York Health Economics Consortium

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An Economic Evaluation of Flaminal

1. BACKGROUND AND METHODS

The treatment of leg ulcers represents a significant burden to the Netherlands healthcare system and has a significant impact upon the quality of life experienced by patients. Delayed healing of wounds can, in some cases, lead to infections and many other complications (including amputation and vascular disease).

The report describes the development of an economic model to evaluate the use of Flaminal in wound treatment. The model uses Markov-type approaches in order to estimate and compare the costs and outcomes of treating different types of wounds with Flaminal versus alternative dressings.

The model was constructed using Microsoft Excel, and applies weekly probabilities (i.e. health state transitions) to predict changes in each patient's health status, quality of life, resource use and costs. Using weekly cycles, the model predicts the patient's health state (i.e. unhealed wound with infection, unhealed wound without infection or healed wound) based on outcomes from existing studies. In order to identify suitable healing rates for inclusion in the model a literature review was undertaken. The databases searched and the search terms used are outlined below:

- **Google:**
  - "incidence of venous ulcers";
  - "incidence of diabetic ulcers";
  - "wound care protocol";
  - "wound treatment protocol";
  - "guideline for ulcers".
- **Cochrane:**
  - "venous ulcers";
  - "diabetic ulcers";
  - "pressure ulcers".

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- **Highwire database (inc. PubMed):**
  - o randomized controlled trial AND silver AND ulcers;
  - o randomized controlled trial AND alginate AND ulcers;
  - o randomized controlled trial AND hydrogel AND ulcers.

The model uses a Markovian approach to simulate a cohort of 1,000 generated patients. Of the 1,000 generated patients, each will experience a different health pathway over the course of the model. The time horizon in the model is one year. However, the model has been designed to allow for longer follow-up if required.

The model is driven by various factors, including the relative healing rate, infection rate and wound recurrence rate associated with each treatment. The effectiveness of each dressing was driven by the primary outcome in a study by De La Brassine *et al.*, the mean percentage reduction in wound surface area at eight weeks (63% at 4 weeks for Flaminal. One study (Viamontes & Jones, 2007) showed a reduction in surface area of 32% over 6.7 weeks for Mepilex. This outcome was then used to predict the healing rate (i.e. median time to healing) and converted to a weekly rate for application in the model. Mean reduction in mean surface area is a surrogate endpoint for healing rate, so we converted the outcome data to a weekly healing rate by using the following formula which was reported by Cardinal et al (2008):

$$Healing\ rate\ (\%) = (LN(1 - Mean\ surface\ area\ reduction\ in\ \%))/weeks)$$

For Aquacel Ag, a mean SA reduction was not available and, as such, a healing rate was used. One study showed the healing rate for Aquacel Ag to be 59.6% over 12 weeks. For all treatments, a recurrence rate of 17% per year was used in the model (Gohel, 2005).

Health-related quality of life inputs (utilities) were applied to each health state in order to generate quality-adjusted life years (QALYs). The utilities used in the model are 0.83 for a healed wound, and 0.61 for an unhealed wound (Palreyman, 2008).

The cost of dressings (€4.60 for Flaminal, €10.97 for Aquacel Ag alone and €7.78 for Mepilex alone) was applied to each week in the model, based on the mean number of expected changes (assumed to be three per week). Resource use (i.e. use of healthcare staff, equipment and disposables) was applied each week in the model. The level of use was dependent upon the patient's health states, as demonstrated in Table 1.1 below. This was multiplied by the unit cost of each resource (also shown in Table 1.1) to calculate the weekly cost for each health state and, consequently, the total cost for the entire cohort of patients.

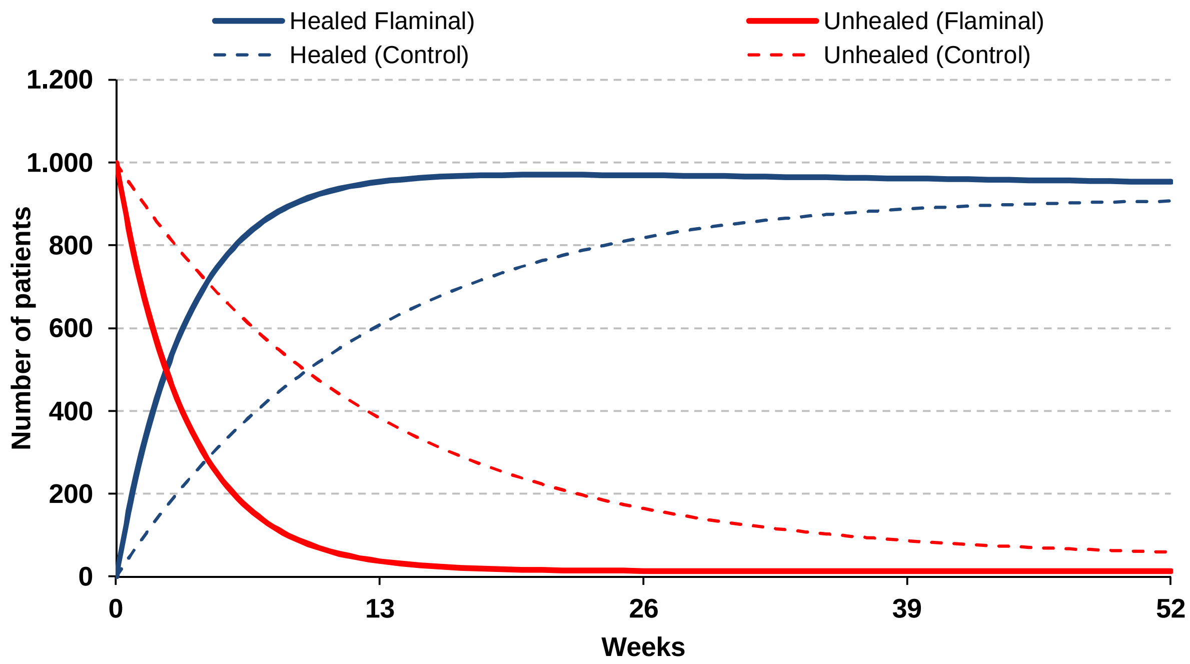
Table 1.1: Resource use and unit costs

Resource	No wound	Unhealed	Infected	Unit cost
Nurse visit	-	3.00	3.00	€36.44
Travel costs	-	3.00	3.00	€25.65

2. RESULTS (FLAMINAL VERSUS AQUACEL AG ALONE)

The proportion of patients in each state throughout the model is shown in Figure 2.1 below.

Figure 2.1: Modelled cohort over time



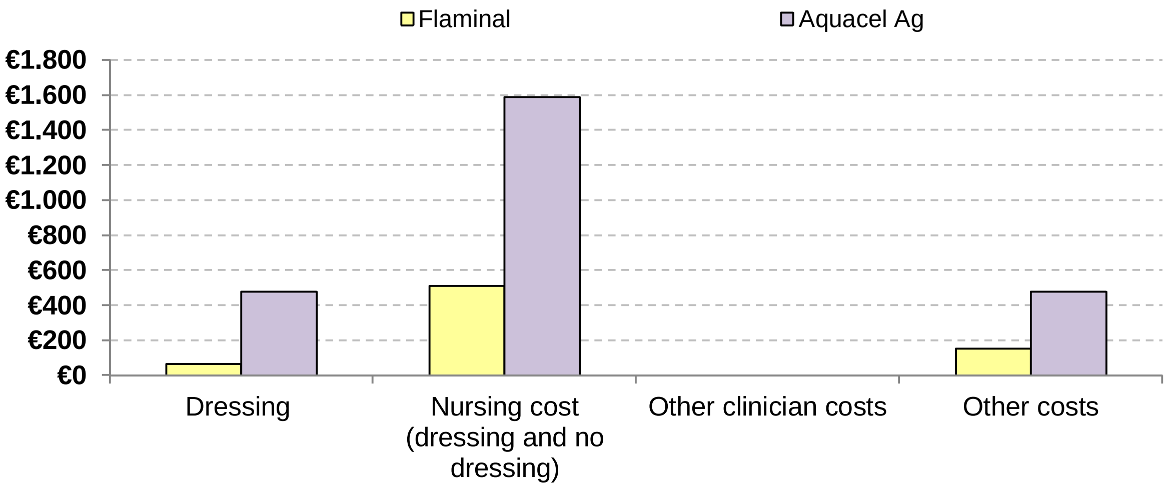
As demonstrated in Table 2.1 below, Flaminal was demonstrated to be cost-saving when compared to Aquacel Ag. In addition, health gains were observed for patients receiving Flaminal. Specifically, Flaminal is predicted to save a total of €413 per patient over one year. This is due to the substantial savings in terms of nurse time associated with dressing changes, since Flaminal's improved healing rate leads to a reduction in the total number of dressings required (see Figure 2.2).

Table 2.1: Model outputs (per patient)

	Flaminal	Aquacel Ag	Incremental
Dressing	€65	€478	-€413
Nurse time (per dressing)	€511	€1,588	-€1,077
Travel	€154	€478	-€324
Total cost	**€729**	**€2,544**	**-€1,814**
QALYs	**0.796**	**0.754**	**0.042**

ICER (incremental cost per QALY)			**Dominates**
Dressing changes	**14.08**	**43.97**	**29.89**
Nurse time (hours)	**9.39**	**29.32**	**19.93**
Nurse time (days)	**1.17**	**3.66**	**2.49**

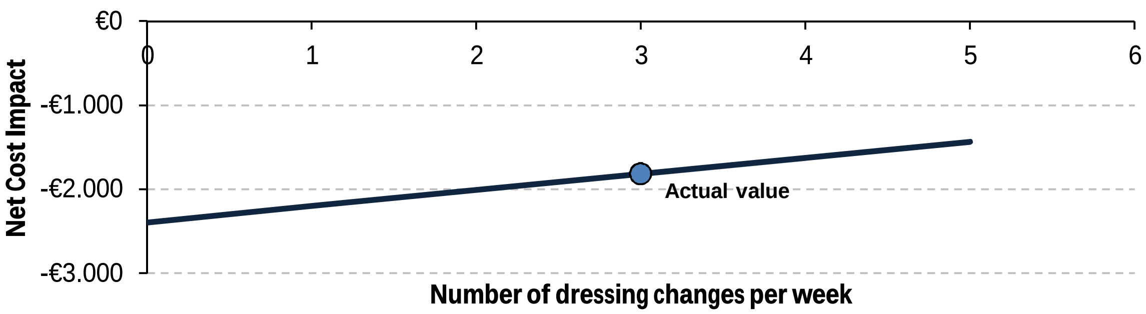
Figure 2.2: Costs at one year



Sensitivity Analysis

Because some of the model inputs (i.e. the frequency of dressing changes) are not certain, it is judicious to undertaken exploratory analysis on the variability of results when key parameters are changed. Figure 2.3 below, shows the impact of varying the number of dressing changes per week for Flaminal.

Figure 2.3: Impact of varying the frequency of dressing changes

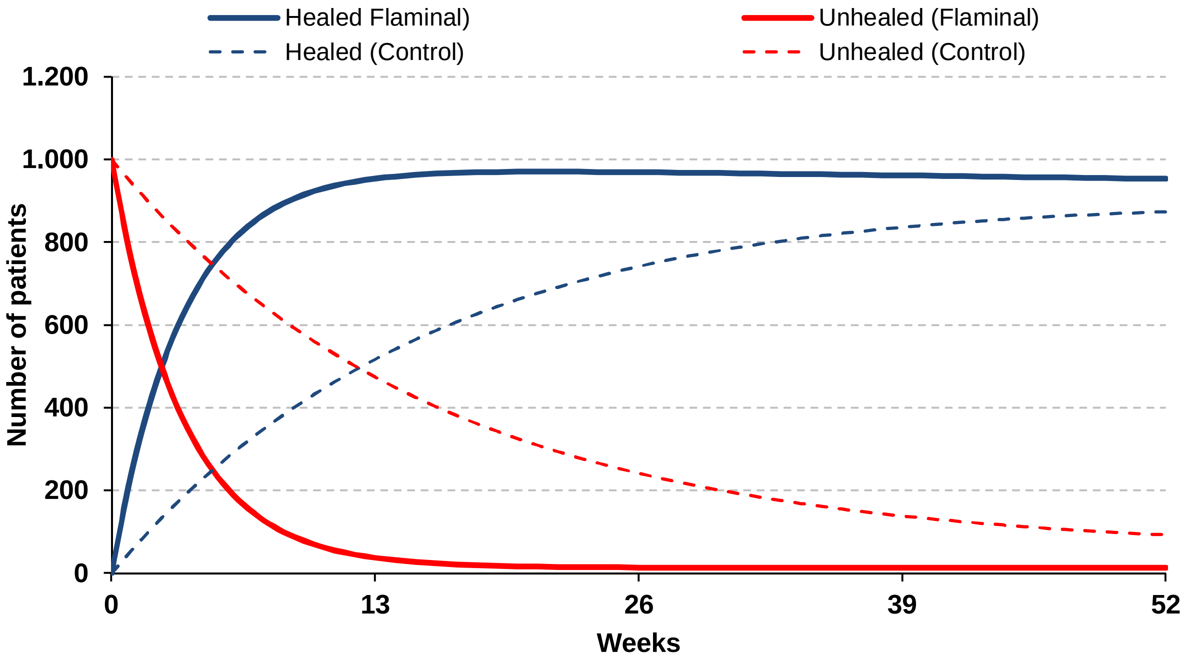


It is clear from this analysis that the cost savings associated with Flaminal remain robust to variations in the frequency of dressing changes.

3. RESULTS (FLAMINAL VERSUS MEPILEX ALONE)

The proportion of patients in each state throughout the model is shown in Figure 3.1 below.

Figure 3.1: Modelled cohort over time



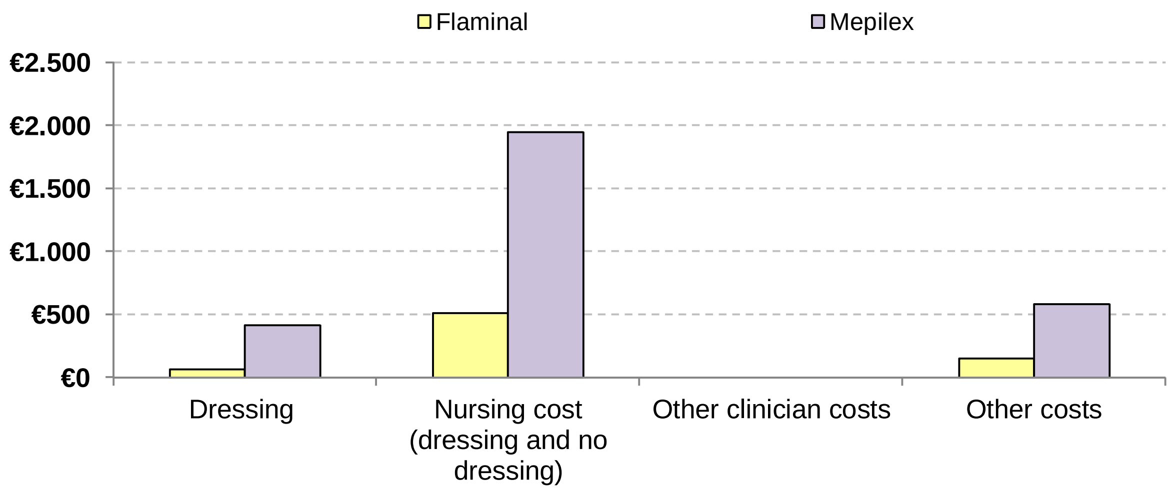
As demonstrated in Table 3.1 below, Flaminal was demonstrated to be cost-saving when compared to Mepilex. In addition, health gains were observed for patients receiving Flaminal. Specifically, Flaminal is predicted to save a total of €351 per patient over one year. This is due to the substantial savings in terms of nurse time associated with dressing changes, since Flaminal's improved healing rate leads to a reduction in the total number of dressings required (see Figure 3.2).

Table 3.1: Model outputs (per patient)

	Flaminal	**Mepilex**	**Incremental**
Dressing	€ 65	€ 416	-€ 351
Nurse time (per dressing)	€ 511	€ 1,947	-€ 1,436
Travel	€ 154	€ 586	-€ 432
Total cost	**€ 729**	**€ 2,948**	**-€ 2, 219**
QALYs	**0.796**	**0.741**	**0.055**

ICER (incremental cost per QALY)			**Dominates**
Dressing changes	**14.08**	**53.97**	**39.89**
Nurse time (hours)	**9.39**	**35.98**	**26.59**
Nurse time (days)	**1.17**	**4.50**	**3.32**

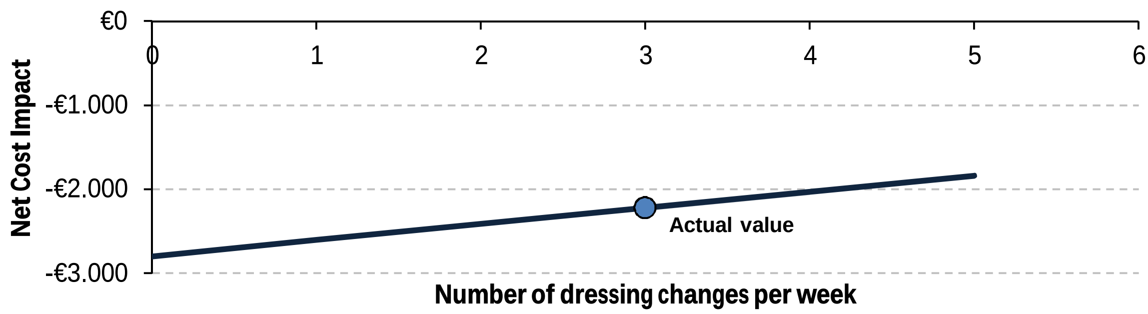
Figure 3.2: Costs at one year



Sensitivity Analysis

Because some of the model inputs (i.e. the frequency of dressing changes) are not certain, it is judicious to undertaken exploratory analysis on the variability of results when key parameters are changed. Figure 3.3 below, shows the impact of varying the number of dressing changes per week for Flaminal.

Figure 3.3: Impact of varying the frequency of dressing changes



It is clear from this analysis that the cost savings associated with Flaminal remain robust to variations in the frequency of dressing changes.

4. DISCUSSION

As with any economic model, this analysis is not without its limitations. In populating the model with quantitative data, some assumptions were necessary. For instance, the modelling approach assumes that we can assess an “average” patient, and applies the same decision-making criteria across a whole population of wound care patients. In actuality, it is probable that individual characteristics of patients may determine the choice of intervention. However, this model should be thought of a tool to aid such decision making, and should be used to inform decision makers that the choice of therapy should be based on a deeper consideration than price alone.

If the prices of dressings are the only consideration taken into account by decision makers, simple dressings would be the choice. However, this analysis proved that effectiveness outcomes of dressings should be also taken into account and the dressings that are demonstrated to have higher healing rates are likely to be even more cost-effective and result in significant cost savings due to less use of labour intensive dressing changes. The net cost impact of Flaminal stayed cost-saving even when the frequency of dressing changes for Flaminal was doubled. The number of dressings used in the longer term was less with Flaminal due to higher healing rates and, therefore, the total expenditure for Flaminal was significantly less than for alternative dressings over one year.

This analysis has also excluded a number of other factors that may have demonstrated even greater cost savings for Flaminal. For instance, limiting the time horizon to one year may underestimate the true cost savings, since unhealed wounds (of which there are a greater number in the Mepilex and Aquacel Ag cohorts) would continue to incur additional costs in the longer-run. Furthermore, because Flaminal includes a patented enzyme system, GLG, it does not require supplementary antimicrobial dressings or therapies, which may be required with the other dressings (hence, adding to the cost of those alternative therapies). Finally, the actual cost of dressing changes may be underestimated in this model, since the cost of other materials was not included. Because Flaminal results in fewer dressing changes over time, the costs savings are likely to be even greater than reported in this study.

5. REFERENCES

- De La Brassine M, Thirion L & Horvat L. A novel method of comparing the healing properties of two hydrogels in chronic leg ulcers. *European Academy of Dermatology and Venereology* 2006; 20
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