

COST MINIMISATION AND OPPORTUNITY COST ANALYSIS OF FULLY LIQUID HEXAVALENT AND MENINGOCOCCAL VACCINES IN SPAIN



Cuesta, I.¹; Carcedo, D.²; Menor-Rodríguez, M. J.¹; Drago, G.³; Escolano, M.⁴; López-Belmonte, J. L.³; López, S.¹; Parra, H.¹; Rivero, A.⁵; Tamames, S.⁶ Virtual ISPOR Congress (16-19 November 2020)

1. Vaccine Expert Group of the General Council of Nurses, Madrid, Spain. Mailing address: Calle Fuente del Rey, zip code: 28023, Madrid. 2. Health Economics & Outcomes Research. Hygeia Consulting, Madrid, Spain. 3. Sanofi Pasteur, Spain. 4. Pharmacist. Health Services Inspector of Valencian Autonomous Region. Former General Director of Public Health of Valencian Autonomous Region, Spain. 5. Attending physician. Hospital Universitario La Paz, Madrid, Spain. 6. Expert Manager. Castilla y León Autonomous Regional Health Council, Spain.

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BACKGROUND

Spain has a **national vaccination schedule** that includes recommended vaccines based on age throughout Spain, although administration is not mandatory [1]. The increasing number of vaccines in recent years has led to the R&D of **combined vaccines**, such as **Hexavalent** and **MenACWY** vaccines.

Many health-economic evaluations of vaccination programmes have been published in Spain, e.g. García-Altés [2] and Cortés et al. [3]; however the **health-economic value assessment of vaccine presentations is rare**. **Fully liquid vaccines** are becoming widely used, as reconstitution is not needed.

The Spanish General Nursing Council conducted a **time and motion (T&M)** study to measure the preparation and administration time of fully liquid and non-fully liquid vaccines requiring reconstitution. The study found that **administering fully liquid vaccines requires approximately one minute less compared to reconstituted** vaccines [4].

OBJECTIVES

The simplification of vaccine preparations **saves time** and **reduces potential immunisation errors**.

The objective of this study was to **analyse the opportunity cost of using fully liquid vaccines** that do not require reconstitution versus **non-fully liquid vaccines** that do require reconstitution, specifically analysing the hexavalent (DTaP-IPV-HB-Hib) vaccine and the Meningococcal ACWY (MenACWY)* vaccine (helps to protect against four strains of meningococcal bacteria) through a **cost-minimisation analysis (CMA)**.

METHODS

A **CMA** was carried out to **assess the potential savings** associated with the use of fully liquid presentations vs reconstituted hexavalent and MenACWY vaccines, taking into account the time required to prepare and administer these vaccines and considering preparation errors. The number of vaccine doses administered per year was calculated (Table 1), and the time required for the vaccination visit was obtained from a time and motion study (Figure 1). The percentage of preparation errors was obtained from the EUDRAVIGILANCE database (0.19% for reconstituted vaccines and 0.08 % for fully liquid vaccines). The unit costs of the vaccines and nursing salaries were obtained from the national database (eSalud).

Based on the CMA, the **opportunity cost** associated with the use or avoidance of fully liquid vaccines was analysed to assess **whether the potential resources saved through the use of such vaccines could be reinvested**. A **multidisciplinary panel of experts** was consulted and asked to complete a questionnaire. The questionnaire results were assessed, discussed and agreed upon over two meetings. Experts were asked to specify which five possible activities could be carried out with the time saved; these activities were prioritised according to their relevance to the Spanish healthcare system and were finally grouped into categories and a mean score was established.

To assess the uncertainty associated with the CMA variables, both **univariate and scenario sensitivity analyses were performed**.

Table 1. Target population: candidates to receive the hexavalent and MenACWY vaccines per 100,000 inhabitants

Autonomous Region	Time saved grouping all vaccines (hours)			Economic savings grouping all vaccines (€)		
	2018 cohort (hours)	2007 cohort (hours)	Total (hours)	2018 cohort (€)	2007 cohort (€)	Total (€)
Andalucía	3,737.60	2,868.60	6,606.21	131,911.4	101,241.7	233,153.2
Aragón	520.28	210.63	730.91	18,362.4	7,433.8	25,796.1
Asturias	301.04	118.86	419.90	10,624.6	4,194.9	14,819.5
Balears, Illes	533.76	189.99	723.76	18,838.1	6,705.4	25,543.6
Canarias	768.40	267.56	1,035.96	27,119.3	9,442.9	36,562.2
Cantabria	199.09	96.63	295.72	7,026.4	3,410.3	10,436.7
Castilla y León	778.98	672.90	1,451.88	27,492.6	23,748.7	51,241.3
Castilla-La Mancha	782.70	322.77	1,105.47	27,623.8	11,391.5	39,015.3
Cataluña	3,221.86	1,455.18	4,677.05	113,709.3	51,357.9	165,067.2
Com. Valenciana	1,967.72	877.64	2,845.36	69,446.9	30,974.6	100,421.5
Extremadura	413.88	147.68	561.56	14,607.2	5,212.0	19,819.3
Galicia	881.21	373.53	1,254.73	31,100.4	13,182.8	44,283.3
Madrid	3,038.00	1,246.04	4,284.03	107,220.2	43,976.4	151,196.6
Murcia	779.78	312.07	1,091.84	27,520.7	11,013.8	38,534.5
Navarra	285.89	111.71	397.60	10,089.9	3,942.4	14,032.4
País Vasco	834.88	361.42	1,196.31	29,465.5	12,755.8	42,221.3
Rioja, La	124.07	56.60	180.67	4,378.9	1,997.6	6,376.5
Ceuta and Melilla	172.73	32.29	205.02	6,096.3	1,139.6	7,235.9
SPAIN	19,341.87	9,722.10	29,063.98	682,633.9	343,122.1	1,025,756.4

Figure 1. Diagram of the methodology used for the project

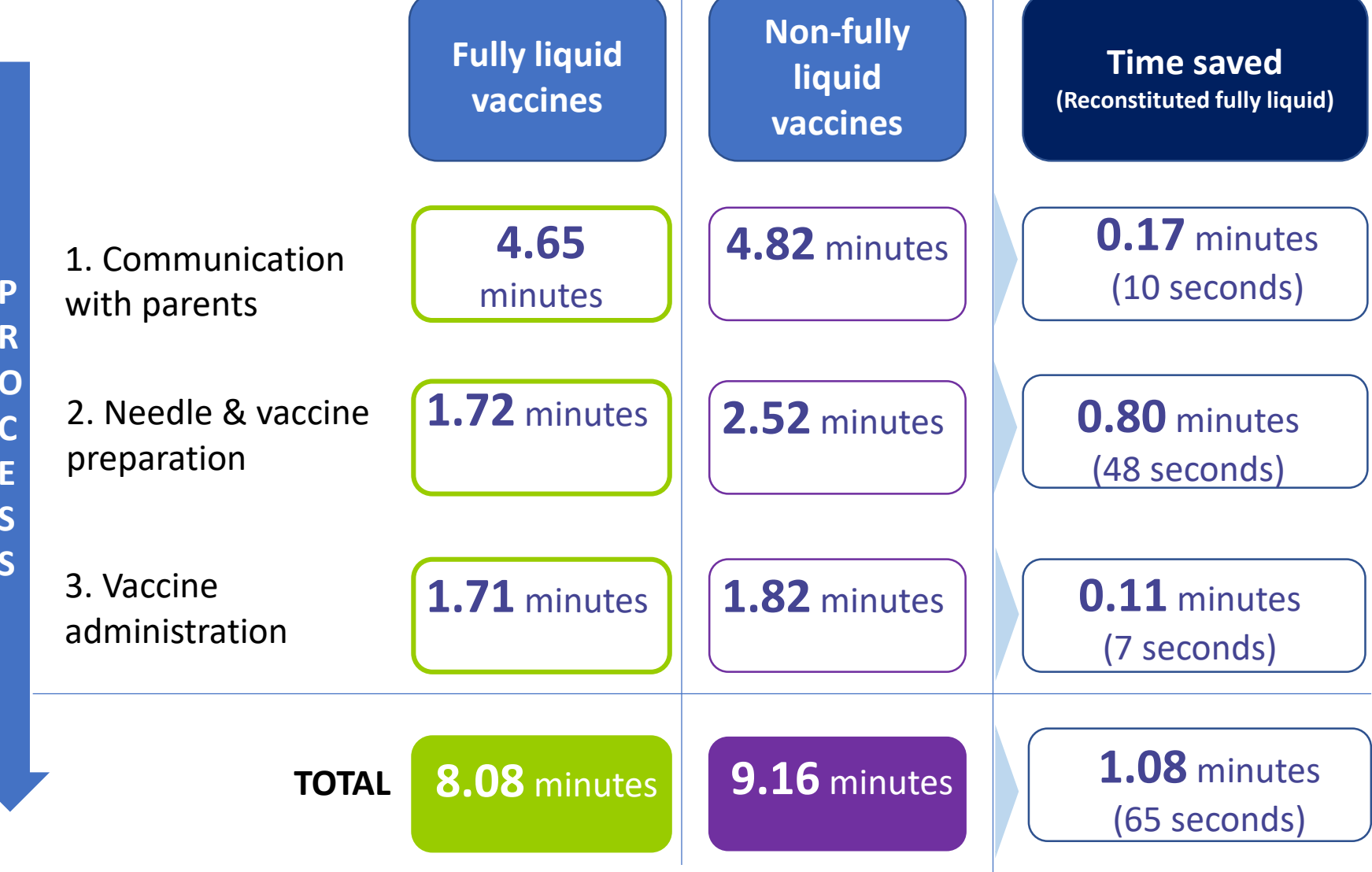
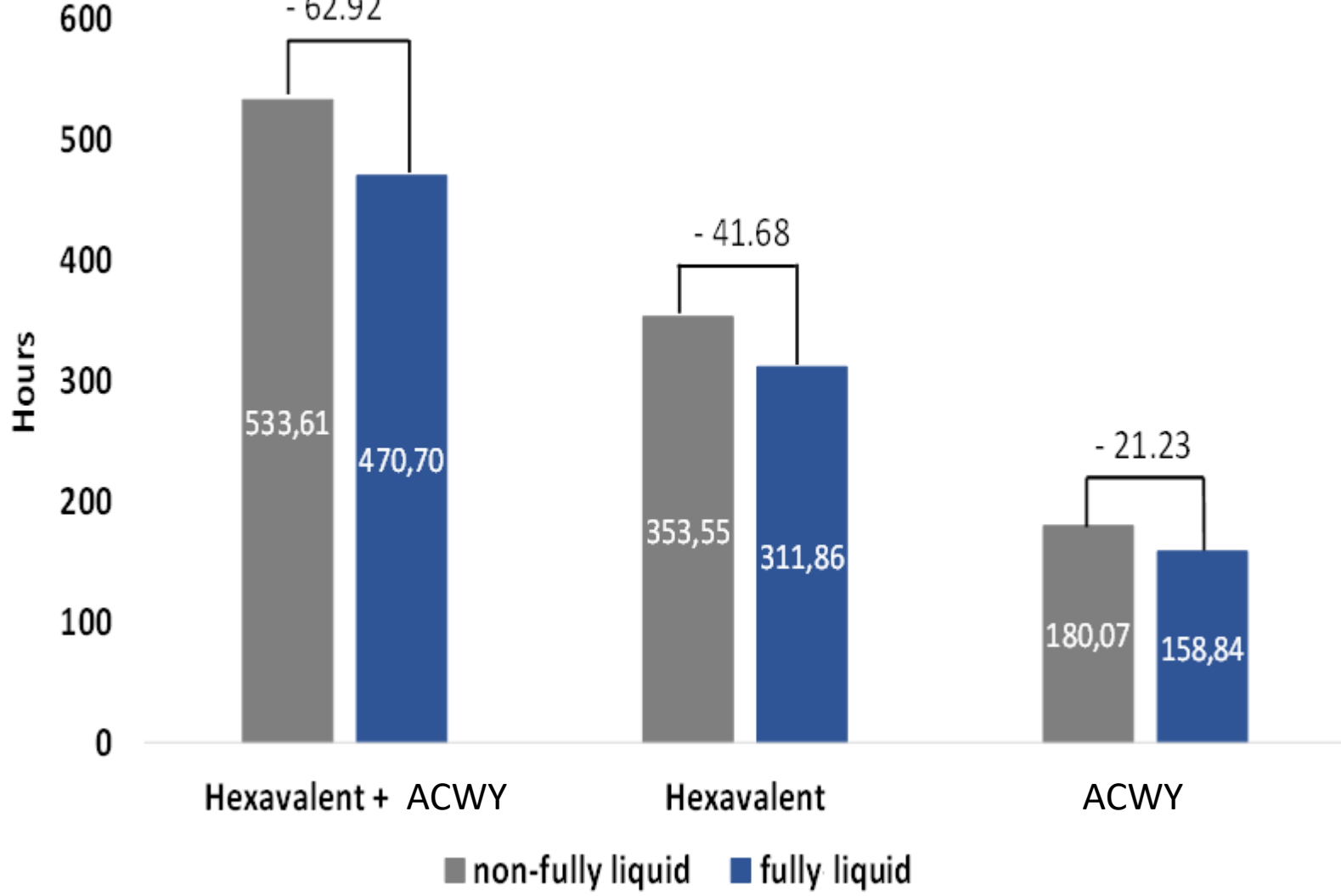


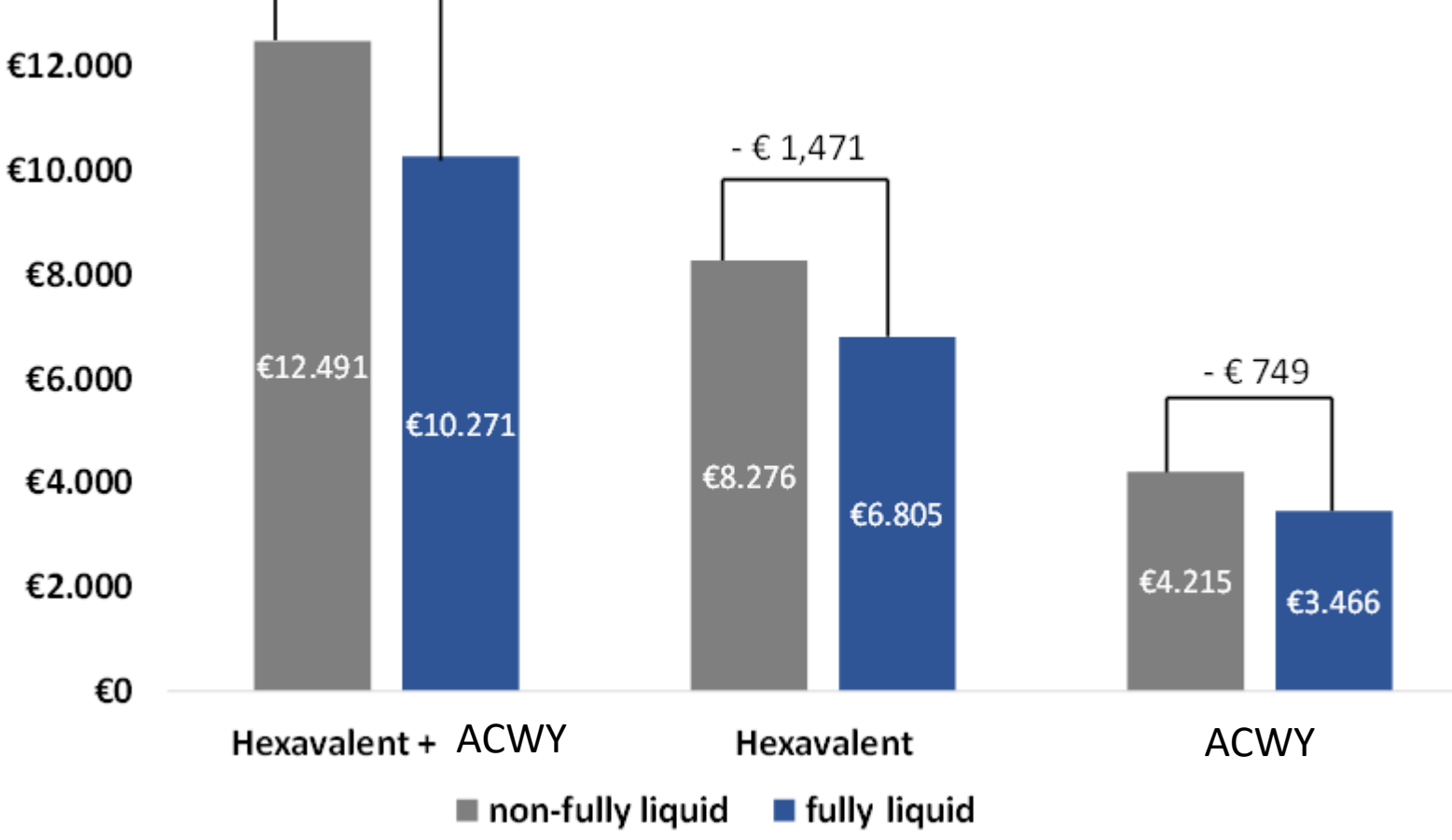
Figure 2. Time spent (hours) per 100,000 inhabitants for the administration of both types of vaccines



RESULTS

In Spain, the **use of fully liquid vaccines** instead of non-fully liquid vaccines **would save 62.92 nursing hours per year per 100,000 inhabitants** (41.68 hours with the hexavalent vaccine and 21.23 with MenACWY) (Figure 2). Savings in nursing costs and those **associated with the avoidance of errors would translate into €2,220.5 per 100,000 inhabitants** (Figure 3).

Figure 3. Total direct cost (euros) per 100,000 inhabitants associated to the administration of fully and non-fully liquid vaccines



The density of the target population (expressed per 100,000 inhabitants) differs between autonomous communities; therefore, the time saved and the economic savings also differed among them. Table 2 shows these results broken down by autonomous community.

Table 2. Time spent (hours) per 100,000 inhabitants in the administration of both types of vaccines

Autonomous Region	Time saved per 100,000 inhabitants (hours)			Economic savings per 100,000 inhabitants (€)		
	Hexavalent cohort (hours)	MenACWY 12 y.o. cohort (hours)	Total (hours)	hexavalent cohort (€)	MenACWY 12 y.o. cohort (€)	Total (€)
Andalucía	44.46	56.04	100.51	1,569.2	1,977.9	3,547.1
Aragón	39.54	16.09	55.63	1,395.6	567.7	1,963.3
Asturias	29.39	11.13	40.52	1,037.4	392.8	1,430.1
Balears, Illes	45.40	18.53	63.93	1,602.2	654.0	2,256.3
Canarias	35.11	13.60	48.71	1,239.3	479.8	1,719.1
Cantabria	34.27	16.88	51.14	1,209.4	595.6	1,805.1
Castilla y León	32.32	40.26	72.58	1,140.6	1,421.0	2,561.6
Castilla-La Mancha	38.55	16.11	54.66	1,360.6	568.6	1,929.3
Cataluña	42.87	20.12	62.99	1,512.9	710.1	2,223.0
Com. Valenciana	39.76	18.03	57.79	1,403.4	636.3	2,039.7
Extremadura	38.79	13.60	52.39	1,369.0	480.0	1,849.0
Galicia	32.65	13.60	46.25	1,152.3	479.9	1,632.2
Madrid	46.12	20.25	66.38	1,627.8	714.7	2,342.6
Murcia	52.72	22.21	74.94	1,860.7	784.0	2,644.7
Navarra	44.25	18.32	62.56	1,561.6	646.5	2,208.1
País Vasco	38.43	16.80	55.24	1,356.4	593.0	1,949.4
Rioja, La	39.68	18.12	57.80	1,400.4	639.5	2,039.9
Ceuta and Melilla	203.78	44.84	248.61	7,191.9	1,582.5	8,774.4
SPAIN	41.68	21.23	62.92	1,471.2	749.3	2,220.5

The total savings at the national level were roughly **€1.1 million** (€682,633.9 for the hexavalent cohort and €343,122.1 for the meningococcal cohort). Table 3 shows the results of the sensitivity analyses.

		CMA ^a results		
		Total direct cost considering:		
^a CMA: Cost-minimisation analysis; ^b T&M: time and motion		Non-fully liquid vaccines (€)	Fully liquid vaccines (€)	Difference (€)
Base case		12,491.3	10,270.9	-2,220.5
Scenario analysis				
Alternative scenario No. 1		13,060.2	10,441.1	-2,619.1
Alternative scenario No. 2		11,717.4	9,907.8	-1,809.6
Univariate				
Time saving reported in the T&M ^b study	Min: Andalucía	8,841.1	7,073.9	-1,767.2
	Max: Murcia	15,962.6	13,277.0	-2,685.7
Mean salary of nursing staff	Min: -20%	10,032.5	8,232.6	-1,799.9
	Max: +20%	14,950.2	12,309.1	-2,641.1
Acquisition costs of hexavalent and MenACWY	Min: -20%	12,451.9	10,254.9	-2,197.0
	Max: +20%	12,530.7	10,286.8	-2,243.9
Increment in the percentage of errors associated with vaccine administration	0,10	12,647.8	10,334.1	-2,313.7
	0,20	12,804.2	10,397.3	-2,406.9
	0,30	12,960.7	10,460.6	-2,500.1
	0,40	13,117.1	10,523.8	-2,593.3
	0,50	13,273.6	10,587.0	-2,686.5

Table 4. Activities proposed by the panel of experts to use the extra time associated with the use of fully liquid vaccines

Table 4 lists the **actions proposed by the experts to reinvest the time saved by using vaccines that do not require reconstitution**. The numerical values associated with each activity show the priority agreed by the experts (where 1 equals maximum priority and 5 equals minimum priority). Health managers agreed with nursing staff in choosing **communication with parents as the priority option** for the time saved.

In economic terms, the potential savings achieved by the CMA (Figure 3) could be assimilated to the opportunity cost of using fully liquid vaccines, since the time saved is understood as being part of nurses’ working hours, so the **value of this time is the monetary unit of the analysis**.

CONCLUSIONS AND KEY MESSAGES

- One component of vaccination cost is **the time spent by healthcare professionals in preparing and administering the vaccines**. This time can be reduced by using devices that facilitate the task, such as **fully liquid (ready to use) vaccines**.
- This study analysed how the use of **different presentations of two vaccines impacted on the opportunity cost**. Fully liquid vaccines can increase **time efficiency**, [5] **improving on mishandling, diminishing errors, reducing the number of steps** involved in vaccine preparation, and may help **reduce vaccination workload** in primary healthcare centres.
- Fully liquid hexavalent and MenACWY vaccines instead of non-fully liquid presentations **would provide savings in health professionals’ time, which could be reinvested in improving the quality of the visit**.

References: *Fully liquid meningococcal ACWY vaccines will not be available in Spain until at least 2021.

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