

Intravenous administration of morphine in the emergency room inflicts a substantial economic burden in the EU5

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Introduction and objective

Intravenous (IV) opioids are the mainstay of treatment for moderate-to-severe acute pain in the emergency room (ER) setting. In the United States, this is associated with a high economic impact of approximately \$150 per patient, largely due to the costs associated with IV administration¹. In Europe, where moderate-to-severe acute pain in the ER is often managed by nurse-titrated IV morphine, such an analysis has not yet been performed. This study employed a micro-costing approach to estimate the costs of IV morphine administration in the ER setting across the EU5.

Methods

We conducted a structured literature review to identify EU5 clinical guidelines and ER clinical studies that informed on the relevant costing inputs and parameters for the micro-costing model. The model consisted of five input categories: analgesic, workforce time, material used for IV administration and management of opioid-related adverse events (AEs) and IV-related complications. These inputs were further grouped either under drug administration costs or costs associated with the treatment of AEs and IV-related complications.

Where necessary, costs were converted to EUR and adjusted to 2016 values using historical consumer price index rates. The methodology used to calculate the appropriate cost for each costing input is briefly described below; details and sources of the data used are summarised in Table 1.

- Drug administration costs
 - › Drug: costs were derived from the ex-VAT public selling price of morphine and adjusted according to the total dose/no. of boluses of IV morphine administered
 - › Materials: costs were based on hospital paid price of materials (medical supplier price where not available) and adjusted according to no. of units required per patient
 - › Workforce: salary-based cost of nursing time – adjusted according to duration of each procedure
- AEs and IV complications treatment costs
 - › AEs: The AEs considered in the model were nausea, vomiting, hypotension and respiratory depression. Their risk was derived from interventional or observational ER studies. Cost per-patient was estimated assuming that nausea and vomiting are treated with IV metoclopramide, hypotension with saline administration and respiratory depression as in Kane-Gil². Costs were adjusted according to their probability of occurrence
 - › IV complications: The IV-related complications included phlebitis, extravasation and harmful IV prescription errors. Cost per patient was estimated assuming that phlebitis and extravasation are managed with a new cannula insertion and harmful IV prescribing errors as described in Abraham et al³.

Table 1: Summary of micro-costing model input parameters

Costing input	Input parameter	Sources	
		No. of studies	Total sample size
Drug administration			
<i>Drug</i>			
Morphine	10 mg dose	7	914
<i>Materials</i>			
IV cannula infusion set	1.3 units	7	3,414
Draw up needles*	2 units	-	-
Syringe (10 mL)*	1 unit	-	-
Saline (100 mL) for dilution*	1 unit	-	-
Pre-filled (10 mL) saline syringe*	1 unit	-	-
<i>Workforce</i>			
Cannulation	5.4 mins	4	1,011
Drug preparation	7.9 mins	2	121
Flushing	2 mins	1	35
Drug administration	14.8 mins	4	724
Patient monitoring*	14 mins	-	-
AEs and IV complications			
<i>AEs treatment</i>			
Nausea	12.1% risk	14	1,443
Vomiting	5.8% risk	11	906
Hypotension	2.1% risk	8	1,154
Respiratory depression	1.1% risk	9	1,710
<i>IV complications treatment</i>			
Phlebitis	2.6% risk	1	1,498
Extravasation	0.4% risk	4	102,204
Harmful IV prescribing errors	1.2% risk	1	330

*Input parameters chosen based on EU5 clinical guidelines only

Results

The costs of nurse-titrated IV morphine administration in the ER across the EU5, as calculated through micro-costing, are detailed in Table 2 below.

Table 2: Cost of nurse-titrated IV morphine administration in EU5

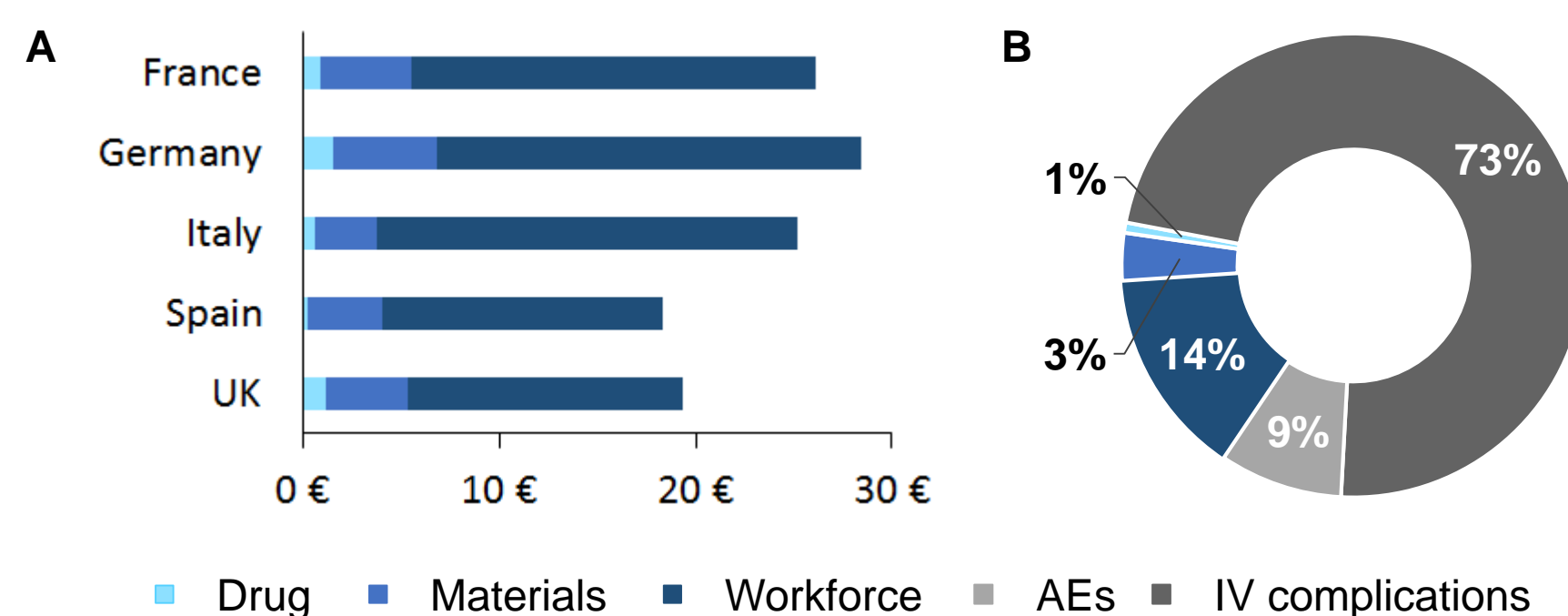
Costing input	Cost (€)				
	FR	DE	IT	ES	UK
Drug administration					
<i>Drug</i>					
Morphine	0.88	1.56	0.63	0.30	1.20
<i>Materials</i>					
IV cannula infusion set	0.28	1.51	0.55	1.79	1.46
Draw up needles	0.25	0.16	0.10	0.07	0.17
Syringe (10 mL)	0.29	0.24	0.03	0.08	0.06
Saline (100 mL) for dilution	3.06	2.32	1.81	1.50	1.91
Pre-filled (10 mL) saline syringe	0.80	1.07	0.67	0.27	0.56
<i>Workforce</i>					
Cannulation	2.51	2.63	2.61	1.75	1.71
Drug preparation	3.68	3.85	3.82	2.56	2.51
Flushing	0.93	0.98	0.97	0.65	0.64
Drug administration	6.90	7.23	7.17	4.80	4.71
Patient monitoring	6.52	6.83	6.78	4.54	4.45
AEs and IV complications					
<i>AEs treatment</i>					
Nausea	1.13	1.42	1.11	0.74	0.79
Vomiting	1.00	1.16	1.01	0.67	0.69
Hypotension	0.10	0.11	0.13	0.08	0.10
Respiratory depression	8.84	8.84	8.84	8.84	8.84
<i>IV complications treatment</i>					
Phlebitis	0.07	0.11	0.08	0.09	0.08
Extravasation	0.01	0.02	0.01	0.01	0.01
Harmful IV prescribing errors	92.39	92.39	92.39	92.39	92.39
Drug administration*	26.09	28.38	25.14	18.31	19.37
AEs and IV complications*	103.56	104.04	103.58	102.83	102.91
Total	129.64	132.43	128.72	121.13	122.28

*May not sum to total due to rounding

Abbreviations: DE: Germany; ES: Spain; FR: France; IT: Italy; UK: the United Kingdom.

As shown in Fig. 1A, the costs of IV administration of morphine when excluding costs of AEs and IV-related complications range from €18 (Spain) to €28 (Germany). The greatest contributor is the cost associated with nursing time, particularly for the time spent for drug administration and patient monitoring. When the costs of treating AEs and IV complications are also considered, the total cost of IV morphine administration increases to a substantial amount – between €121 (Spain) and €132 (Germany); the key driver for this is the cost of treating harmful IV prescribing errors. Fig. 1B illustrates that the economic burden of treatment with IV morphine is not due to the cost of drug or materials, but rather costs associated with workforce and the treatment of AEs and complications resulting from IV administration.

Fig. 1: (A) Per-country breakdown of IV morphine drug administration only costs and (B) EU5-average cost breakdown of total costs



Conclusion

- Although IV morphine provides rapid and efficient pain relief in the ER, costs associated with the required workforce time and with the management of AEs and of IV complications inflict a substantial economic burden on the NHS in the EU5
- An equally rapid-onset and efficacious analgesic that does not require IV administration should reduce this burden

References

- Palmer et al. Cost of delivering intravenous opioid analgesia in Emergency Departments in the United States. Poster presentation at: ISPOR 21st Annual International Meeting; 2015.
 - Kane-Gill, S.L. et al. The cost of opioid-related adverse drug events. Journal of pain & palliative care pharmacotherapy, 2014; 28(3), pp.282–293.
 - Abraham et al. An Economic Analysis of Postoperative Pain Management with Fentanyl Iontophoretic Transdermal System. Poster presentation at: ISPOR 20th Annual International Meeting; 2015.
- For the list of all references used as source of the different input parameters, please take the leaflet from the stand.