

Cost of Illness of Vaccine-Preventable Diseases (VPDs) in France for those 65 Years and Older

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INTRODUCTION

- VPDs are associated with severe complications commonly in people aged >65 years who are more likely to require hospitalisation and face higher morbidity and mortality.¹ France reported that between October 2018 and February 2019, 85% of influenza mortalities were among those aged ≥75 years.²
- VPDs are associated with a substantial economic burden worldwide.² In the US in 2015 it was estimated that 16.6 million cases of influenza would lead to \$5.79 billion in cost, \$782 million for 1.1 million herpes zoster (HZ) cases and \$1.86 billion for 283,000 pneumococcal disease cases.³
- There are an estimated 1 billion cases of influenza each year worldwide, with 3 million to 5 million severe cases. In France, the estimated rate of invasive pneumococcal disease in 2016 was 5.7 per 100,000 people⁴, and 413 per 100,000 people⁵ for HZ in 2017.
- Therefore, low vaccine coverage in the elderly persists in France, with the highest coverage seen in influenza only just above 50%, with uptake rates among adults aged ≥65 years in France at 52.0% in 2019/20.⁶

OBJECTIVE

- To evaluate the cost of illness (COI) and inform the economic burden of the three most prevalent VPDs (influenza, HZ and pneumococcal) among people aged ≥65 years in France from the payer perspective.

METHODS

Model Description

- A cost calculator was developed in Microsoft Excel®. The model accounts for direct (medical) costs, including those related to diagnosis and other treatment services linked to a particular diagnosis of VPD, as well as costs related to outpatient (defined as not requiring hospitalisation) and inpatient care in a 1-year time horizon.
- To estimate the total annual costs associated with each VPD, the core model concept is derived from a simple multiplication rule of:
 $A = B \times C$
- Where A is the total annual cost associated with the given VPD, B is the estimated annual number of the given VPD, and C is the estimated cost per case of the given VPD. Parameters B and C were derived as follows:
 $B = (age\ specific)\ est.\ annual\ incidence\ rate \times (age\ specific)\ population\ size$
 $C = (age\ specific)\ est.\ direct\ cost\ per\ case + (age\ specific)\ est.\ indirect\ cost\ per\ case^*$

*Indirect Costs were not included due data limitations

- Due to limitations in the available data, parameters B and C were derived from disaggregated inputs and calculations using a method known as micro-costing.
- ### Model Inputs
- #### Targeted Literature Review and Data Extraction
- A targeted literature review was conducted to obtain relevant inputs for each of the specified VPDs (**Table 1**)
 - The over 65 population size was 13,750,578 according to the INSEE estimates.⁷
 - The age groups in the model are further stratified into 65- to 74-year-olds and 75 years and older.
 - For HZ, it is assumed that the management of cases is only within the outpatient setting.

Table 1: Incidence and Cost Inputs

VPD	Input	Data Year	Model Use
Influenza	Incidence of GP visit/100,000 ⁸	Two seasons (2014/2015, 2017/2018)	Ages ≥65: 998.40 Ages 65–74: 998.40 Ages ≥75: 988.40
	Influenza-related excess respiratory hospitalisations (≥65) ⁹	2010-2018	Ages ≥65: 192 Ages 65–74: 85 Ages ≥75: 297
	Cost per GP visit ¹⁰	2013	€24.22
	Cost of hospitalisations ⁹	2011–2018	Ages ≥65: €4,940.14 Ages 65–74: €4,744.25 Ages ≥75: €5,166.87
HZ	Incidence of GP visit/100,000 ⁵	2020	Ages ≥65: 877 Ages 65–74: 736 Ages ≥75: 1041
	% PHN/HZ case ¹¹	2007/2008	Ages ≥65: 7.7% Ages 65–74: 7.7% Ages ≥75: 7.7%
	Cost per HZ case ¹²	2012	Ages ≥65: €280.92 Ages 65–74: €214.88 Ages ≥75: €357.37
	Cost per PHN case ¹²	2012	Ages ≥65: €413.00 Ages 65–74: €353.57 Ages ≥75: €481.78
Pneumococcal disease	Non-invasive pneumonia incidence/100,000 outpatients ¹³	2011/2012	Ages ≥65: 215 Ages 65–74: 215 Age ≥75: 215
	Meningitis incidence/100,000 ^{14*}	2017	Ages ≥65: 2 Ages 65–74: 2 Ages ≥75: 1
	Bacteraemia incidence/100,000 ^{14*}		Ages ≥65: 22 Ages 65–74: 15 Ages ≥75: 39
	Non-invasive pneumonia incidence/100,000 inpatients ¹⁵	2012	Ages ≥65: 66 Ages 65–74: 44 Ages ≥75: 117
	Non-invasive pneumonia cost per case - outpatient ¹³		€126.18
	Meningitis cost per case ¹⁶		€5,904.80
	Bacteraemia cost per case ¹⁶	2014	€3,772.74
	Non-invasive pneumonia cost per case - inpatient ¹⁷	2014	€8,942.06

GP = general practitioner; HZ = herpes zoster; PHN = post-herpetic neuralgia; VPD = vaccine-preventable disease
*Personal communication with EPIBAC to provide breakdown of disease manifestation by meningitis, bacteraemia and bacteraemia with or without meningitis for the age bands of interest.

RESULTS

- The incidences are reported by inpatient and outpatient visits for each disease. The costs follow a similar structure and report the direct costs by inpatient and outpatient. For HZ, all incidences are considered in outpatient visits; hence, there are no direct costs associated to inpatient visits.
- Influenza has the highest cost burden in the elderly population overall and in those aged 75+ years. Within the 65–74-year age group, the highest cost burden is associated with pneumococcal disease by a narrow margin over influenza. This shift is due to the much higher cost-per-case for pneumococcal disease (both inpatient and outpatient) vs. influenza outweighing the lower incidence.
- In all age groups, HZ has the lowest cost burden; this is as expected due to the assumption that the management of cases is only within the outpatient setting.

Table 2: Overall Results for Influenza in France

	65+	65-74	75+
Incidence of Inpatient Visits	26,438	6,266	18,903
Incidence of Outpatient Visits	135,911	72,915	110,390
Total Incidence of Medically Attended	162,349	79,181	81,899
Total Inpatient Costs	€ 130,606,528	€ 29,726,781	€ 97,667,313
Total Outpatient Costs	€ 3,291,662	€ 1,765,943	€ 1,525,720
Total Costs	€ 133,898,190	€ 31,492,723	€ 99,193,033

Table 3: Overall Results for Pneumococcal in France

	65+	65-74	75+
Incidence of Inpatient Visits	12,350	4,472	10,019
Incidence of Outpatient Visits	29,564	15,861	13,703
Total Incidence of Medically Attended	41,914	20,333	23,722
Total Inpatient Costs	€ 94,112,146	€ 33,975,041	€ 76,551,455
Total Outpatient Costs	€ 3,730,307	€ 2,001,271	€ 1,729,036
Total Costs	€ 97,842,453	€ 35,976,312	€ 78,280,491

Table 4: Overall Results for Herpes Zoster in France

	65+	65-74	75+
Incidence of Inpatient Visits	0	0	0
Incidence of Outpatient Visits	129,893	58,436	71,457
Total Incidence of Medically Attended	129,893	58,436	71,457
Total Inpatient Costs	€ 0	€ 0	€ 0
Total Outpatient Costs	€ 37,716,629	€ 13,136,036	€ 26,172,185
Total Costs	€ 37,716,629	€ 13,136,036	€ 26,172,185

Figure 1: Total Incidence of Medically Attended Episodes in France

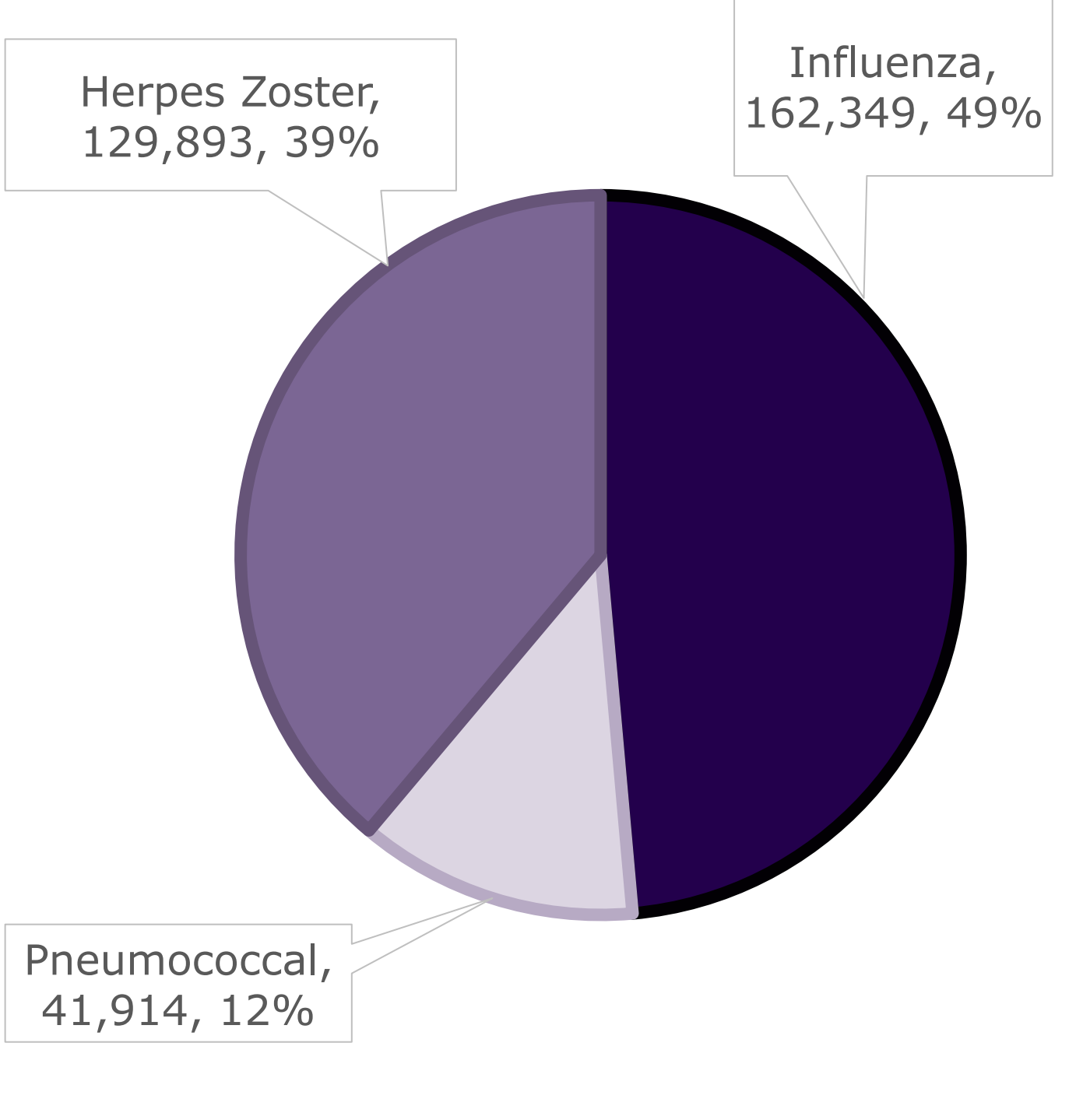
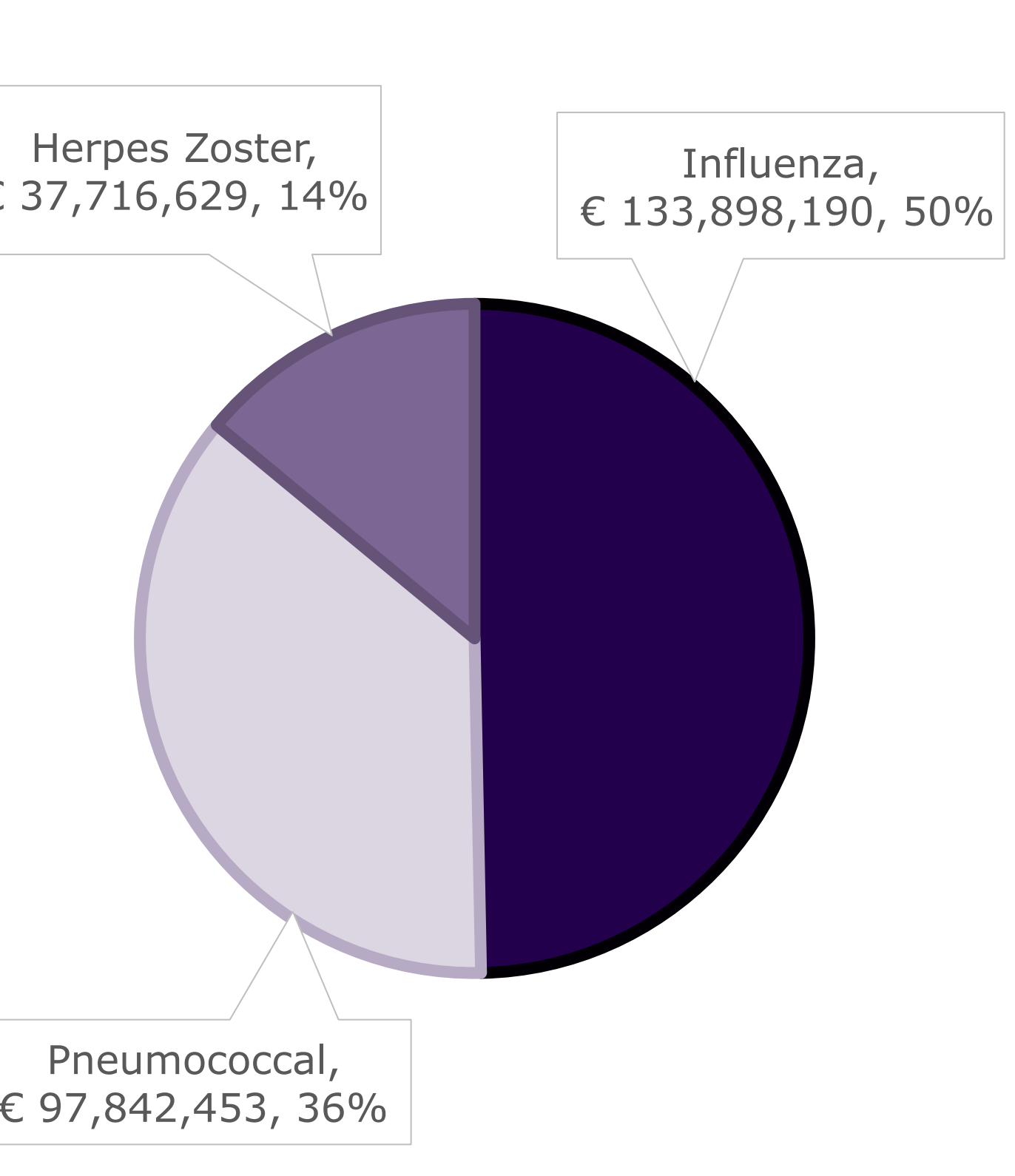


Figure 2: Total Costs in France



CONCLUSIONS

- This research has highlighted the significant economic burden associated with VPDs in the elderly. Despite accounting for confirmed cases over all influenza-like medical visits, conservative estimates demonstrate influenza to be the leading cause of VPDs in the elderly, among other diseases that could be prevented by an increase in immunization, where uptake in France is suboptimal.

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