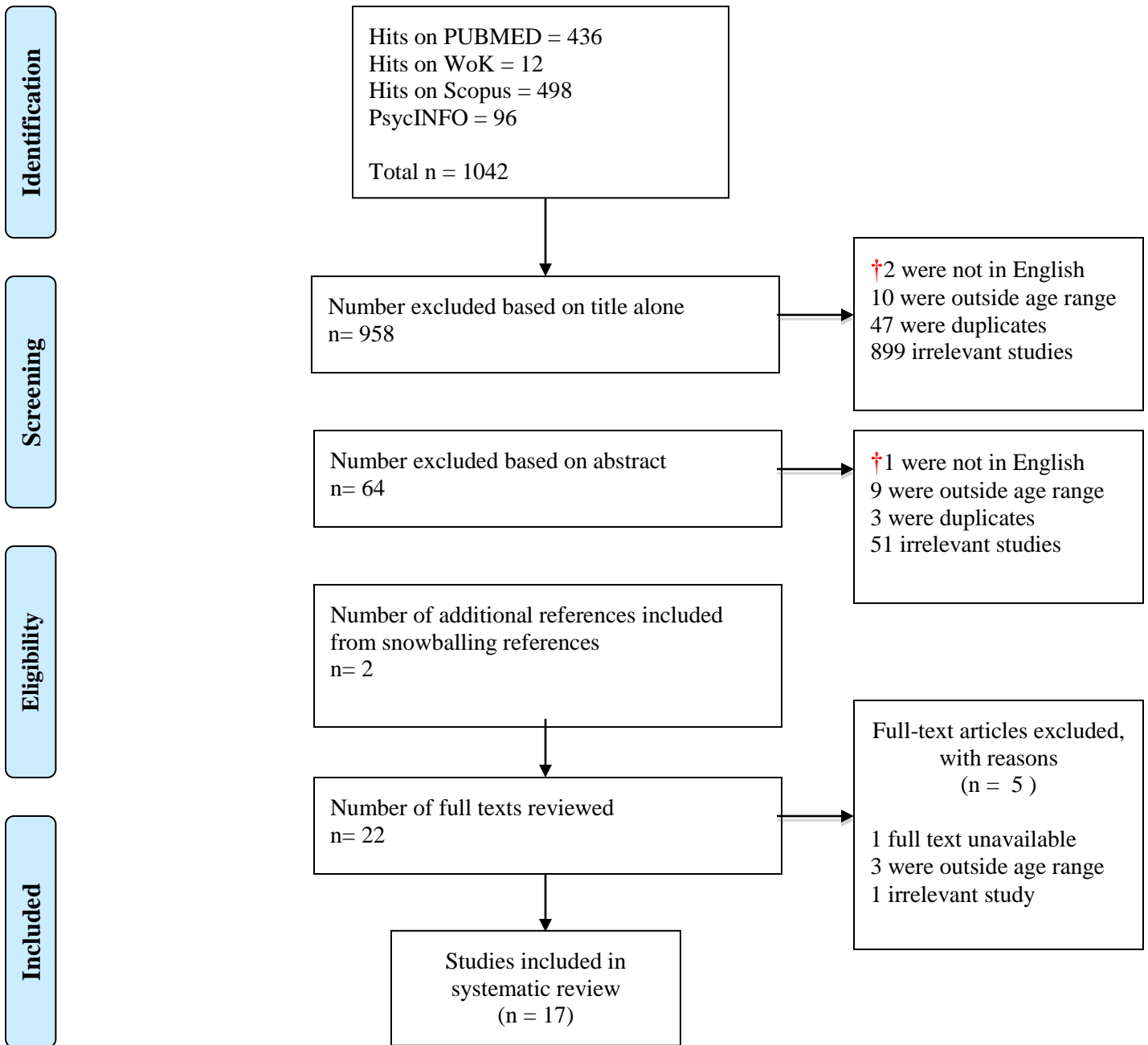
FIGURES AND TABLES

Table 1: Search and selection strategy for systematic review of psychological adjustment in adolescents conceived by assisted reproduction techniques (ART)

Databases searched	Pubmed, Web of Science, Scopus, PsycINFO
Search key words (all in Title/Abstract; MeSH terms were used where appropriate)	<p>Exposure: [Assisted reproduction OR assisted reproductive technolog* OR In-vitro fertilization OR in-vitro fertilisation OR IVF OR sperm donor OR egg-donor OR egg donation OR sperm donation OR insemination OR gamete donation OR embryo donation OR ICSI OR intra-cytoplasmic sperm donation surrogacy* OR surrogate]</p> <p>AND</p> <p>Outcome: [(Adolescen* OR teen* OR teenager* OR young adult*) AND (psycholog* OR adjustment OR well-being OR disclosure OR telling OR open OR behaviour OR socioemotional OR parent-child OR parent-adolescent)]</p> <p>NOT organ donation OR blood donation OR organ OR kidney OR transplant OR heart</p>
Other sources checked	Additional studies were identified through references of included studies.
Inclusion criteria	<ol style="list-style-type: none"> 1. Published in English in peer reviewed journals 2. Studies focusing on ARTs as defined in the search 3. Studies focusing on psychological well being
Exclusion criteria	<ol style="list-style-type: none"> 1. Papers not in English 2. Full article not available 3. Papers that only focus on fertility, pregnancy, or laws 4. Papers that do not focus on adolescence (11-18 years)†
Categories of studies	<p>Parent-adolescent relationships</p> <p>Psychological adjustment of adolescents</p>

†Note: While the Wilson et al. (2011) review defined adolescence as above or equal to 12 years, they included several papers where the age of participants was 11 years. We based our definition of adolescence on theirs but adjusted it to include children of 11 years of age or above.

Figure 1: PRISMA Information Flow Diagram for the Systematic Review of Adolescent Psychological Adjustment in Families Created by Assisted Reproduction



†Note: at all levels of analysis, studies may have been excluded for more than one reason.

Table 2: Summary of longitudinal studies on parent-adolescent relationships and psychological adjustment of adolescents conceived by ART

Longitudinal Studies

Authors, Year, Location, Singleton or Multiple Pregnancies Study	Research design, Study groups (retention rate), Initial response rates at Phase I † Age (mean age) Family type, Disclosure	Outcome measures	Key Findings
(Colpin and Bossaert, 2008) Belgium First-born singletons	Prospective longitudinal 24 IVF (77.4%), and 21 NC (67.7%) families Initial phase one response rate for IVF- 88.6% 15 - 16 year olds (mean age 16.05) Heterosexual coupled parents	Louvain Adolescent Perceived Parenting Scale; Children’s Report on Parent Behaviour; Perceptions of Parents Scale; Responsiveness scale, Behavioural control scale, Psychological control scale, Autonomy Support scale; Parenting Stress Index; Child Behaviour Checklist; Youth Self-Report	Adolescent psychological well-being did not differ between IVF and naturally conceived families.
(Freeman, and Golombok 2012) UK Singletons	Prospective longitudinal cohort 30 DI (86%) families Initial phase one response rate for DI- 77% 12 - 13 year olds (mean age 12.5) Heterosexual coupled parents	Parent interviews; Child and Adolescent Functioning and Environment Schedule; Golombok Rust Inventory of Marital State; Strengths and Difficulties Questionnaire	All families, including families that used donor insemination (DI) were functioning well. In families that were open about their use of DI, there was a lower level of conflict between mothers and sons. Adolescents in these families also reported lower levels of warmth in their relationships with their fathers.
(Gartrell and Bos, 2010) USA	Prospective longitudinal 78 DI (93%) families, and Achenbach normative sample for	Telephone interview with mother; Child Behaviour Checklist (mother and child)	Adolescents born through DI to lesbian coupled mothers are psychologically well adjusted. Lesbian mothers that used DI reported their adolescents to score higher in social, school/academic, and total competence when compared to

Not limited to singletons, one set of twins	<p>comparison</p> <p>Initial phase one response rate unavailable, as interested participants contacted study administrator</p> <p>16 - 18 years old (mean age: 17.05)</p> <p>Lesbian families (coupled and single)</p>		Achenbach's normative sample of American youth of the same age. Mothers also rated their children to show less social problems, rule-breaking, aggressive and externalizing problem behaviors.
<p>(Bos and Gartrell, 2011)</p> <p>USA</p> <p>Not limited to singletons, one set of twins</p>	<p>Prospective longitudinal</p> <p>78 DI (93%) families, and Achenbach normative sample for comparison</p> <p>16 - 18 years old (mean age: 17.05)</p> <p>Lesbian families (coupled and single)</p>	Child Behaviour Checklist (mother and child); Online questionnaire	No differences were found between psychological adjustment between adolescents conceived by a known, and a not-yet-known donor. This suggests that donor type does not influence adolescent psychological adjustment. The majority (67%) of adolescents with an identity-release donor plan on contacting him when they turn 18 years. No differences were found between adolescents with different types of donors in relation to their psychological development and stability.
<p>(Gartrell et al., 2012)</p> <p>USA</p> <p>Not limited to singletons, one set of twins</p>	<p>Prospective longitudinal</p> <p>77 DI families (93%)</p> <p>16 - 18 years old (mean age: 17.05)</p> <p>Lesbian families (coupled and single)</p>	Descriptive online questionnaire on 1) academics, extracurriculars and aspirations, 2) friendship, family interaction and role models, 3) health problems, psychotherapy and wellbeing.	Adolescents born through DI to lesbian mothers reported themselves to be academically successful, with active friendship networks, strong family bonds, and overall high ratings of wellbeing. Over 80% of the adolescents felt they could confide in their mothers, and almost all described their mothers as good role models.
<p>(van Gelderen et al, 2012)</p> <p>USA</p> <p>Not limited to singletons, one set of twins</p>	<p>Prospective longitudinal</p> <p>77 DI (93%) families, and Washington Healthy Youth Survey for control</p> <p>16 - 18 years old (mean age: 17.05)</p>	Online questionnaire (children) with sections on 1)quality of life, 2)donor status 3)maternal relationship continuity and 4) stigmatization	Self-ratings of adolescents conceived by DI to lesbian mothers showed they had comparable ratings of quality of life when compared to controls. No correlation was found between quality of life rating and donor status. There was also no relation found between the mothers' relationship continuity and the quality of life rating of the adolescents.

	Lesbian families (coupled and single)		
(Golombok et al., 2001): UK Healthy singletons	Prospective longitudinal 34 IVF (83%), 49 adoptive (89%), 38 (NC) (88%) families Initial phase one response rate for IVF- 95%, for DI-62%, for adoptive-76%, and for NC-62% 67% of all fathers interviewed, and 76% of all fathers completed questionnaires 11 - 12 years old (mean age: 11.92) Heterosexual coupled parents	Quality of Parenting Interview; Child and Adolescent Functioning and Environment Schedule; Expression of Affection Inventory; Conflict Tactics Scale; Strengths and Difficulties Questionnaire; Social Adjustment Inventory for Children and Adolescents	All families were functioning within a normal range. Slight differences between groups included lower sensitive responding of IVF mothers compared to NC mothers, higher ratings of dependability of IVF children towards their mothers, and higher scores of affection of both IVF mothers and fathers. No differences related to parental control were found between the families.
(Golombok et al., 2002a) UK Healthy singletons	Prospective longitudinal 37 DI (82%), 49 adoptive (89%), 91 (77%) NC families 11 - 12 years old (mean age: DI 11.89, Adopted 11.96, NC 12.45 years) Heterosexual coupled parents	Golombok Rust Inventory of Marital State; State-Trait Anxiety Inventory; Beck Depression Inventory; Quality of parenting interview; Child and Adolescent Functioning and Environment Schedule; Expression of Affection Inventory; Conflict Tactics Scale; Strengths and Difficulties Questionnaire (mothers and teachers)	All families were well adjusted psychologically. Few differences between groups included greater expressed warmth of DI mothers when compared to adoptive mothers, and the perception of DI adolescents of their mothers as more dependable. DI fathers were less involved in disciplining their adolescent when compared to NC and adoptive fathers. No differences in adolescent wellbeing were found between groups.
(Golombok et al., 2002b): UK, The Netherlands, Italy and Spain Healthy singletons	Prospective longitudinal 102 IVF (88%), 94 DI (85%), 102 adopted (89%), 102 (85%) NC families 11-12 years old (mean age: 11.9 in UK, 11.1 in The Netherlands, and the rest fall within that range)	Golombok Rust inventory of Marital State; State-Trait Anxiety Inventory; Beck Depression Inventory; Quality of Parenting Interview; Child and Adolescent Functioning and Environment Schedule; Expression of Affection Inventory; Conflict Tactics Scale; Strengths and Difficulties Questionnaire	No differences were found in mother-child warmth, dependability, and sensitivity towards the child between any groups. Slight differences indicated that IVF and DI mothers showed greater emotional involvement with their child, and they enjoyed motherhood more than NC mothers. IVF and DI fathers expressed more warmth and emotional involvement than adoptive and NC fathers and enjoyed fatherhood more. Some of the IVF and DI parents were over involved with their children. No differences were found in disputes, and

	Heterosexual coupled parents		disciplinary control or adolescent's psychological wellbeing.
(Murray et al., 2006) UK Healthy singletons	Prospective longitudinal 17 egg donation (ED) (84%), 35 DI (82%), 34 (83%) IVF families 11 - 12 years old (mean age: ED 11.60, DI 11.87, IVF 11.97) Heterosexual coupled parents	Mother interview, child interview, Golombok Rust inventory of Marital State; State-Trait Anxiety Inventory; Beck Depression Inventory; Quality of Parenting Interview; Child and Adolescent Functioning and Environment Schedule; Expression of Affection Inventory; Strengths and Difficulties Questionnaire	No differences between ED and IVF families. Few differences found between groups showed lower levels of sensitive responding towards children in ED mothers when compared to DI mothers, while DI mothers were more likely to be emotionally over involved with children than ED mothers. All of the children were well adjusted.
(Golombok et al., 2009): UK Healthy singletons	Prospective longitudinal 26 IVF (79%), 27 adopted (79%), 56 NC (77%) families 18 years old (mean age: IVF 18.83, Adopted 18.83, NC 18.17) Heterosexual coupled parents	Child and Adolescent Functioning and Environment Schedule; Inventory of Peer and Parent Attachment; SCL-90-R; Self-Perception Profile for college students; semi-structured questions about feelings related to ART or adoption	Parent-adolescent relationships did not differ between the groups in terms of warmth or conflict. Adolescents born through IVF showed slightly more physical aggression and reported themselves to do more poorly in school (but differences disappeared when 2 outliers were removed). No difference in psychological or peer problems was reported. The adolescents who knew about their conception reported that this did not cause them distress.
(Owen and Golombok, 2009): UK Healthy singletons	Prospective longitudinal 26 IVF (83%), 26 DI (71%), 38 adoptive (81%), 63 NC (81%) families Participation Rates for fathers: 54%, 23%, 61% and 56% 17 - 18 years old (mean age: 17.33) Heterosexual coupled parents	Golombok Rust Inventory of Marital State; Trait Anxiety Inventory; Beck Depression Inventory; Quality of Parenting Interview; face to face interview (maternal only); Parents of Adolescents Separation Anxiety Scale; Conflict Behaviour Questionnaire	Few differences indicated lower levels of anxiety in mothers that had used DI. Mothers that used ART (IVF and DI) also showed a higher degree of warmth to their children, with the highest level of warmth in DI mother-child dyads. IVF mothers showed higher levels of disciplinary indulgence and DI mothers showed higher levels of disciplinary aggression when compared to NC mothers. No differences were found between fathers in regard to either warmth or conflict.
(Wagenaar et al., 2008b): The Netherlands	Prospective longitudinal 246 IVF (69%), 233 NC (51%) families	Education level; general cognitive ability (Dutch CITO test); school performance; learning and developmental disorders via parental report	The school performance of adolescents born through IVF was no different from that of adolescents conceived spontaneously. No differences were found in ability/performance nor in the number of children with developmental disorders in comparison with the control group.

Singletons	Initial phase one response rate for IVF-72% and for NC-55% 8 - 18 years old (mean age: IVF 12.2, NC 12.21) Heterosexual coupled parents		
Wagenaar et al., 2009): The Netherlands Singletons	Prospective longitudinal 139 IVF, 143 NC families 9 - 18 years old (mean age: IVF 13.6, NC 13.51) Heterosexual coupled parents	Child Behaviour Checklist (parents); Teacher Report Form	All of the children in the study were within a normal range of behavioural and emotional functioning. Parents of adolescents born through IVF reported their child to have less problem behaviour than controls, although teachers reported no differences between the groups. There was a trend towards less externalizing behaviour in the IVF adolescents and teachers also reported a trend towards more withdrawn and depressive behaviour in adolescents born through IVF.
Wagenaar et al., 2011 The Netherlands Singletons	Prospective longitudinal 86 IVF (67%), 97 NC (70%) families 11-18 years old (mean age: IVF 15.71, NC 15.07) Heterosexual couples parents	Youth Self-Report	Behaviour and socioemotional functions as reported by IVF adolescents and controls were found to be within normal range, with no significant differences between groups.

Table 3: Summary of cross-sectional studies on parent-adolescent relationships and psychological adjustment of adolescents conceived by ART

Cross Sectional Studies

Authors, Year, Location, Singletons or Multiple Pregnancies	Research design, Sample groups, Response rate, Age (mean age), Family type	Outcome measures	Key Findings
(Scheib et al., 2005) USA Unspecified if singletons or not	Retrospective cohort 29 DI adolescents, 60.4% response rate (from people already participating in another study) † 12-17 years old (mean age: 14.7) Lesbian (41.4%), single mother (37.9%), and heterosexual coupled	Mail-back questionnaires about disclosure and donor	Most adolescents were very comfortable with their conception and they reported knowing about their conception had a neutral to positive impact on their relationship with their parents. The majority of adolescents also reported wanting to know the donor's identity, although not necessarily at age 18 years, and not necessarily to have a relationship with him. All adolescents had an identity release donor.
(Jadva et al., 2009) USA Unspecified if singletons or not	Retrospective cohort 165 people conceived through DI, response rate 19% for first phase of recruitment and 22% for second phase of recruitment (Members of the Donor-Sibling Registry in the USA) 13-61 years old (mean age: 22) 58% heterosexual coupled parents, 23% single mother, 15% lesbian coupled	Online questionnaire about experiences of donor conception and feelings towards parents. The questionnaire included questions about disclosure as well.	Disclosure in adulthood led to more negative experiences, especially feelings of anger at being lied to by their mother. Those told later did however also report more positive feelings and sympathy towards their mother. People conceived through DI benefit from being disclosed to earlier in childhood. Single mothers and lesbian couples parents were more likely to disclose from a young age. DI conceived people in heterosexual coupled families were more likely to find out about their disclosure from a third party.

†Note: For the longitudinal studies described in Table 2, retention rates (how many people participate as compared to the people involved in the first phase of the study) are reported in parentheses following each study group. Response rates (number of people out of those contacted in the initial phase of the study who participated) are reported in the same column, but only once for each longitudinal study. For the cross-sectional studies in Table 3 only response rates are reported.