Assisted reproductive technology: public funding and the voluntary shift to single embryo transfer in Australia

Abstract

**Objectives:** To calculate cost savings to the Australian federal and state governments from the reduction in twin and triplet birth rates for infants conceived by assisted reproductive technology (ART) since 2002, and to determine the number of ART treatment programs theoretically funded by these savings.

**Design and setting:** Costing model using data from the Australia and New Zealand Assisted Reproduction Database, the National Perinatal Data Collection and Medicare Australia on ART treatment cycles undertaken in Australia between 2002 and 2008.

**Main outcome measures:** Annual savings in maternal and infant inpatient birth-admission costs resulting from the reduction in ART multiple birth rate; theoretical number of ART treatment programs funded and infants born by means of these savings.

**Results:** The reduction in the ART multiple birth rate from 18.8% in 2002 to 8.6% in 2008 resulted in estimated savings to government of $47.6 million in birth-admission costs alone. Theoretically, these savings funded 7042 ART treatment programs comprising one fresh plus one frozen embryo transfer cycle, equating to the birth of 2841 babies. Fifty-five per cent of the increased use of ART services since 2002 has been theoretically funded by the reduction in multiple birth infants.

**Conclusions:** Against a backdrop of supportive public funding of ART in Australia, a voluntary shift to single embryo transfer by fertility clinicians and ART patients has resulted in substantial savings in hospital costs. Much of the growth in ART use has been theoretically cross-subsidised by the move to safer embryo transfer practices.

**Methods**

**Data sources for costing model**

**Babies born following ART**

Data on rates of ART use, ART multiple birth rates and number of live-born infants resulting from ART treatment undertaken in Australia between 2002 and 2008 were retrieved from the Australia and New Zealand Assisted Reproduction Database (ANZARD), held at the Perinatal and Reproductive Epidemiology Research Unit of the University of New South Wales.

**Hospital birth-admission costs**

The costs of caring for mothers and their babies born as a result of ART treatment were sourced from a previously published study on the inpatient birth-admission costs of ART births in Australia in 2003. The hospital costs were limited to the cost of the initial birth admission, defined as the inpatient admission for a birth event until the first separation.

We made several adjustments to the hospital admission costs to reflect only the contribution of government funding. First, data from the Australian Institute of Health and Welfare National Perinatal Data Collection were used to stratify singleton, twin...
and triplet birth admissions, based on hospital sector and elected accommodation status, into i) publicly funded patients, ii) privately funded patients in public hospitals, and iii) privately funded patients in private hospitals. Second, the weighted average birth-admission costs of the latter two patient categories were adjusted by 40% and 35% of the cost, respectively, to reflect the government contribution to funding. The resulting weighted average maternal and infant birth-admission costs from a government perspective in the 2003–04 financial year were $6295 for singleton births, $17 058 for twin births and $75 921 for triplet births. These costs were indexed to the year in which they were incurred using the Consumer Price Index “health” group.

**Government costs of ART treatment**

Data from Medicare Australia (http://www.medicareaustralia.gov.au/provider/mbs.jsp) on annual service counts and benefits paid for MBS items 13200 (ART service), 13209 (planning and management of ART treatment), 13212 (oocyte retrieval), 13215 (fresh embryo transfer), 13218 (frozen/thawed embryo transfer cycle), 13221 (sperm preparation) and 13251 (intracytoplasmic sperm injection) were used to calculate the average Medicare benefits for one ART treatment program (comprising one fresh embryo transfer cycle plus one frozen/thawed embryo transfer cycle). These benefits included those paid through the EMSN. With the addition of the estimated cost of PBS drugs used during treatment, the average cost to Medicare for one treatment program ranged from $3865 in 2003 to $7488 in 2008.

**Costing model**

Using 2002–2008 ANZARD data, the numbers of live-birth deliveries in the years 2003 to 2008 following ART treatment were directly adjusted to the twin and triplet birth rates of 2002. The difference in the total birth-admission costs between the actual and adjusted twin and triplet rates for each year relative to 2002 represented the savings to government in birth-admission costs due to the reduction in ART multiple births since 2002. The efficiency of ART treatment in monetary terms was reflected by the annual savings in birth-admission costs per initiated cycle.

The number of ART treatment programs that were theoretically funded by the savings in birth-admission costs was computed by dividing the total savings in hospital costs by the cost to Medicare (MBS and PBS) of one ART treatment program. Finally, the theoretical number of infants born by ART from these savings was calculated by applying annual treatment success rates and multiple birth rates for the year in which the savings were incurred.

**Ethics approval**

This study was approved by the University of New South Wales Human Research Ethics Advisory Panel I: Social/Health Research.

**Results**

**Trends in ART treatment**

ANZARD data showed that the number of initiated ART treatments in Australia increased by over 10% per year on average since 2002, from around 31 000 to almost 57 000 cycles in 2008 (Box 1). There was a similar increase in the number of live-born infants following ART treatment, from 5863 in 2002 to 10 341 in 2008. The rate of multiple births following ART treatment where embryos were transferred decreased by 54% between 2002 and 2008, from 18.8% to 8.6% of ART births, primarily due to an increase in SET cycles from 29.5% to 67.7% of embryo transfer cycles over the same period. This substantial decrease in the multiple birth rate was achieved while clinical pregnancy rates remained stable at around 22% per cycle (Box 1).

**Costing model**

The inputs and results of the costing model are shown in Box 2 and Box 3. Subtracting the hospital costs associated with the observed number of births from the costs associated with the adjusted number of births (adjusted to 2002 multiple birth rates) in each year generated cost savings to government of $47.6 million (in 2008 dollars) over the 6 years. In effect, the indirect cost of an initiated ART cycle, relative to 2002, was reduced on average by $35 in 2003 and up to $271 in 2008 due to savings in birth-admission costs alone.

From the perspective of government accounts, dividing the cost savings in each year by the average MBS and PBS benefits for one ART program theoretically funded 7042 ART programs comprising one fresh plus one frozen embryo transfer cycle.
**2 Costing model of government savings in birth-admission costs due to reduction in assisted reproductive technology (ART) multiple births in Australia, 2002–2008**

<table>
<thead>
<tr>
<th>Model inputs</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of initiated ART cycles</td>
<td>31,220</td>
<td>33,768</td>
<td>38,693</td>
<td>43,751</td>
<td>46,281</td>
<td>52,426</td>
<td>56,940</td>
<td>—</td>
</tr>
<tr>
<td>Number of live-born infants from ART treatment</td>
<td>5863</td>
<td>6244</td>
<td>7036</td>
<td>8416</td>
<td>8966</td>
<td>9746</td>
<td>10,341</td>
<td>—</td>
</tr>
<tr>
<td>Observed number of live-birth deliveries following embryo transfer cycles</td>
<td>3971</td>
<td>4338</td>
<td>5053</td>
<td>6273</td>
<td>7017</td>
<td>7923</td>
<td>8696</td>
<td>—</td>
</tr>
<tr>
<td>Singleton</td>
<td>894</td>
<td>921</td>
<td>956</td>
<td>1029</td>
<td>941</td>
<td>888</td>
<td>793</td>
<td>—</td>
</tr>
<tr>
<td>Twin</td>
<td>27</td>
<td>19</td>
<td>21</td>
<td>22</td>
<td>20</td>
<td>16</td>
<td>22</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>4892</td>
<td>5278</td>
<td>6030</td>
<td>7324</td>
<td>7978</td>
<td>8827</td>
<td>9511</td>
<td>—</td>
</tr>
<tr>
<td>ART multiple birth rate</td>
<td>18.8%</td>
<td>17.8%</td>
<td>16.2%</td>
<td>14.4%</td>
<td>12.0%</td>
<td>10.2%</td>
<td>8.6%</td>
<td>—</td>
</tr>
<tr>
<td>Adjusted number of live-birth deliveries assuming 2002 multiple delivery rates</td>
<td>—</td>
<td>4284</td>
<td>4895</td>
<td>5945</td>
<td>6476</td>
<td>7165</td>
<td>7720</td>
<td>—</td>
</tr>
<tr>
<td>Singleton</td>
<td>—</td>
<td>965</td>
<td>1102</td>
<td>1338</td>
<td>1458</td>
<td>1613</td>
<td>1738</td>
<td>—</td>
</tr>
<tr>
<td>Twin</td>
<td>—</td>
<td>29</td>
<td>33</td>
<td>40</td>
<td>44</td>
<td>49</td>
<td>52</td>
<td>—</td>
</tr>
<tr>
<td>Total</td>
<td>—</td>
<td>5278</td>
<td>6030</td>
<td>7324</td>
<td>7978</td>
<td>8827</td>
<td>9511</td>
<td>—</td>
</tr>
<tr>
<td>Government savings in birth-admission costs</td>
<td>—</td>
<td>$337,851</td>
<td>$1,045,586</td>
<td>$2,256,737</td>
<td>$3,919,702</td>
<td>$5,714,951</td>
<td>$7,720,394</td>
<td>$20,995,222</td>
</tr>
<tr>
<td>Singleton deliveries</td>
<td>—</td>
<td>$742,706</td>
<td>$2,613,444</td>
<td>$5,771,682</td>
<td>$10,149,759</td>
<td>$14,817,761</td>
<td>$20,266,813</td>
<td>$54,362,166</td>
</tr>
<tr>
<td>Twin deliveries</td>
<td>—</td>
<td>$769,113</td>
<td>$978,651</td>
<td>$1,529,385</td>
<td>$2,100,073</td>
<td>$2,975,811</td>
<td>$2,910,354</td>
<td>$11,263,387</td>
</tr>
<tr>
<td>Total</td>
<td>—</td>
<td>$1,773,967</td>
<td>$2,546,510</td>
<td>$5,044,330</td>
<td>$8,330,130</td>
<td>$12,078,621</td>
<td>$15,456,773</td>
<td>$44,630,331</td>
</tr>
<tr>
<td>Total (2008 dollars)</td>
<td>—</td>
<td>$1,475,827</td>
<td>$3,049,919</td>
<td>$5,799,396</td>
<td>$9,098,183</td>
<td>$12,674,833</td>
<td>$15,456,773</td>
<td>$47,554,931</td>
</tr>
</tbody>
</table>

### Theoretical cross-subsidisation of ART treatment

- Estimated average MBS and PBS benefits for one ART program
  - Total: $3865, $4925, $5614, $5768, $6659, $7488
- Theoretical number of ART programs funded
  - Total: 304, 517, 899, 1444, 1814, 2064, 7042
- Cumulative live-birth rate from one ART program
  - Total: 34.0%, 33.9%, 36.1%, 37.0%, 36.5%, 36.1%
- Theoretical number of live-birth deliveries
  - Total: 103, 175, 325, 534, 663, 744, 2544
- Theoretical number of infants born following ART
  - Total: 85, 147, 278, 469, 595, 680, 2254
- Percentages of increased ART use overall funded through savings
  - 55%

---

Applying the respective cumulative live-birth rates and multiple birth rates for the year the savings were generated equated to the birth of 2841 babies following ART between 2003 and 2008.

### Discussion

The decrease in the ART multiple birth rate in Australia between 2002 and 2008 resulted in estimated savings to federal and state governments of $47.6 million in birth-admission costs alone. This means that 55% of the growth in ART services since 2002 was funded by means of the savings achieved through the greater use of SET and reduction in multiple birth infants. Despite a big increase in ART use, the contribution of ART to the total number of twins born in Australia remains small and, indeed, has fallen from 22% in 2002 to 17% in 2008. The savings identified here were based only on the initial birth admission and therefore significantly underestimate the long-term health care costs associated with caring for multiple birth infants. Even after the initial birth admission, twins and triplets are 3.9 and 10.6 times more likely, respectively, to be transferred to another hospital than singleton infants. Therefore, it is likely that even the average cost of the birth episode has been underestimated in our study. Multiple births also continue to generate higher long-term medical, education and social services costs than singleton births.
has persuaded several jurisdictions, such as Belgium, Sweden and Quebec, to provide public funding for ART, thereby encouraging safer embryo transfer practices and leading to reduced multiple birth rates.16-18

A limitation of this study was the accuracy of the assumptions used to adjust the birth-admission costs to reflect the public contribution to funding. The birth-admission costs were estimated from a previous study using Australian Government national public hospital cost weights, and adjustments were based on reported funding allocations for women giving birth in Australian hospitals. However, given the complex funding allocations for admitted patients in Australia, the assumptions used would have some level of uncertainty.

The reduction in multiple births has primarily occurred as a result of a voluntary shift to use of SET. The Fertility Society of Australia Reproductive Technology Accreditation Committee’s code of practice requires fertility clinics to limit the numbers of embryos that should be transferred,19 but there is no legislation enforcing these guidelines. Similarly, the number of embryos transferred is not linked to government funding, which is a model adopted by some countries to reduce multiple birth rates.20

There is still significant variation in the uptake of SET around the world. With a SET rate of 67.7% and an ART multiple birth rate of 8.6% in 2008, Australia is a world leader in safe embryo transfer practices. By comparison, the United Kingdom and United States report SET rates for fresh embryo transfer cycles of only 11.6% in each country and multiple birth rates of 23.1% and 31.4%, respectively. The difference in the proportion of fresh embryo transfer cycles with three or more embryos transferred is also striking, with rates of 40.4% in the US and 4.8% in the UK, compared with 0.6% in Australia.21,22

The reasons for differences in embryo transfer practices between countries are multifactorial. However, studies from the US and Europe consistently show that higher financial support of ART, either through public or private insurance, is associated with low numbers of embryos transferred during treatment and thus lower multiple birth rates.23-27 Where treatment is unaffordable — through high treatment costs and/or lack of government subsidisation — there is a financial incentive for ART patients to achieve pregnancy in a limited number of cycles. In the US in 2006, one standard fresh IVF cycle equated to 44% of an individual’s annual disposable income, compared with 25% in the UK and 6% in Australia.2 Where these variations exert pressure on both ART patients and fertility specialists to transfer two or more embryos in one cycle, one fresh SET cycle followed by one frozen/thawed SET cycle provides live-birth rates comparable to those associated with double embryo transfer.28

Despite the health risks involved for both mothers and babies, a substantial proportion of couples desire multiple births as an outcome of ART treatment.29,30 It is therefore important that policymakers are aware of how changes to ART funding affect access to treatment and clinical practice, and ultimately the health of children born following ART. Although it is the couple who undergo ART treatment in their desire to have a child, it is the children who are most at risk of the adverse sequelae associated with multiple gestation pregnancy. Clearly, it is also false economy to restrict funding for ART, which only accounts for 0.25% of health care expenditure in Australia,6,7 if it results in higher downstream costs of caring for multiple birth children. In Australia, the EMSN was revised in January 2010 to cap benefits paid to patients for selected Medicare items, including all ART services. The impact of this change on SET and multiple birth rates is yet to be seen.

In conclusion, funding arrangements for ART not only affect who can afford to access ART treatment, but also have the potential to alter the health outcomes of children born as a result. For the sake of the health of children born following ART, we should be asking: “Can we afford not to fund it?”

Competing interests: Georgina Chambers is an Australian Research Council (ARC) Postdoctoral Research Fellow funded through an ARC Linkage Grant (LP100200165). The ARC partner organisations are IVFAustralia, Melbourne IVF and Queensland Fertility Group (Virtus Health). Peter Illingworth is a shareholder of Virtus Health and Medical Director of IVFAustralia.

Received 13 Dec 2010, accepted 9 Jun 2011.


7 Chambers GM, Sullivan EA, Ishihara O, et al. The economic impact of assisted reproductive...