

COST-EFFECTIVENESS OF TERATOLOGY COUNSELING- THE MOTHERISK EXPERIENCE

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ABSTRACT

Background

While the benefits of evidence-based counseling to large numbers of women and physicians are intuitively evident, there is an urgent need to document that teratology counseling, in addition to improving the quality of life of women and families, also leads to cost saving. The objective of the present study was to calculate the cost effectiveness of the Motherisk Program, a large teratology information and counseling service at The Hospital for Sick Children and the University of Toronto.

Methods

We analyzed data from the Motherisk Program on its 2012 activities in two domains: 1) Calculation of cost-saving in preventing unjustified pregnancy terminations; and 2) prevention of major birth defects. Cost of pregnancy termination and lifelong cost of specific birth defects were identified from primary literature and prorated for cost of living for the year 2013.

Results

Prevention of 255 pregnancy terminations per year led to cost savings of \$516,630. The total estimated number of major malformations prevented by Motherisk counseling in 2012 was 8.41 cases at a total estimated cost of \$9,032,492.

Conclusions

With an estimated minimum annual prevention of 8 major malformations, and numerous unnecessary terminations of otherwise-wanted pregnancies, a cost saving of \$10 million can be calculated. In 2013 the operating budget of Motherisk counseling totaled \$640,000. Even based on the narrow range of activities for which we calculated cost, this service is highly cost-effective. Because most teratology counseling services are operating in a very similar method to Motherisk, it is fair to assume that these results, although dependent on the size of the service, are generalizable to other countries.

Key Words: *Teratology counseling, teratology information services, congenital malformations, cost-effectiveness*

Starting in the late 1970s, an increasing numbers of Teratology Information Services (TISs) have been established in different countries, to address the growing needs of pregnant women and their

health care providers for evidence-based information on the safety of medications and other environmental agents during pregnancy and lactation.¹ While the benefits of evidence-based

counseling to large numbers of women and physicians are intuitively evident, there is an urgent need to prove to third party payers, and mostly governments, that teratology counseling, in addition to improving the quality of life of women and families, also leads to cost saving. To justify their functions, TISs must, similar to other clinical services, prove their impact on health care. This can be done in several dimensions such as 1) documenting the ability of TISs to prevent unnecessary pregnancy terminations due to unjustified fears of birth defects, and 2) calculating the cost saving of TISs in the prevention of major birth defects and other adverse pregnancy outcomes.

To that end, the objective of the present study was to calculate the cost effectiveness of the Motherisk Program, a large teratology information and counseling service at The Hospital for Sick Children and the University of Toronto..

METHODS

We analyzed data from the Motherisk Program on its 2012 activities in two dimensions:

1. Calculation of Cost-Saving in Preventing Unjustified Pregnancy Terminations

During the clinic visit we routinely use a 10-cm visual analog scale (VAS) to assess each woman's tendency to continue/ or terminate her pregnancy.² Briefly, 100 denotes an absolute intention to continue pregnancy and zero an absolute tendency to terminate the pregnancy. This tool has been validated by showing that the vast majority of women who left our clinic with a 50% or more tendency to terminate pregnancy eventually did so.³ This questionnaire is delivered once before any information is volunteered to the woman, and then again after we have explained to her what is known about her exposures. We have used this tool to calculate the cost effectiveness of preventing unnecessary pregnancy termination.

The cost of surgical termination of pregnancy in Canada has been estimated at \$800

per case in 2009.⁴ A conservative cost of follow up visits, complications, psychiatric consultations and loss of work at \$1000 per case.⁵ Hence the total cost of \$1800, after correction for cost of living in 2013 has been estimated at \$2026 per case.

2. Calculation of Cost-Saving in Preventing Major Malformations

Using the Motherisk clinic and telephone consultation data, we calculated the 2012 yearly numbers of Motherisk patients exposed to known human teratogens and the accepted rates of drug-induced major malformations known to be caused by these agents. For the calculation of economic burden from an undiagnosed major malformation, we calculated lifetime estimates from published original data, corrected for cost of living in 2013.⁶⁻¹⁰

Because human teratogens cause specific malformations, we prorated the cost to these specific malformations (e.g. developmental delays, spina bifida, muscoskeletal malformations, etc.).

RESULTS

Calculation of Cost Saving in Preventing Unjustified Pregnancy Terminations

In an analysis of 516 VAS scores²⁻³, we have shown that 24% of women selected to be seen in our clinic had a tendency of 50% or more of pregnancy termination prior to our intervention. Of these 24%, we reversed the tendency of 78% (18.7% of total cases).³ For the following analysis, we have used these figures to calculate the yearly rate of prevention of unnecessary terminations.

We counsel in our clinic around 300 women per year, which therefore would translate to prevention of at least 55 unnecessary pregnancy terminations. Overall we counsel over the telephone approximately 200 cases per day. Assuming a more conservative rate of reversal of termination from 10% to 5%, this would translate to an additional prevention of 200 cases, to a total

of 255 cases yearly. The direct surgical costs of pregnancy termination have been estimated at \$2056 per case in the year 2012 (see *Methods*), leading to a total estimated yearly cost saving by Motherisk of \$516,630.

Calculation of Cost-Effectiveness of Preventing Major Malformations

The table presents the year 2012 numbers of Motherisk patients exposed to known human teratogens and the accepted rates of drug-induced major malformations known to occur in humans with these agents.² Our analysis revealed that almost all our patients exposed to systemic retinoids terminate their pregnancy following our counseling and that virtually all those exposed to valproic acid and carbamazepine presently

undergo tests that can rule out neural tube defects. Data regarding additional teratogens are presented in the table.

For each teratogenic drug the specific malformations caused by it are known, and hence we calculated the cost of preventing these specific malformations (e.g. spina bifida with prenatal exposure to valproic acid and ischemic encephalopathy with exposure to carbon monoxide). The total estimated number of major malformations prevented by Motherisk in 2012 was 8.41 cases at a total estimated cost of \$9,032,492.

TABLE 1 Estimated Number of Chemically Induced Malformations Prevented by Motherisk per Year (based on patients seen in clinic and those counseled over the telephone)

Agent	Reported major malformations (%)	Number of cases in Motherisk 2012	Estimated % preventive procedures (definitive tests or terminations)	Estimated number of malformations prevented per year
Alcohol (high dose)	10	25	80 ^a	2 ^a
Systemic retinoids	40	5	80 ^b	1.00
Valproic acid	2	37	100 ^c	0.74
Carbamazepine	1	39	100 ^c	0.39
Phenytoin	5	11	20	0.1
Severe carbon monoxide poisoning (grade 4-5)	50	6	100 ^d	3.0
Warfarin	16	6	50 ^c	0.48
Cancer	10	4	50	0.2
Chemotherapy				
Mycophenolate	20	5	50	0.5
Total				8.41
Total estimated cost (calculated for the specific malformations)				\$9, 032,492

^aThe majority of heavy drinkers seen by us have chosen to terminate following the counseling. ^bThe majority tended to terminate. ^cThe neural tube defect is detected antenatally in virtually 100%. ^dWomen with severe poisoning (loss of consciousness) have chosen to terminate. ^eHalf of cases terminate following our advice.

DISCUSSION

In performing the cost-effectiveness analysis presented in this study, we have selected only a narrow portion of our activities and even with these activities our calculations were very conservative. For example, in some cases, first-trimester abortion may result in major complications (0.5%) and even mortality (0.03%)¹¹⁻¹⁴; however, we did not attempt to estimate these costs.

There are numerous other activities that were not calculated for their cost saving effectiveness because accurate data were not available:

1) We did not include in our analysis the over 1000 women per year above the age of 35 who are advised by Motherisk on the risk of chromosomal aberrations associated with age, most of whom subsequently underwent amniocentesis.⁵ Based on a mean risk of 0.5% for Down's syndrome in advanced age, this means that Motherisk counsel at least 50 women carrying a fetus with Down's per year.

2) Folic acid supplementation before conception can decrease the rates of neural tube defects by 75%. We have shown that Motherisk counseling increases dramatically the rates of folate supplementation by women who call Motherisk while planning pregnancy.¹⁵

3) Thirty percent of our callers seek advice about breastfeeding while taking medications.¹⁶ The vast majority of them are considering discontinuation of breastfeeding after exposure to drugs compatible with breastfeeding.¹⁶ Hence, Motherisk advice averts numerous cases where children would have been exposed unnecessarily to formula feeding, and excluded from the tremendous advantages of maternal milk.

4) In addition, we did not calculate less well-defined endpoints such as decreasing levels of anxiety and increasing levels of well-being: we do have evidence that many women tend to have a more peaceful pregnancy after being

reassured they have not endangered their fetuses.¹⁷

5) Similarly, we have made no attempts to quantify the medical educational impact of Motherisk.¹⁸ After each consultation we send a letter summarizing the available data to the physician caring for the mother. This information helps educate physicians and health professionals and is consequently used by them for other similar cases.

With an estimated minimum annual prevention of 8 major malformations (*see Table*), and numerous unnecessary terminations of otherwise-wanted pregnancy, a cost saving of \$10 million can be calculated. In 2013 the operating budget of Motherisk counseling totaled \$640,000. Even based on the narrow range of activities cost calculated by us, this operation is highly cost-effective. Because most teratology counseling services are operating in a very similar way to Motherisk, it is fair to assume that these results, although dependent on the size of the service, are generalizable to other countries. With the exponential increase in the cost of health care, the preventive role of counseling women on their teratogenic risk can decrease the load of major malformation while preventing numerous terminations of otherwise wanted pregnancies.¹⁹

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