Article ID: WMC001830 2046-1690

Induced Abortion on Demand (IAD) in Norway 1979-2009 and a Pre IAD Comparator. A Markov Model Based Cost-Effectiveness Analysis (CEA)

Corresponding Author:
Prof. Jan Norum,
MD, PhD, North Norway Regional Health Authority trust, N-8038 - Norway

Submitting Author:
Prof. Jan Norum,
MD, PhD, North Norway Regional Health Authority trust, N-8038 - Norway

Article ID: WMC001830

Article Type: Original Articles

Submitted on:31-Mar-2011, 10:34:05 PM GMT **Published on:** 01-Apr-2011, 05:33:10 PM GMT

Article URL: http://www.webmedcentral.com/article_view/1830

Subject Categories:ECONOMICS OF MEDICINE

Keywords: Induced Abortion, Norway, Health Economics, Markov Model

How to cite the article: Norum J . Induced Abortion on Demand (IAD) in Norway 1979-2009 and a Pre IAD Comparator. A Markov Model Based Cost-Effectiveness Analysis (CEA) . WebmedCentral ECONOMICS OF MEDICINE 2011;2(4):WMC001830

Source(s) of Funding:

North Norway Regional Health Authority trust

Competing Interests:

None

Induced Abortion on Demand (IAD) in Norway 1979-2009 and a Pre IAD Comparator. A Markov Model Based Cost-Effectiveness Analysis (CEA)

Author(s): Norum J

Abstract

Objective: In the western world, there is a growing concern about an aging population. The number of births per women has been low for decades. The objective was to clarify the cost-effectiveness with regard to induced abortion on demand (IAD) and a comparator.

Methods: A Markov model was established, time perspective was 31 years (1979-2009) and two alternatives compared. A) The induced abortion on demand (IAD) as performed. B) A comparator where 2/3rds of the IAD were avoided to obtain pre IAD figures. Health care (C1), patient/family (C2) and other sectors (C3) costs together with production losses (C4) were calculated in both arms. Savings (S) in terms of life years gained (LYG), health care (S1), patient/family (S2) and other sectors (S3) savings together with production gains (PG) (S4) were included and based on data from Statistics Norway. A 4% discount rate (d.r.) was used.

Results: Between 1979 and 2009, a total of 452,112 pregnancies were terminated. In the comparator arm, 301,408 additional births were obtained and further 5,772 births were added as the children grew up. LYG was indicated 2,372,699 (4% d.r.). Based on the model, the cost/LYG (4% d.r., all resource use) was a saving of Euro 74. Excluding family costs/savings, the figure was Euro 5,187 saved/LYG. The major cost factors were family related costs (66%) and costs in other sectors (23%). Health related costs were negligible (2.5 %). The major saving was due to PG.

Conclusion: From a societal perspective, an intervention avoiding induced abortions is very cost effective and welfare services counteracting family costs are important.

Introduction

Induced abortion on demand (IAD) has been implemented in most western countries during the last decades. Since 1979, women in Norway have had the right to have an IAD performed. Despite the introduction of new contraceptives and several campaigns in the junior high school and high school to educate young Norwegians on the use of contraceptives, the annual abortion figures have been constant. At present every fifth known pregnancy in Norway is terminated by induced abortion (1). The corresponding figures in Denmark, Sweden and England have been reported 1/6, 1/4, 1/5, respectively (2). Similar figures (22 per 100 pregnancies) has been reported from the United States (3-4).

During the last years, Norwegian health care administrators and politicians have expressed a growing concern on how to meet the challenges of an aging population and an increasing dropout from the workforce due to disability. During the last three decades, low birth figures have altered the composition of the European population. In the future less young people will have to take care of an increasing number of elderly people. To handle this upcoming situation, three national reforms have been launched in Norway; A pension reform encouraging Norwegians to stay in the workforce until the age of 70 years, a national insurance reform aiming at less people being reported ill and finally a coordination reform where more patient care is taken care of in the primary health care, aiming to save economic resources and preserve quality of care (5). In a new trend with a strong need for a healthy young generation who can stay in the workforce and take care of the growing number of elderly, it is of interest to compare this development with the induced abortion on demand in Norway during the last three decades. In this study the cost effectiveness was focused and any ethical aspects were not concerned.

Methods

Health economic model

A Markov model was established and three states were implemented (Figure 1). The cost effectiveness analysis was performed from the societal point of view. State A representing a foetus aged 12 weeks or less, state B included a normal birth, state C death or terminated pregnancy. Arrows show how the foetus/child progress through the model over the cycles, which were taken to be 1 year. The transition

probabilities were according to data from Statistics Norway (1). The time perspective was 31 years, which was the time period of the act on demand abortion in Norway (1979-2009). The total cost included health care costs (C1), patient/family costs (C2), costs in other sectors (C3) and productivity losses (C4). The economic benefits were correspondingly in terms of health care savings (S1), patient/family savings (S2), savings in other sectors (S3) and productivity gains (S4). The economic benefits were in terms of health care savings (S1) (6).

Various assumptions can be made in a cost-effectiveness analysis (CEA) depending on which costs and economic consequences that are account edfor. A narrow analysis accounts for health care costs and consequences only, i.e. C1 - S1. A broad analysis include indirect costs and production gains (PG) as well, something that provides an estimation of net social costs, i.e. C1+C2+C3+C4-S1-S2-S3-S4. In a CEA, costs are compared with the incremental health gain; E2-E1 as measured in life years gained (LYG). The exact resource consequence of avoiding abortion is not known. However, modelling can offer support to decision makers as long as it reflects real-world alternatives (7).

Treatment, comparator and effectiveness.

The Norwegian act on demand abortion stipulates that any woman aged 18 years and above has a right to pregnancy termination in a public hospital at no cost to her and without stating any reasons. The terms include she is a resident of Norway and the interruption is performed before the end of 12th week of gestation. Since 1979, the annual abortion rates have been stable around 15.000 cases. Details are shown in Figure 2. In this model, the comparator was a suggested strategy where the pregnant women were supported and informed that the society is in great need for children and therefore will prepare for and welcome the baby. A 67% success rate was employed with a sensitivity analysis ranging from 33 to 100%. The success rate was based on the gap from the present fertility figure (1.9) per woman and the mean fertility rate (2.1) the last nine years prior to the introduction of the Norwegian act on demand abortion. Furthermore, children born due to avoided abortion was calculated having the same fertility rate as Norwegian women in general. According to Statistics Norway, women aged 15-19 years have a fertility rate of 9.3 children born/1000 women (1).The corresponding figure among women aged 20-24 and 25-29 years were 62 and 127, respectively. Implementing these data in the comparator group and calculating half of them females, they would have given birth to 5,772 children during study period.

Costs

All costs were calculated according to Norwegian unit costs and converted into Euros at the rate of 1 Euro = 7.782 NOK as of March 10th 2011 (www.norges-bank.no).

Costs may be divided into health care costs, costs related to patient/family, costs in other sectors and productivity losses (6).The health care costs with regard to induced abortion on demand and the alternative of birth is mainly related to hospitalisation, out-patient follow up of complications. Costs related to patient/family are the shares paid for out-patient visits. In the comparator arm there will be significant costs (kindergarten, food, clothes, transportation etc.) with regard to taking care of a growing child. Costs in other sectors are societal costs with regard to kindergarten and education and finally productivity effects as the grown ups enter the work force.

The Markov Model was run from time of pregnancy to death or end of study period (Figure 1). A time perspective of 31 years and the life expectancy of Norwegians according to Statistics Norway was employed (1). Most authors employ discount rates between 3 and 5%. A 4% discount rate was employed in the study and 0% and 5% was included in the sensitivity analysis. The discount rate was based on the guide and recommendation from the Ministry of Finance (8).

Health care costs (C1)

A) Abortion. The health care costs (C1) were calculated according to the Diagnosis Related Groups (DRG) system and the price list as of January 2011 (9) (DRG 1.0 = Euro 4,750). The cost of an induced abortion was based on DRG 381O (Euro 556).

B) Comparator. There were 9 suggested follow ups during pregnancy and one follow up afterwards (10). They were at 7-10th week, 18th week (incl. ultrasound exam DRG 914Q = Euro 152) and at 24th, 28th, 32th, 36th, 38th, 40th and 41 th weeks of pregnancy and one follow up after delivery. The cost of each visit to the General Practitioner (GP) was for the first visit Euro 44.5 and for the others Euro 38. The cost of giving birth was based on DRG 373 (Euro 2,185). The complication rate was calculated 1.1% (DRG 372 = Euro 3,283). According to statistics from Norwegian Institute of Public Health, 16% have a Caesarean operation (DRG 371 = Euro 5,254). One in five experienced complications DRG 370 = Euro 8,171). Birth related costs occur at least 6 months later than an alternative abortion. The time difference was calculated for employing the 4% discount rate.

Family related costs (C2)

A) Abortion. The shares paid by the patient with regard to an abortion (Euro 39.5) and the travelling

(Euro 33.4) were calculated according to the Norwegian Health Economics Administration (HELFO) data (www.helfo.no).

B) Comparator. Most women (99.9%) in Norway undergo follow ups during pregnancy. There is no patient share to be taken care of for giving birth, but for transportation. A cost of Euro 33.4 per birth was therefore implemented. Furthermore, the cost of raising a child is significant. The National Institute for Consumer Research (SIFO) calculates annually the cost of raising children and the result is implemented in the amount paid in paternity order as decided by the Ministry of Children, Equality and Social Inclusion (www.regjeringen.no/en/dep/bld.html?id=298). In 2010 this monthly cost was according to the age of the child: 0-5 years (Euro 417.4), 6-10 years (Euro 580.4), 11-14 years (Euro 668.6) and 15-18 years (Euro 779.7).These figures were implemented in the Markov model.

Costs in other sectors (C3)

A) Abortion. No costs in other sectors (except C4) were identified.

B) Comparator. The child benefit paid by the Norwegian Labour and Welfare Services (NAV) was in March 2011, Euro 124.6/child/month. The mother and father (the right is divided between them) are in total given a benefit of 10 months out of workforce with one salary covered by NAV. People employed have this right. The employment figures for females aged 20-49 years ranged (four subgroups) from 72-87% (mean 82%) (1). Almost two thirds (73%) were in full time positions. Consequently, it was calculated that 70% ((0.82*0.73) + (0.82*0.26*0.5) = 0.70) received full salary coverage. The mean total cost of a Norwegian worker for 2008 (Euro 75,430) was adjusted for the price index as of February 2011 (Euro 79,808). Couples who do not fulfil the criteria for 10 months salary covered are given a birth benefit. The birth benefit was Euro 4.531 in March 2011 (www.nav.no).

The cost of education is significant. The mean annual cost/pupil in the compulsory primary and secondary school of 2004 (Euro 8,160) was adjusted for the price index as of February 2011 (Euro 9,433). For simplicity, this figure was employed through the whole education period. In Norway, 72% of the youth complete college and 34% have an advanced college or university education (1). These figures were implemented in our model.

From a societal perspective, the birth benefit, the coverage of salary by NAV and the cost of education is covered through the tax system. In practice this is transfer payments (economic resources from one group to another) while the society welfare is unchanged. According to guideline, only the tax financing share of the cost (20%) should be included in a cost-effectiveness analysis when a societal point of view is employed (6, 8).

Production losses (C4)

A) Abortion. Loss of production (C4) due to induced abortion was calculated employing the human capital method (HCM). The mean total cost of a Norwegian worker as of February 2011 (Euro 79,808) was implemented. A total of 230 days/year was calculated for a full position. The cost of one day off was thus Euro 347. Three days off work was calculated with regard to abortion (11). According to Statistics Norway, 70% of women were employed (1).

B) Comparator. The Norwegian Labour and Welfare Services cover the loss of income (one salary) for ten months. The production loss is therefore already included in C3.

Economic consequences - savings (S)

Health care savings (S1), patient/family savings (S2) and savings in other sectors (S3) were observed in the abortion arm and included in the model.

Significant productivity gains (S4) were observed in the comparator arm. According to data from Statistics Norway (www.ssb.no) as of May 2010, 3.6% of the Norwegian population was unemployed and 70 % of the population (16-74 years) were in the workforce. The human capital method (HCM) was used (Euro 79,808/year/worker). Youth dropping out of school and entering the workforce will get a lower income than Norwegians in general and experience a higher unemployment rate. No exact figures were revealed and consequently a conservative figure of half of the HCM figure was employed. For those who had finished university or advanced college education, the HCM figure was included in the model.

Life years gained (LYG) was calculated employing national data on expected survival figures of Norwegians born 2009 as reported by Statistics Norway (1).

Sensitivity analysis

In this survey, a one-way sensitivity analysis to establish the individual effect of each component was performed. The sensitivity analysis included the following parameters: The discount rate (a 0-5% range was employed) and the abortions avoided in the comparator arm (33-100% range) were varied within the ranges given in parenthesis. The corresponding variation in LYG was calculated. Considering health care cost, cost in other sectors and production gains, each individual parameter was varied with +25%.

Results

Life years gained

In the time period between 1979 and 2009, a total of 452,112 pregnancies were terminated (mean 14,584/year) in the abortion arm. Thus, every 5th known pregnancy was terminated in Norway during study period. In the comparator arm, 301,408 births and 150,704 terminated pregnancies were calculated. Furthermore, girls born will grow into women and some of them get pregnant. During study period this accounted for another 5,772 additional births. LYG was thus indicated 2,372,699 (4% d.r.) during study period. The undiscounted figure was 5,099,338 LYG. Employing the expected survival figure of Norwegians (Figure 3), a further 1.9 million LYGs can be expected in a total life perspective (4% d.r.). The undiscounted figure was 15.2 million LYGs.

Cost per life year gained (LYG)

Based on the model, the cost/LYG (4% d.r., all resource use) during study period was calculated a saving of Euro 74 (undiscounted, Euro 3,082). A cost-effectiveness analysis excluding family costs revealed a saving/LYG of Euro 5,187. Details are shown in Table 1. The major cost factors were family related costs (C2) and costs in other sectors (C3) accounting for 66% and 23% of the total cost, respectively. Health related costs (C1) were negligible (2.5 %). The major saving was due to production gain. In a longer time perspective, this factor will be significantly increased as most production gains will occur outside the timeframe of the study.

Sensitivity analysis

The univariate sensitivity analysis (Figure 4) revealed discount rate, production gain and family related costs the main factors having influence on the result. Norwegian authorities have indicated a cut off limit of Euro 54,000/LYG (NOK 425,000/LYG) (8).Employing this limit, avoiding induced abortions is very cost effective and it is probably one of the most cost effective action that can be taken in health care.

Discussion

Most western countries have experienced a drop in fertility rate following the introduction of induced abortion on demand. In Europe in 2005, only Turkey, Island and Albania had rates above 2.0 and only Finland, United Kingdom, Ireland, France, Denmark and Norway had figures above 1.8 (www.epp.eurostat.ec.europa.eu). In the future, less young people in Europe will have to take care of an increasing share of elderly people. This trend can be counteracted by either a significant immigration from other continents or an increased fertility rate in the European population.

In the present study, avoiding abortions was clearly cost saving to the society. Whereas the topic of abortion has been heavily debated, surprisingly none health economic studies comparing abortion with a “life saving” alternative was revealed. However, economics has been discussed in the induced abortion setting. In the United States taxpayers funding for elective abortions have been heavily debated (12-15). At present, law funds cannot be used for an abortion unless the life of the mother is in danger. Whereas the US abortion rates have been declining for almost 30 years, since the legislation in 1973, the figures stalled in 2008. Almost half of US pregnancies were unintended and half of them were terminated by abortion. The cost of abortion in US was between USD 400-500.

In our model, the cost of vacuum aspiration (surgical abortion) was employed due to the fact that medical abortion has only been available during the very last years. Mifepristone, misoprostol and methotrexate have all been employed for medical abortion (16-17). The use of medical abortion has escalated during the last years in Norway and rose from 45% to 67% between 2006 and 2009. The DRG of medical abortion (DRG 814S = Euro 190) is lower than the one of surgical abortion (Euro 556). This in accordance with the findings of Hu et al. who documented that medical abortion had the lowest cost figure (17). Calculating 1/3rd surgical and 2/3rds medical abortions the saving in our study was reduced from Euro 74 to Euro 55. However, complications occur and the true difference is less than Euro 19 (18). The cost of medical abortion was also studied by Van Bebber and colleagues who concluded the mean total cost was USD 351 (19). In Nigeria and Ghana in Africa, Grossman and colleagues documented in a computer based decision analysis clinic-based manual vacuum aspiration more cost effective than medical abortion (20). Furthermore, they concluded the access to safe abortion the most important factor in saving lives and societal costs.

We did not implement any raised cost of mental disorder following induced abortion. This is in accordance with the findings of Munk-Olsen and colleagues who did not reveal any significantly increased risk of psychiatric contact after abortion (21).

Our comparator was based on pre IAD figures. Is it realistic to achieve these figures again? Rasch and coworkers revealed the most important factors associated with the decision to have an abortion was

being single, followed by having two children or more, being unskilled, student and unemployed (2). A higher rate of abortion among non-Westerns was caused by the fact that they were more often unemployed. Consequently, keeping people employed and having access to good welfare services are of importance to lower abortion figures. Another way may be the introduction of a copayment system. In Norway, a strong decline in female sterilization rates was observed after the introduction of a new copayment system where the women paid Euro 781 each (22). However, knowing that most Americans cover the cost of abortion themselves and the US still experience similar figures as the Scandinavian ones, this is probably not a good alternative. This was also supported by the experience in Massachusetts where universal health care coverage was associated with a decrease in the number of abortions performed (23).

Family cost was significant in the presented. This may explain why women being single, unemployed, students and unskilled workers have higher abortions rates (2). However, family costs may be counteracted by good well fare services. In Norway, families with children have tax reductions and received monthly child benefits until the child reaches the age of 18 years. Single women are given extra child benefits. Beside economic support, behavior and attitudes established at a young age seems to be important to keep abortions figures low (24).

Conclusion

In conclusion, a strategy to reduce the abortion figures is cost-saving to the society. A significant cost has to be handled by the family, but economic support initiatives/systems may lower the burden. In the future, politicians and health care administrations should be more focused on the lack of children than the growing number of elderly people. The children are the future of Europe.

References

1. Statistics Norway. Statistical yearbook of Norway 2010. Statistics Norway, Oslo, 2009.

2. Rasch V, Gammeltoft T, Knudsen LB, Tobiassen C, Ginzel A, Kempf L. Induced abortion in Denmark: effect of socio-economic situation and country of birth. Eur J Public Health 2008;18:144-9.

3. Jones RK, Kooistra K. Abortion incidence and access to services in the United States, 2008. Perspect Sex Reprod Health 2011;43:41-50.

4. Jones RK, Zolna MR, Henshaw SK, Finer LB. Abortion in the United States: incidence and access to services, 2005 Perspect Sex Reprod Health 2008;40:6-16.

5. Ministry of health and care services. The coordination reform. Report no. 47 (2008-2009) to the Storting. Ministry of health and care services, Oslo, 2009.

6. Drummond MF, Sculpher MJ, Torrance GW, OBrien BJ, Stoddart GL. Methods for the economic evaluation of health care programmes. Oxford Medical Publications, 2nd ed. Oxford, New York, Toronto: Oxford University Press, 1997.

7. Mullins CD, Ogilvie S. Emerging standardization in pharmacoeconomics. Clin Ther 1998;20:1194-202.

8. Ministry of Finance. A guide to health economic analysis from the society?s point of view. Ministry of Finance, Oslo, 2009.

9. Norwegian Directorate of Health. Information about Diagnosis Related Groups for 2011. Norwegian Directorate of Health, Oslo, 2010.

10. The Norwegian Gynecological Association and the Norwegian Medical Association. A guide in delivery aid. Norwegian Medical Association, Oslo, 2008.

11. Vestfold hospital trust. Gynecology, treatment and exams. Procedures. Vestfold hospital trust, T?nsberg, February 2007.

12. Annas GJ. The real pro-life stance. Health care reform and abortion funding. N Engl J Med 2010;362:e56.

13. Annas GJ. Justice John Paul Stevens. The practice of medicine and the rule of law. N Engl J Med 2010;362:2246-2249.

14. Annas GJ. Abortion politics and health insurance reform. N Engl J Med. 2009;361:2589-91.

15. Tanne JH. Us anti-abortion groups say health reform package should not pay for abortion. BMJ 2009;339:3065.

16. Murthy A, Creinin MD. Pharmacoeconomics of medical abortion. A review of cost in the United States, Europe and Asia. Expert Opin Pharmacother 2003;4:503-513.

17. Hu D, Grossman D, Levin C, Blanchard K, Goldie SJ. Cost-effectiveness analysis of alternative first-trimester pregnancy termination strategies in Mexico City. BJOG 2009;116:768-79.

18. Agustsson AI, Jonsdottir K, Gudmundsson JA. Medical abortions ? experience from the first 246 treatments in Iceland. Laeknabladid 2010;96:331-3.

19. Van Bebber SL, Phillipos KA, Weltz TA, Gould H, Stewart F. Patient costs for medication abortion. Results from a study of five clinical practices. Women Health Issues 2006;16:4-13.

20. Hu D, Grossman D, Levin C, Blanchard K, Danu R,

Goldie SJ. Cost-effectiveness analysis of unsafe abortion and alternative first-trimester pregnancy termination strategies in Nigeria and Ghana. Afr J Reprod Health 2010;14:85-103.
21. Munk-Olsen T, Laursen TM, Pedersen CB, Lidegaard O, Mortensen PB. Induced first trimester abortion and risk of mental disorder. N Engl J Med 2011;364:332-9.
22. Bakken IJ, Skjeldestad FE, Schoyen U, Husby MG. Strong decline in female sterilization rates in Norway after the introduction of a new copayment system. A registry based study. BMC Women Health 2007;7:12-15.
23. Whelan P. Abortion rates and universal health care. N Engl J Med. 2010;362:e45.
24. Sydsjo A, Josefsson A, Sydsjo G. Trends in induced abortions between 1975 and 2000 in a cohort of women born in 1960-64 in four Scandinavian countries. Eur J Contracept Reprod Health Care 2010;15:150.

Illustrations

Illustration 1

Figure 1. The figure shows the Markov model with three stages.

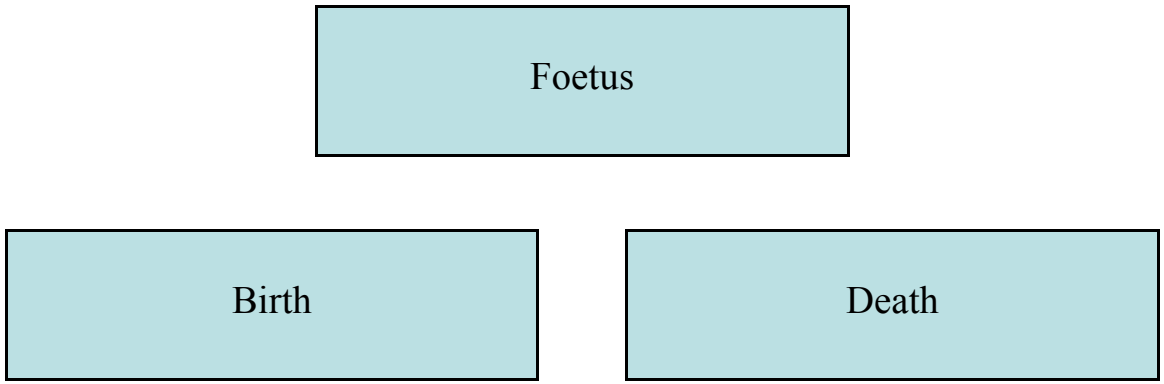


Illustration 2

Figure 2. The cumulative number of induced abortions in Norway 1979 - 2009.

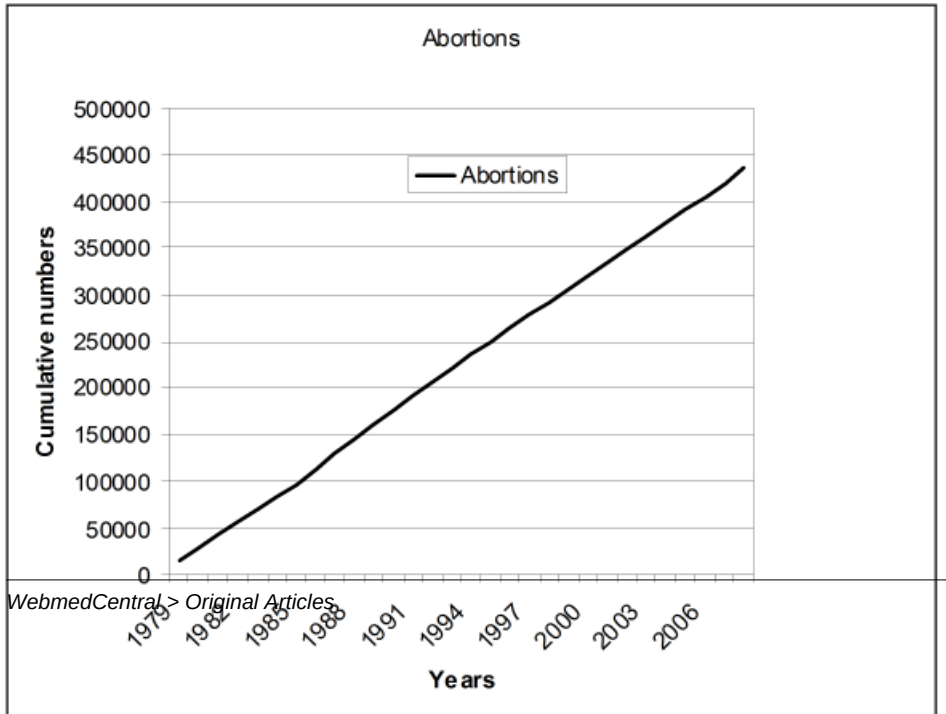


Illustration 3

Figure 3. Life expectancy curve of Norwegians born in 2009.

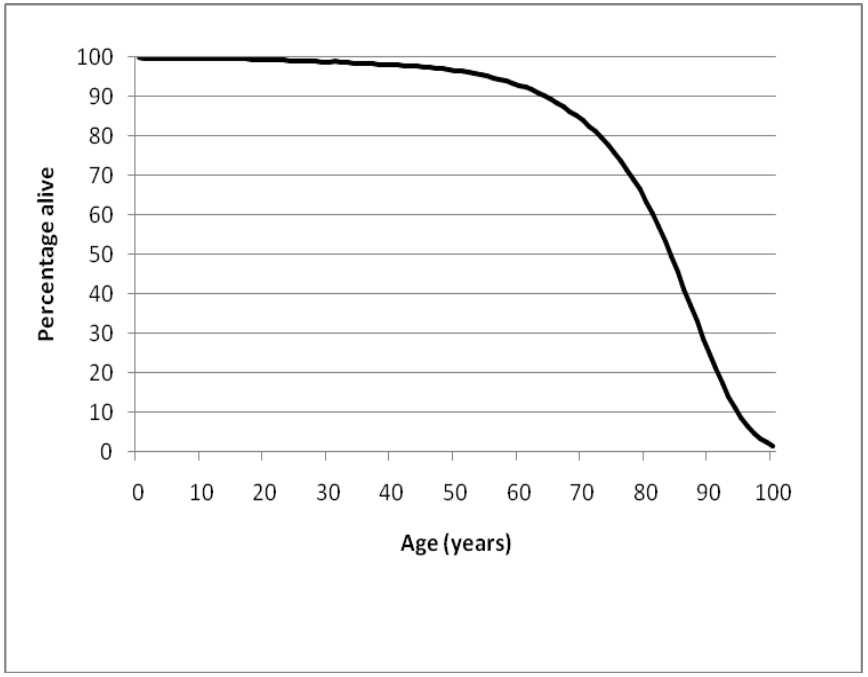


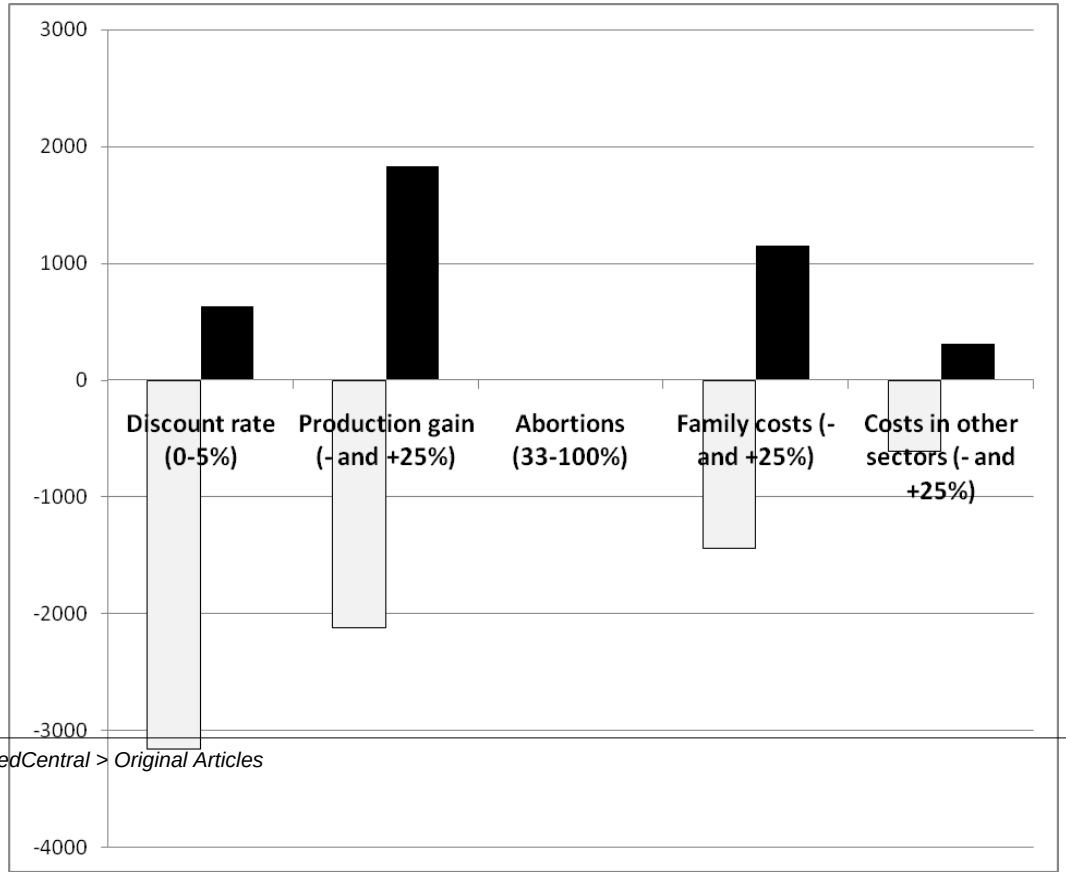
Illustration 4

Table 1. The cost-effectiveness depending on key costing assumptions.

	Cost* 0% d.r.	**Cost* 4% d.r.**	**Cost* 5% d.r.**	**C/E (0% d.r.)**	**C/E (4% d.r.)**	**C/E (5% d.r.)**
Health care cost only (C_1)	817	467	415	160	197	208
Health care + family cost (C_1+C_2)	26,948	12,730	10,739	**5285**	5365	5374
Total cost (excl. family cost) (C_1+ C_3+C_4)	12,502	6,424	5,554	2,452	2,707	2,779
Total cost (C_1+C_2+ C_3+C_4)	38,633	18,686	15,878	7,576	7,876	7,946
Societal perspective (C_1+ C_3+C_4-S_1-S_3-S_4)	-41,850	-12,307	-8920	-8,207	-5,187	-4,464
All resource use (C_1+C_2+						

Illustration 5

Figur 4. The sensitivity analysis



Disclaimer