DEVELOPMENT OF A BUDGET IMPACT MODEL (BIM) TO EVALUATE THE FINANCIAL IMPACT OF ADOPTING DRUG X FOR THE SUPPLY OF ENERGY, ESSENTIAL FATTY ACIDS AND OMEGA-3 FATTY ACIDS TO PATIENTS, AS PART OF A PARENTERAL NUTRITION REGIMEN, WHEN ORAL OR ENTERAL NUTRITION IS IMPOSSIBLE, INSUFFICIENT OR CONTRA-INDICATED.

THE PROBLEM/OPPORTUNITY

Complications caused by disease related malnutrition (DRM) are associated with longer hospital stays. Thus, malnutrition significantly increases healthcare costs, as shown by numerous studies worldwide. The cost of malnutrition in Europe (extrapolated from UK data), estimates that 33 million Europeans have DRM, costing about €170 billion per year (data from 2007).

In the UK, public expenditure on DRM in 2007 was estimated to be in excess of £13 billion per annum. In comparison, the economic cost of being overweight or obese are estimated at only £6.6—7.4 billion per year in the UK, or approximately half the estimated cost of DRM. Another UK study showed that each malnourished patient costs the UK National Health Service (NHS) on average an additional £1003 over 6 months compared with a similar non-malnourished patient. In the Republic of Ireland, the annual cost associated with adult malnourished patients in Ireland was estimated at over €1.4 billion, representing 10% of the healthcare budget. Most of this cost (i.e. 70%) arose in acute hospital or residential care settings, with nutritional support estimated to account for less than 3% of spend. In The Netherlands, the additional cost of managing patients with disease-related malnutrition were estimated at €1.9 billion in 2011, accounting for 2.1% of health expenditure. In Belgium, average costs for malnourished patients were €1152 per hospital stay more than for well-nourished patients. In Spain, an analysis of hospital database records revealed that malnourished patients spent nearly twice as much time in hospital as their counterparts in the general population, accounting for significantly higher hospital admission costs (€5228 compared with €3538; $p<0,001$).

Substantial costs were associated with malnutrition-related comorbidities, including urinary-tract infections, pressure ulcers, falls and/or fractures, and acute respiratory infections in the US. Using midpoint cost estimates, these complications correspond to a cost of nearly $37,000 per episode. In Singapore, costs associated with malnutrition were, on average, 24% greater than for hospital patients who were well nourished. Finally, data from Brazil showed that hospital costs for malnourished patients increased by up to 309% compared with well-nourished patients.

Nevertheless, a range of investigations have shown that nutritional interventions such as DRUG X can address the problem of DRM, and contribute to better patient recovery and cost savings. These include:

- ✓ fewer complications
- ✓ fewer infections
- ✓ reduced incidence and faster healing of pressure ulcers
- ✓ reduced length of hospital stay
- ✓ better survival rates
- ✓ reduced costs

A BIM was required to estimate the financial impact of adopting DRUG X to prevent and/or treat DRM.

OUR APPROACH

The structure of the BIM was developed to be simple and transparent, reflecting the recent guidance on budget impact analysis published by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR).

The model estimates the incremental budget impact of adopting DRUG X as part of the PN regimes for critically ill patients during their stays in the ICU by combining epidemiological data, market uptake assumptions, as well as acquisition costs of DRUG X and comparators and medical resource use (MRU) in ICU expressed as daily cost of ICU.

We use a prevalence-point BIM to evaluate the economic impact of adopting DRUG X in a healthcare system. While comparison between standard of care and “new drug” scenario is the common approach in BIMs, this approach presents some limitations and it is not required in many settings. This kind of comparison requires the use of assumptions on current market share for competitor drugs which is particularly difficult in indications such as parenteral nutrition given how many delivery systems and separately drugs are used in combination and the difficulty in obtaining market share data for the specific patient population. We proposed a model which does not explicitly model the current market share of each therapy, but simply makes an assumption about what proportion of DRUG X´s market share is drawn from each alternative. Therefore, budget impact is calculated by summing the costs associated with DRG X (including drug acquisition and total cost for length of stay) and then subtracting the costs (including drug acquisition and longer LOS) associated with the treatments that DRUG X has displaced from the market. The advantage of the current approach is that it does not require the complexity and additional assumptions required for estimating current market share. This approach was taken in order to reduce the burden of collecting data on the current market share of all relevant replacement therapies. However, assumptions regarding where DRUG W will draw its market share are still required for modeling purposes.

Efficacy data was derived from a meta-analysis by Pradelli et al. indicating that the inclusion of fish oil/omega-3 fatty acids in parenteral nutrition regimens reduces the length of hospital stay in ICU. Fish-

oil/omega-3 fatty acid containing lipid emulsions were associated with reductions in length of stay, by approximately 2 days in ICUs (1.92 days, 95% CI 3.27—0.58 days; p =0.005). This data is used in the model to calculate the cost of MRU and was captured by estimating the daily cost of ICU and multiplying this value by the LOS associated with both DRUG X and standard lipids. The same meta-analysis also indicated a reduction in infections associated with the use of fish oil/omega-3 fatty acids in parenteral nutrition regimens but to avoid double counting it was decided to not include this potential benefit as daily cost of ICU might include the cost for antibiotics associated with the treatment of infections.

Drug costs was estimated by firstly dividing the current unit cost of the drugs by the content of package expressed in ml. The calculated cost per ml is then multiplied by the patient average weight (obtained from Pradelli et al 2013) and by the number of treatment days and by the average daily dose in ml.

Population estimates in the model are based on the number of registered ICU beds, the % of the registered beds dedicated to adult patients, the yearly capacity in terms of ICU bed days, the occupancy rate, the average LOS of patients in ICU and the number of patients receiving PN.

Figure 1 shows the population estimates used in the model.

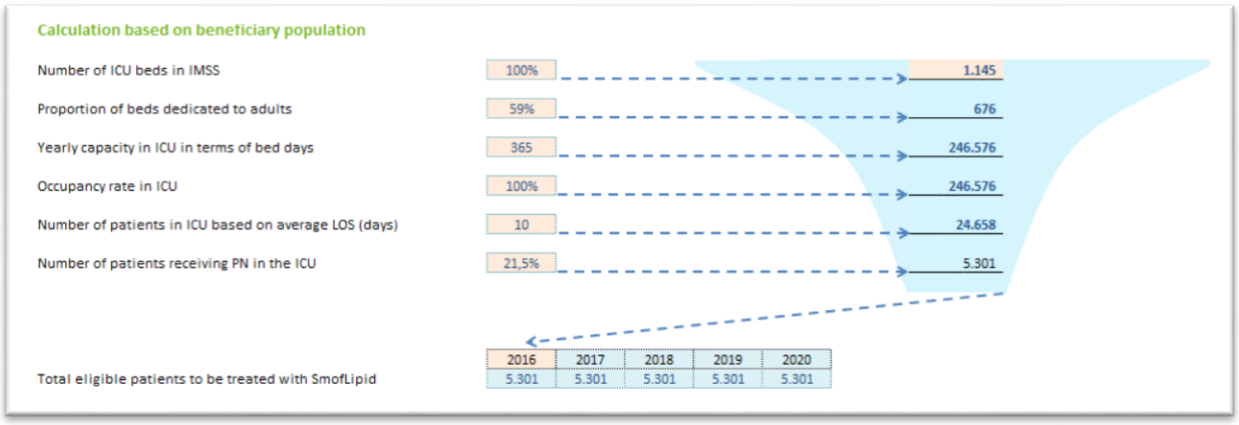


Figure 1. Population estimates

As mentioned above, the model does not take the traditional approach of comparing a "current market" scenario (in which each replacement therapy's current market share is explicitly modelled) with a "new market" scenario in which the drug of interest is introduced. Instead, the model simulates DRUG X

entering the market and drawing market share in pre-defined proportions from the other available therapies.

As the model originally works with the estimated market shares per treatment (Figure 2), those estimated shares from the alternative therapies are converted into the shares that those treatments will represent from the DRUG X shares (figure 3).

Step 1. Enter the overall market share percentage anticipated for SmofLipid in each year:

	2016	2017	2018	2019	2020
Optimistic scenario	6,0%	7,7%	8,8%	8,8%	8,8%
SmofLipid Market Uptake (Base Case Scenario)	5,8%	7,5%	8,6%	8,6%	8,6%
Pessimistic scenario	5,6%	7,3%	8,4%	8,4%	8,4%

Scenario analysis +/- 20,0% Base Case

Selected scenario	5,75%	7,47%	8,62%	8,62%	8,62%

Step 2. Enter the percentage of each treatment alternative:

	2016	2017	2018	2019	2020
Lipovenous -- LCT	17%	16%	15%	15%	15%
Lipovenous -- MCT/LCT	75%	75%	75%	75%	75%
Lipofunding 20%	2%	3%	3%	3%	3%
Total (must sum 100% of total eligible patient population)	100%	101%	101%	101%	101%

Figure 2: Estimated market shares of smofLipid and replacement therapies.

For example, if in Year 1 DRUG X is assumed to reach 5.8% market share (figure 2) the model simulates what proportion of DRUG X's 5.8% is drawn from each of the other replacement therapies.

Step 3 .Enter the percentage of SmofLipid market uptake that will come from each treatment alternative:

	2016	2017	2018	2019	2020
Lipovenous -- LCT	18%	17%	16%	16%	16%
Lipovenous -- MCT/LCT	79%	81%	81%	81%	81%
Lipofunding 20%	2%	3%	3%	3%	3%
Total (must sum 100% of anticipated SmofLipid market uptake)	100%	101%	101%	101%	101%

Patient Count Calculation

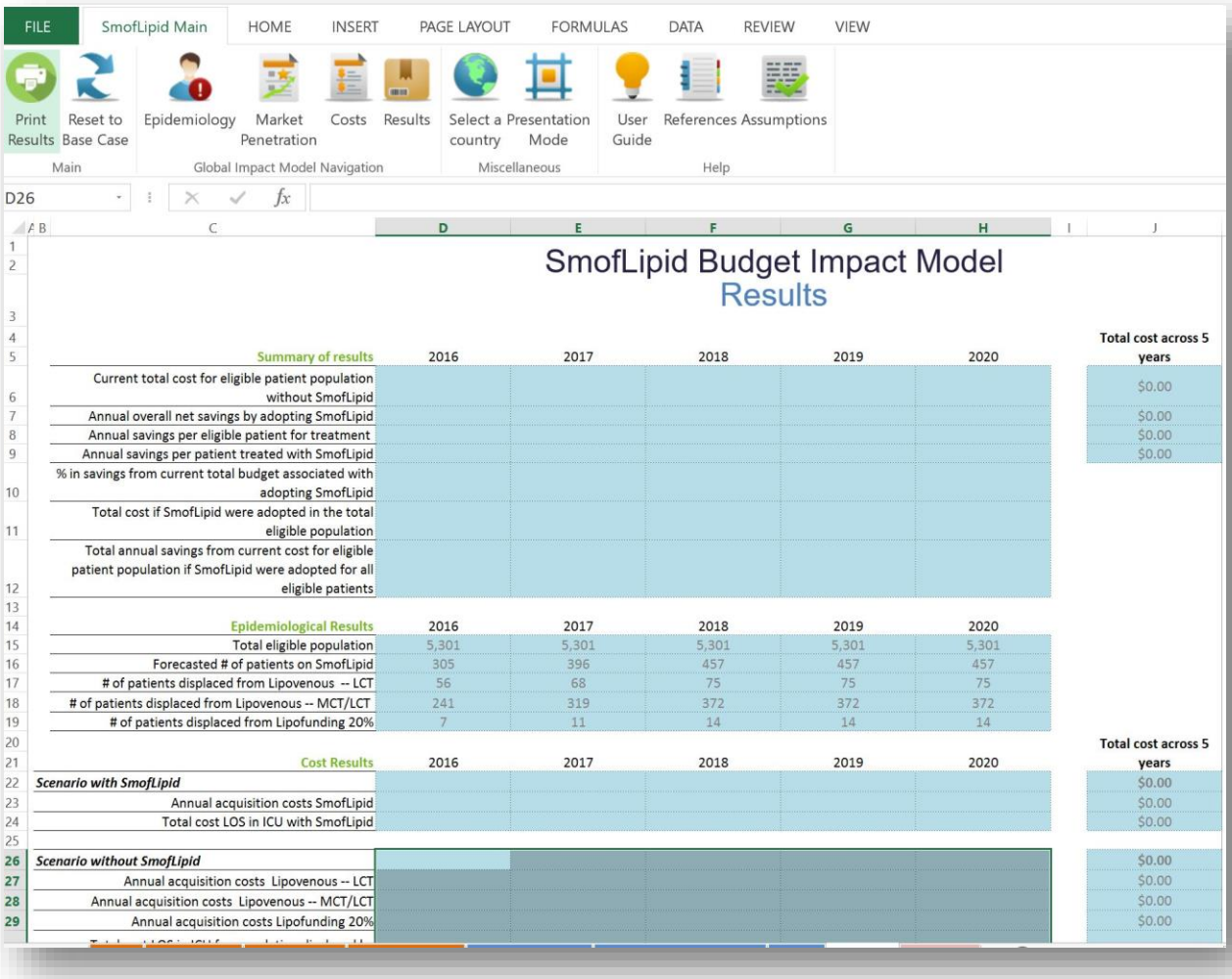
	2016	2017	2018	2019	2020
# of eligible patients	5.301	5.301	5.301	5.301	5.301
# patients on SmofLipid	305	396	457	457	457
# of patients displaced from each therapy by SmofLipid					
Lipovenous -- LCT	56	68	75	75	75
Lipovenous -- MCT/LCT	241	319	372	372	372
Lipofunding 20%	7	11	14	14	14
Total	304	398	461	461	461

Figure 3: Market shares that SmofLipid draws from the other replacement therapies.

Sensitivity analyses were set up to test the sensitivity of model results to changes in the most uncertain value (market uptake). Sensitivity analyses can be run automatically by increasing or decreasing the market uptake of DRUG X. Two pre-programmed scenarios are included in the model to simulate "optimistic" and "pessimistic" market share scenarios, respectively.

RESULTS

A generic BIM able to assess the financial impact of adopting DRUG X in any healthcare system was developed. The model provides a simply framework reducing the burden of data collection.



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