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**FINAL**
**Report No: 33**

# Impact of TAU reports

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***This report was prepared for the Technology Assessment Unit (TAU) of the McGill University Health Centre (MUHC)***

**by**

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## EXECUTIVE SUMMARY


Objective

Between its inception in January 1, 2002 and June 30, 2007 the McGill University Health Centre (MUHC) Technology Assessment Unit (TAU) produced 29 reports. Of these, two reported wait time data and included no policy recommendations, and a further two made recommendations that have no potential budget impact. This report summarizes the impact on policy of 27 reports and the impact on the budget of 25.

Method

The extent of acceptance of the recommendations of each report and the financial impact on MUHC policy was evaluated through interviews with local administrative and clinical decision makers. Economic impact was estimated by comparing the *potential* utilization of the technology concerned (if no report had been produced) with the *actual* utilization in the years following the report.

Results

*Policy Impact*: The policy recommendations of 25 of the 27 reports have been fully incorporated into hospital policy. The recommendations of one report were not accepted. In another, although not rejected, appropriate measures to carry out recommendations were not initiated.

*Economic Impact*: Over its 5 year existence, TAU has recommended acceptance of 6 (24%) new technologies, not previously accepted as an MUHC budget expense, resulting in an increased expenditure of approximately $1 million. Over the same time interval 19 (76%) TAU reports have recommended rejection or only a very limited acceptance of a technology, resulting in estimated savings to the MUHC's budget of approximately $12.8 million. The administrative costs of TAU have totaled $1.2 million.

Discussion

In general, for these reports and recommendations to be acceptable to the community or jurisdiction to which they apply, it is important that the collection and analysis of data should be scientifically impeccable, that the fairness and good judgment of the individuals responsible for developing the policy recommendations be beyond question, and that the process be completely transparent.

Detailed review of these reports suggests the following specific reasons for their high rate of adoption into hospital policy and highlights several generic lessons learned;

- Most reports were prepared in response to requests from the hospital administration. (Lesson #1 - Requested advice is more likely to be followed than unsolicited advice).
- Reports were generally completed within approximately 3 months. (Lesson #2 - To be useful the information contained in an HTA must be available in a timely fashion.)
- Key Stakeholders (healthcare workers most affected by the decision) were involved from the beginning in the development of each report. (Lesson #3 – Increased relevance and better "buy-in" occurs with early involvement of key stakeholders.
- The development of policy recommendations has also involved the participation of hospital administrators, other healthcare professionals and patients. (Lesson #4 – Multidisciplinary involvement in the review process enhances both the administrative feasibility and the acceptability of recommendations.)
- Failure to act on one accepted report was partly because the technology was already implanted. (Lesson #5-Evaluation must precede, not follow use of a technology, if recommendations are to be accepted).
- Another reason for non-impact of this report was that key players (Chief of Surgery, Divisional Heads) were unaware of its existence. (Lesson #6- Decision-makers and all potential users of a technology under consideration should be identified at an early stage and individually made aware of the recommendations).

## Conclusion

Local HTA reports concerning the commitment of resources to new technologies can have a high impact on policy when prepared in a scientifically rigorous and timely fashion with the assistance of key clinical and administrative stakeholders as equal partners in the process. The primary objective of TAU reports is not to save money but to assist the hospital's decision-making process. Nevertheless these reports have likely resulted in net savings to the hospital budget.

## SOMMAIRE


Objectif

Entre sa création le 1er janvier 2002 et le 30 juin 2007, l'Unité d'évaluation des technologies (UET) du Centre universitaire de santé McGill (CUSM) a produit 29 rapports. De ce nombre, deux fournissaient des données sur les délais d'attente et ne comportaient aucune recommandation, et deux autres proposaient des recommandations sans effet sur le budget. Le présent compte-rendu résume l'impact de 27 rapports sur les politiques de même que l'impact de 25 rapports sur le budget.

Méthode

Le niveau d'acceptation des recommandations de chaque rapport et leur impact financier sur la politique du CUSM ont été évalués à partir d'entrevues menées avec les décideurs administratifs et cliniques locaux. L'impact économique a été estimé en comparant l'utilisation *potentielle* de la technologie concernée (si aucun rapport n'avait été produit) avec l'utilisation *réelle* au cours des années qui ont suivi le rapport.

Résultat

*Impact sur les politiques* : Les recommandations de politique de 25 des 27 rapports ont été entièrement intégrées aux politiques de l'hôpital. Les recommandations d'un rapport n'ont pas été acceptées. Dans un autre, bien que les recommandations n'aient pas été rejetées, les mesures necessaires pour les mettre en œuvre n'ont pas été prises.

*Impact économique* : Au cours de ses cinq années d'existence, l'UET a recommandé l'acceptation de 6 nouvelles technologies (24 %), non prévues au budget d'opération du CUSM, ce qui a donné lieu à un accroissement des dépenses d'environ 1 million de dollars. Pendant la même période, 19 rapports de l'UET (76 %) ont recommandé le rejet ou l'acceptation très limitée d'une technologie, ce qui a donné lieu à des économies budgétaires d'environ 12,8 millions de dollars pour le CUSM. Parallèlement, le coût administratif de l'UET s'est élevé à 1,2 million de dollars.

Discussion

En général, pour que ces rapports et recommandations soient acceptables pour la communauté ou la région auxquelles ils sont destinés, il est important que la collecte et l'analyse des données soient scientifiquement impeccables, que l'impartialité et le bon jugement des personnes responsables de l'élaboration des recommandations politiques soient incontestables et que le processus soit complètement transparent.

Un examen détaillé de ces rapports indique les raisons spécifiques suivantes responsables de leur taux élevé d'intégration aux politiques de l'hôpital et fait ressortir plusieurs leçons générales tirées de l'expérience :

- La plupart des rapports ont été rédigés en réponse à des demandes de l'administration de l'hôpital. (Leçon 1 – Un avis demandé est plus susceptible d'être suivi qu'un avis non demandé).
- Les rapports étaient généralement réalisés dans les trois mois suivant la demande. (Leçon 2 – Pour être utile, l'information contenue dans une ETS doit être disponible rapidement.)
- Les professionnels de la santé les plus touchés par la décision « *stakeholders* » ont été impliqués dès le début dans la démarche d'évaluation. (Leçon 3 – Une participation des professionnels les plus touchés par la technologie assure une pertinence accrue et un taux d'acceptation plus élevé.)
- L'élaboration des politiques a aussi fait appel à la participation des administrateurs, d'autres professionnels de la santé et des patients. (Leçon 4 – La participation de tous les acteurs concernés au processus d'examen améliore tant la faisabilité administrative que l'acceptabilité des recommandations.)
- L'échec du suivi d'une des recommandations d'un rapport déja acceptée est relié en partie à l'utilisation de la technologie déjà en place. (Leçon 5 –L'évaluation doit précéder l'utilisation d'un technologie et non la suivre, pour que les recommandations soient acceptées).
- Une autre raison pour laquelle ce rapport n'a eu aucun d'impact, c'est que les principaux intervenants (chef de la chirurgie, chefs de division) n'étaient pas au courant de son existence. (Leçon 6 – Les décideurs et tous les utilisateurs potentiels d'une technologie

évaluée doivent être identifiés très tôt dans le processus et mis au courant individuellement des recommandations).

Conclusion

Les rapports d'ETS locaux concernant l'engagement de ressources pour de nouvelles technologies peuvent avoir un impact élevé sur les politiques lorsqu'ils sont rédigés de façon scientifique et rigoureuse, avec l'aide des intervenants cliniques et administratifs clés comme partenaires à part entière dans le processus. L'objectif premier des rapports de l'UET n'est pas d'économiser de l'argent, mais de contribuer au processus décisionnel de l'hôpital. Néanmoins, ces rapports ont sans doute donné lieu à des économies récurrentes pour le CUSM.

## INTRODUCTION

The Technology Assessment Unit (TAU) of the McGill University Health Centre (MUHC) was established in November 2001 and published its first report in February 2002. Its structure and function have been described elsewhere [1,2]. All reports are available in full on the web, <www.mcgill.ca/tau/> , and articles based on seven of these reports have been published in the peer-reviewed literature [3-10]

HTAs that have no influence on policy are wasted effort. It was therefore a self imposed condition of the creation of TAU that there should be a regular evaluation of the impact of its recommendations. The first evaluation was carried out in 2004. Between January 1, 2002 and June 30, 2007 the TAU has produced 29 reports. Of these, two reported wait time data and included no policy recommendations. This report summarizes the impact of 27 reports that contained policy recommendations.

## METHOD

To identify the extent of acceptance of the recommendations of each report, and their actual impact on MUHC policy, the administrative and/or clinically responsible decision makers were interviewed. The information was summarized and returned to the individuals concerned for verification.

To estimate economic impact we first extracted from each report the estimated *potential* extent of utilization of the technology concerned, (how much it would have been used within the MUHC if no report had been written). The *actua*l utilization in the year(s) subsequent to the report was then ascertained from hospital administrative data. The difference between the potential and actual utilization was then multiplied by the average unit cost, from the point of view of the MUHC, in order to estimate the saving or increase in expenditure attributable to the report.

In several instances after an interval of one or two years the increased expenditure resulting from the use of a new technology was partly or completely covered by a specific increase in the hospital's budget. Once this had occurred the expense was no longer considered. Thus the expenditures and savings shown are in the effect changes in the hospital's opportunity costs.

Our ability to judge the extent to which the difference between potential and actual usage was attributable to any report varied. In some, such as Report No 1 (Needlestick Injuries), injury rates and infection rates were known, and their health impact could be estimated with confidence, while hospital policy was clearly based on the report. In others, such as Report No 9 (Drotrecogin alfa for severe sepsis) the clinicians in the ICU were already adopting a conservative approach to the use of this medication. The TAU report reinforced that policy, thus making it easier to carry out in the face of pressure to “do everything possible” for critically ill patients.

## RESULTS

The policy recommendations, the potential health impact and the economic impact of each report is summarized in Table 1. Of 29 reports, only 27 included policy recommendations and only 25 included policy recommendations with potential for budget impact.

### Policy Impact

Of the 27 reports that included policy recommendations, in 25 all recommendations have been accepted by the hospital and incorporated into policy. In one report (Number 25, Needlestick Injuries) the recommendations were not accepted by the Hospital Administration. In another, (Number 18, VAC Wound Closure Therapy), although not rejected by the Administration, the administrative steps necessary to carry out the recommendations were not initiated.

*We tried to identify the reasons why the recommendations of these two reports (19,25) were not incorporated into hospital policy.*

Report 19: *VAC wound closure therapy***.**
The TAU report found that in spite of extensive use, the evidence of benefit of this technology was insufficient to justify its routine use. It did not recommend that VAC therapy should be discontinued, but that its use should not be further extended in the absence of new evidence. It also recommended that present users of the technology should collaborate in a research project to establish efficacy.

This report had no clear effect on policy. At the time the report was requested, this technology had already been partly acquired as a result of a special offer by the supplier of a lower price if the devices were acquired before a given date. Thus, it was already in wide use in several different surgical divisions and most users were convinced of its efficacy.

Although there is no evidence that these recommendations were rejected by the administration, the necessary steps to assure that additional VAC machines were not acquired or rented were not taken. In addition there was a failure to transmit the report to the head of surgery and to the relevant surgeons who ordered these treatments. As a result the use of this technology increased in the year following the report.

Report 25: *Needlestick injury*
This report revisited the issue previously studied in report number 1, namely whether the hospital should routinely use safety devices for the insertion of intravascular infusion lines. It found that the issues have not substantially changed since the first report and recommended that the hospital should continue to use the device only for certain high-risk areas such as the HIV clinic, but not introduce the device for universal use.

The Administration rejected this recommendation and has approved the extra budget necessary to implement complete conversion to the safety device. The reasons given are the " importance of the decision and Ontario's adoption of the safety device in all hospitals". [Ann Lynch. Associate Executive Director]

This outcome is consistent with the hospital's policy that clearly confers responsibility for such decisions on the hospital's administrative authorities. Thus, the recommendations of TAU reports are no more

than advice, and it is entirely appropriate that the responsible authorities should overrule such advice on political, social or economic grounds.

## Economic Impact

The estimated budget impact of each report is shown in Table 1. Those reports which resulted in budget savings are summarized in Table 2, and those which resulted in increased expenditure in Table 3.

The estimated economic impact of each report, viewed from the point of view of the MUHC, was calculated as the difference between the estimated expenditure that would have occurred if the report had not been written, less the observed expenditure subsequent to its publication. Whenever increased expenditures resulted in a specific addition to the hospital's budget they were excluded from further consideration.

Over the five years since its inception TAU has recommended acceptance of six technologies, four of which resulted in increased budget commitments totaling a little over $1 million (Table 3). In the case of these technologies the MUHC Administration had refused funding and in the absence of TAU reports it is unlikely that they would have been funded. In each case the TAU committee concluded that the extent of the benefits achieved by these technologies and their modest cost justified their support from the general budget in spite of the opportunity costs involved.

Over the same 5 year period 19 reports recommended rejection or very limited acceptance of technologies, resulting in a saving of approximately $12,663,057. The operating cost of the TAU was approximately $1.2 million. (See Table 2).

## DISCUSSION

In general, for these reports and recommendations to be acceptable to a critical community such as an academic hospital, it is important that the collection and analysis of data should be scientifically impeccable, that

the fairness and good judgment of the individuals responsible for developing the policy recommendations be beyond question, and that the process be completely transparent.

In addition, however, detailed review of these reports suggests the following specific reasons for their high rate of adoption into hospital policy and highlights several generic lessons to be learned;

- Most reports were prepared in response to requests from the hospital administration. (Lesson #1 - Requested advice is more likely to be followed than unsolicited advice).
- At the time that advice was asked for by the administration, the need for a decision was usually urgent. It is unlikely that advice delivered one to two years later could have influenced policy. These reports were generally completed within approximately 3 months. (Lesson #2 - To be useful the information contained in an HTA must be available in a timely fashion.)
- In all reports, stakeholders (senior representatives of the departments most involved in the technology in question) were identified and co-opted onto the Technology Assessment Unit. They were thus involved from the beginning in the preparation of the evidence, and were full voting members of the TAU committee that approved the report. This resulted in reports being more readable, understandable, and relevant to the users of the technology, while the health professionals involved felt they had communication with, and were represented on the decision-making body. This resulted in better "buy-in" of the final report. (Lesson #3 – Increased relevance and better “buy-in” occurs with early involvement of stakeholders in report production.)
- HTA recommendations developed far from the institutions in which they are to be applied cannot easily take count of local conditions, values, and priorities. The development of these policy recommendations has involved the participation of hospital administrators, nurses, pharmacists, medical doctors, other healthcare professionals and patients. (Lesson #4 – Multidisciplinary development of recommendations enhances both their administrative feasibility and the acceptability.)
- Failure to act on the recommendations of one report (VAC therapy) was partly because the technology had already become implanted in hospital practice before the evaluation took place.

(Lesson #5-Evaluation must precede, not follow use, if recommendations are to be accepted).

- A second reason for non-impact of the VAC report was that key players (Chief of Surgery, Divisional Heads) were unaware of its existence. (Lesson #6 It is insufficient to merely transmit reports to the responsible administrators and make them public on the Web. Decision-makers and all potential users of a technology under consideration should be identified at an early stage and individually made aware of the recommendations).

## CONCLUSIONS

Local HTA reports concerning the commitment of resources to new technologies can have a high impact on policy when prepared in a scientifically rigorous and timely fashion with the assistance of key clinical and administrative stakeholders as equal partners in the process. The primary objective of TAU reports is not to save money but to assist the hospital's decision-making process. Nevertheless these reports have likely resulted in net savings to the hospital budget.

# Table 1

**A summary of the reports, their recommendations, and their potential annual health, and budgetary impact. Details available at www.mcgill.ca/tau**

| No | Subject of report (Date) | Recommendation | Annual Health Impact | Annual Budget Impact |
|---|---|---|---|---|
| **1** | Needlestick Safety Device (02/2002) | Health benefit small. *Not recommended* | Prevention of 40 injuries pa , 1HIV /250Yrs, 1 HB/142Yrs, HC/37Yrs. | -$151,482 |
| **(25)** | Needlestick Safety Device. Update (05/2006) | *Not recommended for general use.* Use only in high risk areas | Use of 293,409 devices would prevent: 52NS injuries pa, HIV/227Yrs, 1HB/238Yrs, HC/19Yrs. | Report not accepted |
| **2** | Antiviral treatment for chronic Hepatitis C (10/2002) | Highly cost – effective. *Recommended* | Prevention of cirrhosis, hepatoma, and hepatic failure in 23-36%. Symptom relief in 23% | Yr1 +$40,500 Yr2 +$111,782 Yr3 +$127,546 * |
| **3** | Mitoxantrone for Multiple Sclerosis (12/2002) | Evidence of modest benefit. *Use only in very active cases* | Probable slower progression for some patients | - $25,000 |
| **(24)** | Mitoxantrone for Multiple Sclerosis. Update (05/2006) | Evidence unchanged *Stricter limitation of use advised.* | Same | - $70,000 |
| **4** | Glycoprotein2b/3a Inhibitors in PCI (11/2002) | Intégréline as effective as Reopro.*Use Reporo only for v high risk..* | Uncertain. Possibly none | - $401,008 |
| **5** | LMW Heparin for DVT & PulmEmb (02/2003) | Effective, Cost-effective. *Recommended* | None | - $43,643 |
| **6** | Stents for large bowel obstruction (02/2003) | Effective, Cost-Effective Recommended | Obstruction relieved, colostomy avoided. Budget neutral | Nil |
| **7** | Video capsule Endoscopy ((03/2003) | Unproven *Should be research funded* | Possibly avoidance of laparotomy | -$ 18,700 |
| **8** | Eprex subcut. Risk of red cell aplasia (08/2003) | *Eprex IV or Anaresp Recommended* | Avoidance of pure red cell aplasia | Nil |

* Projected to be cost saving after 2013. HB=Hepatitis B. HC= Hepatitis C. LMW= Low Molecular Weight. DVT= Deep Vein Thrombosis.

Table 1 (continued)

| No | Subject of report (Date) | Recommendation | Annual Health Impact | Annual Budget Impact. |
|---|---|---|---|---|
| **9** | Drotrecogin alfa For severe sepsis (08/2003) | Unproven. *Use only for v. high risk cases* | Uncertain | - $143,000 |
| **(29)** | D. Alfa.Follow up | Same | Same | - $143,000 |
| **10** | Drug Eluting Stents (DES) for PCI (07/2003) | Effective. Not cost-effective. *Use only for high risk cases* | Avoidance of repeating 10% of angioplasties | - $1,522,500 |
| **11** | ICD (09/2003) | Effective. High Cost. *Limit use to 50 pa.* | Saving of 2.9 lives per 100 implants | - $594,000 |
| **12** | Esophageal stents (09/2003) | Effective. *Recommended* | Dysphagia relief for approximately 60 days. | + $13,528 |
| **13** | Biventricular pacing for CCF (03/2004) | Evidence of benefit limited. *Limit use to 6 per year.* | Uncertain. No mortality benefit. ? Improved QOL for 50% patients. | - $90,000 |
| **14** | Gliadel Wafer for Malignant Glioma (01/2004) | Evidence of benefit limited. *Restrict use to 10 pa.* | Averaged increased survival 7 weeks | + $149,770 |
| **15** | Gastric Band for Morbid Obesity (04/2004) | Effective, but not yet approved. *Use Roux-en-Y* | The two procedures equally effective. Banding more costly. | - $328,320 |
| **16** | Matrix Coils for Cerebr. Aneurysm (06/2004) | Benefit unproven. *Not recommended* | None proven | - $42,865 |
| **17** | Stem Cells from unrelated donors (04/2005) | Effective. High cost. *No increase without special funding* | None. Untreated cases are referred to of the hospitals. | - $925,000 |
| **18** | Probiotics C.Diff (01/2005) | Unproven. *Not recommended* | None | Nil |
| **19** | VAC therapy (06/2005) | Unproven. *Increased use not recommended* | None proven | Recommendation not carried out |
| **20** | Neuro monitoring in Spinal Surgery (07/2005) | Effective, necessary. *Recommended* | Avoidance of spinal injury | + $46,000 |

ICD= Implantable Cardiac Defibrillator. CCF= Congestive Cardiac Failure.

**Table 1 (continued)**

| No | Subject of report (Date) | Recommendation | Annual Health Impact | Annual Budget Impact. |
|---|---|---|---|---|
| **21** | Microdialysis for brain injury (08/2005) | Benefit unproven. *Research funding recommended* | None proven | - $65,000 |
| **22** | Botox for Anal Fissure/achalasia (12/2005) | Evidence marginal. *Use only for very restricted criteria*. | Uncertain | Nil |
| **23** | Testing strategy for HER2 breast ca. (05/2006) | An optimal strategy was identified | Best use of Herceptin | Nil |
| **26,27** | Wait Times 1 and 2 (09/2006) | None. Descriptive Studies only. | N/A | Nil |
| **31** | Wait Times 3 Fracture treatment (05/2007) | *Urgently request funding for a new OR* | Avoidance of delayed fixation of 540 fractures per year | Nil |

All evaluations of impact were performed between 06/2007 and 08/2007.

Negative (-) $ numbers represent savings to the hospital budget due to following the recommendations. Positive (+) numbers represent additional spending as a result of following the recommendation.

All recommendations except those in Reports 19 and 25 have been accepted and incorporated into hospital policy. Report number 31 has been accepted but not yet implemented.

## Table 2

**Estimated savings consistent with or because of TAU reports. 02/03 to 06/07.**

| No | Subject | Date | 02-03 | 03-04 | 04-05 | 05-06 | 06-07 | Total Savings. |
|---|---|---|---|---|---|---|---|---|
| 1 | Needlestick | 02/02 | $151,482 | $151,482 | $151,482 | $151,482 | $151,482 | $757,410 |
| 3 | Mitoxantrone | 12/02 | $25,000 | $25,000 | $25,000 | | | $75,000 |
| (24) | Mito Update | 05/06 | | | | $70,000 | $70,000 | $140,000 |
| 4 | Glyco 2b/3a | 11/02 | $401,008 | $401,008 | $401,008 | $401,008 | $401,008 | $2,005,040 |
| 5 | LMWHeparin | 02/03 | | | $20,447 | $44,450 | $66,040 | $130,937 |
| 7 | Video Capsule | 03/03 | $18,700 | $18,700 | $18,700 | $18,700 | $18,700 | $93,500 |
| 9 | Drotrocog. alfa | 08/03 | | $143,000 | $143,000 | $143,000 | | $429,000 |
| (29) | Drot. Up date | 03/07 | | | | | $143,000 | $143,000 |
| 10 | DES † | 07/03 | ? | $2,313,750 | $1,830,000 | ? | ? | $4,143,750 |
| 11 | ICD* | 09/03 | | $594,000 | ? δ | ? | ? | $594,000 |
| 13 | BVPacmakers‡ | 03/04 | | $90,000 | ? | ? | ? | $90,000 |
| 15 | Gastric Band | 04/04 | | | $328,320 | $328,320 | $328,320 | $984,960 |
| 16 | Matrix Coils | 06/04 | | $42,865 | $42,865 | $42,865 | $42,865 | $171,460 |
| 17 | Stem Cells | 04/05 | | | $925,000 | $925,000 | $925,000 | $2,775,000 |
| 21 | Microdialysis | 08/05 | | | | $65,000 | $65,000 | $130,000 |
| | | | | | | | | |
| | **Savings** | | **$596,190** | **$3,779,805** | **$3,885,822** | **$2,189,825** | **$2,211,415** | **$12,663,057** |
| | Cost of TAU | | $280,672 | $294,066 | $263,350 | $161,823 | $202,111 | $1,202,022 |
| | **Savings-cost** | | **$315,518** | **$3,485,739** | **$3,622,472** | **$2,028,002** | **$2,009,304** | **$11,461,035** |

† From 04/05 special funding received.
δ There was saving but it cannot be quantitated.
* From 06-07 received special funding
‡ From 04/05 received special funding

# Table 3

## Estimated increased expenditure because of TAU reports. From 02/03 to 06/07.

| No | Subject | Date | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | Total, |
|---|---|---|---|---|---|---|---|---|
| 2 | Hepatitis C | 10/02 | $40,500 | $111,782 | $127,546 | $127,546 | $127,546* | $534,920 |
| 12 | Oesophageal stents | 09/03 | | | $13,528 | $13,528 | $13,528 | $40,584 |
| 14 | Gliadel Wafer | 01/04 | | | $149,770 | $149,770 | $149,770 | $449,310 |
| 20 | NM** | 07/05 | | | | | $46,000 | $46,000 |
| | **TOTAL** | | **$40,500** | **$111,782** | **$290,844** | **$290,844** | **$336,844** | **$1,070,814** |

***** Projected to be cost saving after 2013

** Neuro monitoring in spinal surgery

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