Cost-effectiveness analysis of in-vitro fertilization: estimated costs per successful pregnancy after transfer of one or two embryos

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Standard protocols for in-vitro fertilization (IVF) include transfer of two or three embryos. Not surprisingly, the rate of twin pregnancy after IVF is high (about 24% of all pregnancies). Routine transfer of one, rather than two, embryos would be expected to result in a much lower rate of twin pregnancies at the cost of a lower take-home baby rate. The aim of this study was to compare hypothetical costs to society incurred by pregnancies achieved with IVF protocols based on the transfer of one or two embryos. We compared actual (for two-embryo transfers) and hypothetical (for one-embryo transfers) take-home baby rates; risks of twin pregnancies; and costs of sick leave and hospitalization during pregnancy, deliveries, neonatal intensive care, and handicap care after transfer of one or two embryos. The study showed that even when more treatments might be needed to achieve similar baby take-home rates after transfer of one compared with two embryos, the lower twin pregnancy rate of the former approach caused it to be more cost-efficient than the latter. In conclusion, IVF costs are the sum of fertilization treatment costs and the costs for health care of the pregnant women and their offspring. Considering the association of the latter costs with numbers of embryos transferred, studies of one-embryo transfer protocols are urgently needed.

Key words: health economy/IVF/twin pregnancies

Introduction

In-vitro fertilization (IVF) is now a well established treatment for infertility. During IVF, transfer of several embryos is common to enhance the success rate (Wood et al., 1985). As a result, multiple pregnancy is far more common after IVF (15–30%) than after spontaneous conceptions (1.05–1.35%) (Guttmacher, 1953; MC Working Party on Children Conceived by In Vitro Fertilization, 1990; Bollen et al., 1991; Cohen et al., 1993; Sundström, 1996). Today, most clinics recommend transfer of no more than three embryos. However, reducing the number of transferred embryos from four or more to three does not significantly reduce the number of triplet pregnancies (Cohen et al., 1993). Vauthier-Brouzes et al. (1994) reported on a randomized trial between transfer of two and four embryos. The pregnancy rates were 61 and 46% respectively. These results led the authors to recommend limiting transfer to two embryos only.

Recently, investigators have focused attention on the costs of IVF, showing that multiple-gestation pregnancies contribute a great deal to those costs (Corfman et al., 1993; Callahan et al., 1994; Neuman et al., 1994; Gissler et al., 1995; Goldfarb et al., 1996). Callahan et al. (1994) studied hospital charges for deliveries at Brigham and Women’s Hospital in Boston from 1986 to 1991. Total charge to the family was estimated as $9845 for a singleton delivery, and $37 947 for twins ($18 974 per baby). Goldfarb et al. (1996), in a retrospective study, estimated the costs of IVF procedures and maternal as well as neonatal costs as $39 000 for singleton or twin pregnancies and $340 000 for triplet and quadruplet pregnancies.

Strategies to reduce the number of IVF-related multiple-gestation pregnancies are called for (Corfman et al., 1993). Obviously, the most effective strategy in this regard would be to reduce further the number of embryos transferred to a woman. That kind of strategy might reduce the success rate of IVF, even when the take-home baby rate seems to be no worse after transfer of two than after transfer of more than two embryos (Sundström, 1996). In Sweden, transfer of two embryos is now routine. However, the twin pregnancy rate is ~24% of all achieved pregnancies (Sundström, 1996). Transfer of only one embryo would be the ultimate strategy to reduce twin pregnancy rates from IVF. As far as we know, no clinic in Sweden or elsewhere has adopted a policy of routinely transferring one embryo only.

In the following analyses, we estimated the costs of IVF from the viewpoint of Swedish County governments (who are financing most hospitals) and the Regional Insurance Office (RIO or ‘Försäkringskassan’). We compared estimated costs accrued from the transfer of two embryos with those from the transfer of only one embryo. In the absence of knowledge of the actual take-home baby rate after transfer of one embryo, cost estimates were based on different reasonable pregnancy rates.

Materials and methods

In Sweden, almost all hospital care is financed by tax money collected by the Counties. IVF is exempt from the general right to equal health care. In some Counties, patients have to pay for IVF themselves. In other Counties, one or two IVF treatments are paid for by the County Government for couples fulfilling certain criteria.

Payments for sick leave are in part paid by the RIO, in part by the employer. For the following estimates of costs, we have focused on the year 1995. During that year, payment for the first 2 weeks of sick leave was the responsibility of the employer. For longer episodes of sick leave, the RIO paid 90% of the salary up to a certain level.
1995, RIO paid an average of Swedish Krone (SEK) 313 per day of sick leave to women aged 20–45 years. No data for 1995 are available regarding the number of days women with singleton pregnancy or with twin pregnancy were on sick leave. A survey of a 20% sample of all sickness leave certificates for women with twin pregnancies showed an increase in the average duration of sick leave from 58 days in 1982 to 97 days in 1988 (H. Rydström, unpublished data).

Women with singleton pregnancies were on sick leave for an average of 41 days during 1991 (Håkansson, 1993). For the following estimations, we used the 1988 data for twin pregnancies and the 1991 data for singleton pregnancies (see sensitivity analyses below). In the absence of any information on the number of distinct episodes constituting the total time on sick leave during pregnancy, we regarded the average number of days on sick leave per pregnancy as based on one episode. According to this, the average cost to RIO for sick leave was SEK 25 979 (97–14 days×313) for women with twin pregnancies and SEK 8451 (41–14 days×313) for those with singleton pregnancies.

At our institution, women with twin pregnancy were treated as inpatients for a median of 6 days during 1995. To estimate the median days of hospitalization for those with singleton pregnancy, we extracted from the hospital data base all those who after gestational week 22 had been admitted to the labour and delivery unit on the first working day of each calendar month during 1995. Among these women, the median stay in hospital during pregnancy or after delivery was 1 day (patients admitted for labour and discharged on the same day were regarded as receiving 0 days of inpatient care). The charge for hospitalization in our Department was SEK 3889 per day during 1995. Hence, the average hospitalization charge was SEK 23 334 for women with twin pregnancies and SEK 3889 for those with singleton pregnancies.

Pregnant women with twins are more often delivered by Caesarean section than those with singleton pregnancy. For example, in our department, the Caesarean section rate was 25% for twins and 8.6% for singleton pregnancies in 1995 (OR = 3.4; P < 0.0001). According to the hospital’s charging system (DRG), the estimated cost is SEK 30 070 for an uncomplicated Caesarean section and SEK 41 984 for a complicated Caesarean section. The cost is SEK 10 636 for an uncomplicated vaginal delivery and SEK 16 190 for a complicated vaginal delivery. All twin deliveries, whether vaginal or by Caesarean section, are regarded as complicated. We estimated that 10% of singleton deliveries were complicated. The average costs of delivery were SEK 22 639 (41 984×0.25 + 16 190×0.75) for twin deliveries and SEK 12 917 (41 984×0.086×0.1 + 16 190×0.914×0.1 + 30 070×0.086×0.9 + 10 636×0.914×0.9) for singleton deliveries.

Among children born at our department from 1994 through 1995, 819 (13%) of 6284 singletons and 83 of 143 (58.9%) of twins were treated in the Neonatal Intensive Care Unit (NICU) (OR = 9.5, 95% CI: 6.7–13.7, P < 0.0001). This NICU admission rate does not differ significantly from the rate among the 36 IVF twins from a total of 116 twins born between June 1995 and December 1996 (61.1%).

Generally, even if only one twin required treatment, both were transferred to an observational paediatric unit. Twins stayed at this unit for an average of 8.7 days. The corresponding figure for singleton children was 4.3 days. At the Department of Paediatrics, the daily cost of treatment in the NICU was SEK 6756 and in the neonatal unit SEK 1212. Thus, the total paediatric cost for a twin child was SEK 122 940, or SEK 245 880 per pair. The corresponding figure for a singleton child was SEK 61 540. Hence, when the likely need for NICU care is taken into account, the average neonatal paediatric costs were SEK 144 783 per twin delivery and SEK 8021 per singleton delivery.

Not all children surviving NICU treatment are healthy. Some will have various handicaps. A French estimation made from 1982 showed that the risk of serious handicap was 0.00199 for a singleton child and 0.01368 for a twin child (RR = 6.9), and that the treatment costs of a seriously handicapped child were French Franc (FF) 3 000 000 (Papiernik, 1983). From these figures, it can be calculated that the average cost for the treatment of a severely handicapped singleton child was FF 5970 and that of a twin child FF 41 040, or FF 82 080 per twin pair. These costs were adjusted for the change in average French consumer price index between 1982 (127) and 1995 (205) and for the average SEK value of the FF in 1995 (143.39). According to these adjustments, the French figures were multiplied by a factor of 2.3 for the 1995 analyses, giving an estimated average cost for care of severely handicapped children as SEK 188 784 per twin pregnancy and SEK 13 731 per singleton pregnancy.

**IVF outcomes**

One of the clinics contracted with our Department to perform IVF procedures (Cura Clinic, Malmö, Sweden), reported for 1994–1995 an average clinical implantation rate of 25% after routinely transferring two embryos per cycle (Sundström, 1996). Of 1488 transferred embryos, 363 implanted (one transfer with three embryos was excluded). Of the 363 implanted embryos, 54 were lost before gestational week 18. That is, 309 of 1488 (21%) transferred embryos resulted in children (P. Sundström, personal communication). Of all women delivered, 24% had twin pregnancies. Hence, the probability of having a singleton baby was 24.8%, the probability of having twins 7.8%, and the probability of having no baby was 67.4% after transfer of two embryos. In the following cost analyses, we initially set the probability of having a child as 21% after transfer of one embryo only (the same as the implantation rate mentioned above).

We used the χ²-test to compare categorical variables (Siegel, 1956). Odds ratio (OR) with 95% confidence interval (CI) was calculated according to Miettinen (1974). The Mann–Whitney U-test was used to compare continuous variables (Siegel, 1956).

For cost analyses, we focused on costs for pregnancy and its consequences because these costs are borne by the health care system and the RIO, whereas costs for IVF procedures are often borne by the patients themselves. For the cost-effectiveness analyses, we compared the total costs, including costs for IVF, of different scenarios. The chance of one embryo undergoing spontaneous division, producing monozygote twins, has been set as 1% of all pregnancies in this study (Derom et al., 1987).

**Results**

**Cost analyses**

In the following, we have estimated the various costs ‘booked’ at the moment of transferring one or two embryos, considering the reported chances of singleton (0.248) or twin (0.078) pregnancy after transfer of two embryos, and the hypothetical chances of singleton (0.21) and twin pregnancies (0.0021) after transfer of one embryo.

As shown in Table I, the average costs for prenatal sick leave was estimated as SEK 4122 after transfer of two embryos and SEK 1830 after transfer of only one embryo (Appendix a). The average costs of hospital care (excluding delivery costs) was SEK 2785 after the transfer of two embryos, and SEK 866 after transfer of one embryo (Appendix b). Average
Table I. Estimated costs (in Swedish Krone) to the County and the Regional Insurance Office after in-vitro fertilization with transfer of one or two embryos. Costs are based on 1995 rates

<table>
<thead>
<tr>
<th>Costs</th>
<th>One embryo</th>
<th>Two embryos</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sick leave</td>
<td>1830</td>
<td>4122</td>
<td>2292</td>
</tr>
<tr>
<td>Hospital care during pregnancy</td>
<td>866</td>
<td>2785</td>
<td>1919</td>
</tr>
<tr>
<td>Costs for delivery</td>
<td>2760</td>
<td>4970</td>
<td>2210</td>
</tr>
<tr>
<td>Neonatal care</td>
<td>1988</td>
<td>13 279</td>
<td>11 291</td>
</tr>
<tr>
<td>Handicap care</td>
<td>3280</td>
<td>18 130</td>
<td>14 850</td>
</tr>
<tr>
<td>Total costs</td>
<td>10 724</td>
<td>43 286</td>
<td>32 562</td>
</tr>
</tbody>
</table>

*Based on the assumption that 0.21% of transferred embryos develop to children, and that 7.8% of women deliver twins after a two-embryo transfer compared with 0.21% after transfer of one embryo only.

delivery costs were SEK 1766 for twins and SEK 3204 for singletons (total: SEK 4970) after transfer of two embryos, and SEK 48 for twins and SEK 2713 for singletons (total: SEK 2760) after transfer of one embryo (Appendix c). After transfer of two embryos, ‘booked’ average neonatal intensive care costs for twins were SEK 11 290 for twins and SEK 1989 for singletons (total: SEK 13 279). After transfer of one embryo, the corresponding costs were SEK 304 for monozygotic twins and SEK 1684 for singletons (total: SEK 18 130). After transfer of one embryo, the corresponding costs were SEK 396 for monozygote twins and SEK 2884 for singletons (total: SEK 3280).

In summary, transfer of two compared with one embryo causes an extra post-treatment cost for the RIO and County amounting to SEK 32 562 per IVF cycle.

Sensitivity analyses
The data on average sick leave among pregnant women were out-dated and uncertain. We performed sensitivity analysis to determine how variations in the difference in the number of days on sick leave between women with a twin pregnancy and those with a singleton pregnancy influenced the total costs. For these calculations, we have assumed that the number of days on sick leave for those with a singleton pregnancy was 41 days, and all other costs are constant. As shown in Figure 1, variations in the number of days that women with twin pregnancies were on sick leave influenced the ‘booked’ total costs minimally.

The daily hospital charges for treatment in NICU differ markedly between different hospitals in Sweden. Therefore, we investigated the influence of the NICU charges on the ‘booked’ costs for the RIO and the County after replacement of one or two embryos. For these calculations we used an average daily charge for care both in the NICU and in the observational paediatric unit (all other variables constant). The difference in ‘booked’ costs after transfer of one or two embryos increased markedly with increasing daily charges for paediatric care (Figure 2).

Costs for treatment of handicapped children are particularly uncertain. They are based on estimations from another country (France) more than a decade ago (Papiernik, 1983). Therefore, we studied how costs for the care of handicapped children influenced the costs to the RIO and County generated by transfer of one or two embryos. For these calculations we assumed all other costs constant and an unchanged relationship between costs for a handicapped twin and singleton, i.e. 13.74. The difference in costs for the RIO and County after transfer of one or two embryos increased with increasing costs for treatment of handicapped children. For example, the costs would increase from SEK 19 860 to SEK 39 237, if the costs for treatment of a handicapped child increased from SEK 1 000 000 to SEK 10 000 000 (Figure 3).

Cost-effectiveness analyses
Based on the above cost analyses, we calculated the costs for each pregnancy resulting in a child. We assumed the probability
transfers. IVF treatment costs are not included (1995 rates)

after in-vitro fertilization (IVF) treatments of 100 women with two-embryo transfers. The number of treatments needed to obtain this result is related to different hypothetical probabilities of successful pregnancy after each treatment (assumed constant for repeated treatments)

Table II. Costs (in Swedish Krone) to society, represented by the County Government and the Regional Insurance Office, associated with successful pregnancies after in-vitro fertilization (IVF) treatments of 100 women with two-embryo transfers. IVF treatment costs are not included (1995 rates)

<table>
<thead>
<tr>
<th>Method</th>
<th>Accumulated pregnancies*</th>
<th>Total costs</th>
<th>Costs per pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>33</td>
<td>4 328 600</td>
<td>131 170</td>
</tr>
<tr>
<td>A2</td>
<td>54</td>
<td>7 377 372</td>
<td>136 618</td>
</tr>
</tbody>
</table>

A1: One treatment cycle for all 100 women. A2: One treatment cycle for all 100 women and a repeated treatment for those who did not become pregnant the first time.

*Pregnancies resulting in children.

to be unchanged of either any pregnancy or of twin pregnancy during repeated treatments of those who did not become pregnant at the first IVF attempt. The costs are based on treatment of 100 women. According to the probabilities for pregnancy used in this study, 33 of 100 treated women would have a child after one IVF treatment cycle with the transfer of two embryos. Of the 67 women not succeeding the first time, 21 would achieve a child after an additional treatment cycle with two-embryo transfer. As shown in Table II, the costs, except treatment costs, to the RIO and the County per child achieved was SEK 131 170. For repeated treatments, the cost per child was slightly higher, at SEK 136 618.

The probability of pregnancy after transfer of only one embryo is unknown. In the following comparisons between one- and two-embryo transfers, we have assumed different probabilities for successful pregnancy after one-embryo transfers. For each probability, we calculated the number of IVF cycles with one embryo transfer needed to achieve at least 30 successful pregnancies among 100 women, to compare their costs to the RIO and the County with those for the 33 pregnancies achieved with one two-embryo transfer (Table III). In Table IV, for each probability of pregnancy after one-embryo transfers, we show the number of treatment cycles needed to achieve successful pregnancy in at least 50 of 100 women, to compare the costs with those of the 54 pregnancies achieved after two two-embryo transfers.

Based on the data in Tables I–IV, we have constructed Figures 4 and 5, which show total costs for a successful pregnancy (treatment costs plus costs for the RIO and the County) in relation to some reasonable probabilities of pregnancy after transfer of only one embryo and different prices for IVF treatment. The costs related to one-embryo transfer are compared with those of one (Figure 4) or two (Figure 5) two-embryo transfers. As in Tables III and IV, one-embryo transfers are repeated to achieve numbers of successful pregnancies similar to those obtained after two-embryo transfers.

In Figure 4, we have shown how the costs to the County Government and the RIO are affected by the treatment costs of IVF and the hypothetical chance of pregnancy after transfer of one embryo. The costs following one-embryo transfer are compared with those following two-embryo transfers. As shown in the figure, if the chance of successful pregnancy after transfer of only one embryo is $\geq 10\%$ and the price per IVF cycle is less than approximately SEK 12 000, one transfer with two embryos is less cost-effective than repeated transfers with only one embryo each time. If the probability for

![Figure 3. Estimated costs (in Swedish Krone) for the County Government and the Regional Insurance Office following in-vitro fertilization (IVF) with transfer of one (broken line), or two embryos (solid line). Assuming all other factors to be constant, the graph shows how increasing costs for the care of a handicapped child alters the total costs.](image)

**Figure 3.** Estimated costs (in Swedish Krone) for the County Government and the Regional Insurance Office following in-vitro fertilization (IVF) with transfer of one (broken line), or two embryos (solid line). Assuming all other factors to be constant, the graph shows how increasing costs for the care of a handicapped child alters the total costs.
Figure 4. Estimated total costs (in Swedish Krone) [in-vitro fertilization (IVF) treatment costs plus costs associated with pregnancies following successful IVF treatments] for the County Government and the Regional Insurance Office after one-embryo transfers. The costs are based on a scenario in which IVF treatments are repeated until 30 of 100 women have achieved successful pregnancies to compare the costs with those associated with one two-embryo transfer (thick solid line). The costs associated with one-embryo transfers are estimated for different probabilities (10, 15, 20, 25, 30%) of successful pregnancy after each treatment cycle and for different prices per treatment.

Figure 5. Estimated total costs (in Swedish Krone) [in-vitro fertilization (IVF) treatment costs plus costs associated with pregnancies following successful IVF treatments] for the County Government and the Regional Insurance Office after one-embryo transfers. The costs are based on a scenario in which IVF treatments are repeated until 50 of 100 women have achieved successful pregnancies to compare the costs with those associated with one two-embryo transfer (thick solid line). The costs associated with one-embryo transfers are estimated for different probabilities (10, 15, 20, 25, 30%) of successful pregnancy after each treatment cycle and for different prices per treatment.

is a less cost-effective approach than repeated transfers with only one embryo each time. If the probability for successful pregnancy after transfer of one embryo is ≥15% and the cost of treatment is less than approximately SEK 24 000 per cycle, two cycles with transfer of two embryos each time will be less cost-effective than repeated transfers with only one embryo each time. For higher probabilities of successful pregnancy after transfer of one embryo, that method is most cost-effective for most reasonable prices per IVF cycle.

**Discussion**

This study suggests that IVF with one-embryo transfer may be more cost-effective than IVF with two-embryo transfer, even when the take-home baby rate is lower after the former approach. The sharply reduced risk of twin pregnancy after one-embryo transfer results in cost reductions to the hospital owner and the RIO that may compensate for the costs of the extra IVF treatments needed to achieve the same number of successful pregnancies as after two-embryo transfers.

The findings in this study are largely hypothetical. First, IVF clinics routinely transfer at least two embryos if at all possible. There are no data available regarding routine transfer of only one embryo. In one study of an oocyte donor programme, the pregnancy rate was 11.1% after transfer of only one embryo (Yaron et al., 1997). However, the reason for transferring only one embryo was not stated, and one might suspect that no more embryos were available. It is conceivable that the quality of an embryo is not good if it is the only one that could be obtained. However, in one Swedish IVF clinic, 23 of 93 (24%) women treated during 1994–1995 became pregnant after transfer of only one embryo. In these cases only one embryo had been available (P. Sundström, personal communication). Second, the estimations in this study are based on several uncertainties. We have not been able to distinguish between costs for spontaneous pregnancies and IVF pregnancies. According to a Finnish IVF study, even a singleton pregnancy following IVF is more often complicated than a spontaneous singleton pregnancy (Gissler et al., 1995). The rate of preterm birth was increased, and the newborn more often needed treatment in NICU after IVF than after spontaneous conception. A similar trend was found for multiple pregnancies. Therefore, it is reasonable to expect the real costs to the community for singleton and twin pregnancies after IVF treatment to be higher than those we have estimated. However, this does not necessarily mean that the difference in costs between one-embryo and two-embryo transfers deviates from our estimations. Moreover, the results of IVF, the number of days on sick leave, duration of hospitalization, Caesarean section rate, need for neonatal intensive care, the costs for that kind of care, and the costs for treatment of handicapped children are all variables that differ from country to country, from hospital to hospital, and from year to year. For example, the risks of developing serious handicap might be quite different for children born in France in 1983 from those for any child born in Sweden in 1995, or for a child born after IVF in Sweden in 1995. However, it is possible that the difference in risk of developing serious handicap between
twins and singletons is more stable than the absolute risk to one or the other group of children. Performing sensitivity analyses, we have been able to show the impact on cost-differences between one- and two-embryo transfers of only a few of these uncertain variables. Third, we have not adjusted the costs and risks of two-embryo transfers for embryo reduction. This procedure is extremely seldom among Swedish women with twin pregnancy, but might be more common in other societies. Therefore, depending on how common this procedure is in a population, the economic effects of two-embryo transfers might be less than here postulated.

In this study, we have focused on the costs to society of IVF. The results therefore reflect only a part of the problem. For example, a cost-effectiveness analysis from the perspective of the parents and the children, would have to focus on life-quality issues associated with pregnancy complications, Caesarean section, treatment of a long-desired infant in the NICU, and the risks of having and of being a handicapped child. These risks need to be weighed against the risks of needing more IVF treatment cycles and of achieving no pregnancy at all if fewer embryos are routinely transferred. Moreover, multiple pregnancy may not be perceived as a risk by the patients. According to a survey among 3800 couples with infertility problems seen at a centre in Chicago, 67% had a desire for twins (Gleicher et al., 1995).

Based on this survey, they claimed infertile couples have a strong desire for twins. However, the response rate of 15% hardly justifies this claim. At any rate, even if couples really do have a desire for twins, society will carry a large part of the costs for the complications associated with twin pregnancy and birth. Governments therefore might have regulatory interests in how IVF is performed. By sponsoring IVF, they will accrue costs in the short term, but might also be able to establish guidelines for the number of embryos transferred. The possible need for higher number of treatment cycles to achieve pregnancy after one-embryo transfer will increase treatment costs. However, once only one embryo is needed, natural cycle IVF might be an appropriate approach in some cases to reduce costs per cycle. In the long run, governments might profit from sponsoring IVF treatments which are restricted to one- or maximally two-embryo transfers, by saving the costs of complications associated with twin or multifetal pregnancies.

Moreover, ovulatory stimulations without IVF contribute to the increasing multiple pregnancy rates seen in some societies, including Sweden (B.Källén, unpublished data). The risks of multiple pregnancy after stimulation of the ovaries depends on the experience and skills of the gynaecologist in charge of the treatment. Obviously, the costs to society might be reduced if efforts are directed at the issue of reducing the risks of multiple pregnancies after ovulatory stimulations.

To define the true difference in pregnancy rates following transfer of two or only one embryo, a prospective randomized study is needed. Based on the present results, we believe that the need for such a study is urgent.

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References
Håkansson, A., Thoren, E., Cars, H. et al. (1993) Paid leave of absence from work during the last part of the third trimester. A new attitude to leave of absence reduces the number of days on leave of absence [in Swedish]. Läkartidningen, 90, 2543–2546.
Sundström P. (1996) Replacement of eggs after in-vitro-fertilization. Two ests in how IVF is performed. By sponsoring IVF, they will accrue costs in the short term, but might also be able to establish guidelines for the number of embryos transferred. The possible need for higher number of treatment cycles to achieve pregnancy after one-embryo transfer will increase treatment costs. However, once only one embryo is needed, natural cycle IVF might be an appropriate approach in some cases to reduce costs per cycle. In the long run, governments might profit from sponsoring IVF treatments which are restricted to one- or maximally two-embryo transfers, by saving the costs of complications associated with twin or multifetal pregnancies.

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Appendix: calculation of costs
Appendix a
Transfer of one embryo: SEK 8451 × 0.21 + SEK 25 979 × 0.21 × 0.01 = SEK 1830.
Transfer of two embryos: SEK 8451 × 0.248 + SEK 25 979 × 0.078 = SEK 4122.

Appendix b
Transfer of one embryo: SEK 3889 × 0.21 × 1 + SEK 3889 × 0.21 × 0.01 × 6 = SEK 866.
Transfer of two embryos: SEK 3889 × 0.248 × 1 + SEK 3889 × 0.071 × 6 = SEK 2785.

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Appendix c

Transfer of one embryo: SEK 41 984 × 0.21 × 0.086 × 0.1 + SEK 16 190 × 0.21 × 0.914 × 0.1 + SEK 30 070 × 0.21 × 0.08 × 0.9 + SEK 10 636 × 0.21 × 0.914 × 0.9 + SEK 41 984 × 0.21 × 0.01 × 0.25 + SEK 16 190 × 0.21 × 0.01 × 0.75 = SEK 2760.

Transfer of two embryos: SEK 41 984 × 0.248 × 0.086 × 0.1 + SEK 16 190 × 0.248 × 0.914 × 0.1 + SEK 30 070 × 0.248 × 0.086 × 0.9 + SEK 10 636 × 0.248 × 0.914 × 0.9 + SEK 41 984 × 0.078 × 0.25 × + SEK 16 190 × 0.078 × 0.75 = SEK 4970.

Appendix d

Transfer of one embryo: SEK 8021 × 0.21 + SEK 144 738 × 0.21 × 0.01 = SEK 1988.

Transfer of two embryos: SEK 144 738 × 0.078 + SEK 8021 × 0.248 = SEK 13 279.