

COUNTING THE COST OF MENINGOCOCCAL DISEASE IN FRANCE

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INTRODUCTION

- Invasive meningococcal disease (IMD) can present as meningococcal septicemia or meningitis. Severe cases of meningococcal septicaemia can cause *purpura fulminans*¹.
- IMD is fatal in 50% to 80% of cases if not treated^{2,3,4}. Even if treated, 5 to 10% of patients die 24 to 48 hours after first symptoms². This rate is even higher for patients with *purpura fulminans* (15 to 30%)^{5,6}.
- Sequelae include cerebral lesions, hearing loss, learning difficulties, severe cognitive deficit, cerebral palsy, or epilepsy⁷. *Purpura fulminans* leads to skin necrosis, limb ischemia needing orthopedic surgical management and sometimes even limb amputation⁶.
- Though vaccination against serogroups C, A, Y and W has been available for several years, incidence of meningococcal infections in France is still about 1 case per 100,000 inhabitants. *Purpura fulminans* is reported in 30% of cases⁶. In France, there is high predominance of B (74%) and C (17%) serogroups¹.
- The economic impact of meningococcal infection is substantial because of major sequelae requiring lifetime care. To date, very few data on the economic impact of meningococcal infection in France has been published.

OBJECTIVES

- This study aimed to estimate lifelong management costs associated with 2 severe cases of IMD in France.

METHODS

- The study was adapted from the Meningitis Research Foundation (MRF) study conducted in the UK⁹.
- Two scenarios of severe IMD cases were developed:
 - a 6-year old with *purpura fulminans* resulting in amputation of both legs below the knee (Scenario A),
 - a 3-year old with meningitis resulting in severe neurological sequelae (Scenario B).
- Alternative scenarios were created to include additional typical sequelae of IMD: chronic renal insufficiency (CRI), profound deafness and epilepsy were assessed.
- Lifelong patient management was defined by consulting with specialist clinicians and experts: paediatrician, orthopedic surgeon, neurosurgeon, physical readaptation doctor, nephrologist, otorhinolaryngologist, prostheses specialist, social assistant, occupational therapist, psychomotility specialist, and home adaptation engineer.
- Health, disability, educational and other resources associated with each step of the management were collected from experts and families of patients with similar sequelae. Assumptions have been made on families' revenues, type of home and distance from home to healthcare professionals, etc.
- Direct medical and non medical costs as well as indirect costs have been included (income loss was calculated for parents only, and productivity loss due to the patients' lifetime disability was not included).
- A 4% discount rate decreasing to 2% after 30 years was applied as recommended by French Authorities guidelines¹⁰.
- Unit costs (€ 2013) associated with each resource were obtained from the literature, the National Health Insurance (NHI) and companies' websites.
- Time horizon was based on assumption of life expectancies of patients (77 and 55-years for scenario A and B respectively).
- Results are presented from NHI, publicly funded organisations and patient or his/her private health insurance perspectives.

ANALYSES

- A total of 19 experts agreed to participate in the study and both scenarios were validated by national experts of IMD.
- For each scenario, the following outcomes were estimated by type of expense and by type of payer:
 - discounted and undiscounted total cost of IMD from beginning of symptoms to patient death,
 - discounted and undiscounted annual mean cost.
- Additionally, sensitivity analyses were performed around parameters where uncertainty exists using lower and upper boundary estimates.

RESULTS

Brief description of scenarios	Scenario A	Scenario B
Age at first symptoms	6-year old	3-year old
Type of IMD	Septicemia with <i>purpura fulminans</i>	Meningitis
Major sequelae	Amputation of both legs below the knee / skin grafts	Severe neurological sequelae (cognitive deficiencies, hemiplegia, homonymous hemianopsia, behavioural disorder and hydrocephalus)
Consequences	Stay in a readaptation center Prostheses Special equipments: manual and sport wheelchairs, crutches and pressure garments Health professionals consultations Home and car adaptation Family revenue loss	Stay in a readaptation center Ventriculoperitoneal shunt (insertion and revision) Stay in child and adult institutions Special equipments: electric wheelchair, medicalised stroller and support corset Health professionals consultations Home and car adaptation Family revenue loss
Additional sequelae explored	Chronic renal insufficiency requiring kidney transplantation	Profound deafness and epilepsy

Scenario A

- Purpura fulminans* with amputations is associated with a lifelong discounted cost of €768,875 (min: €585,025 – max: €959,964).
- The most important cost driver is the cost of prostheses (36.6%).

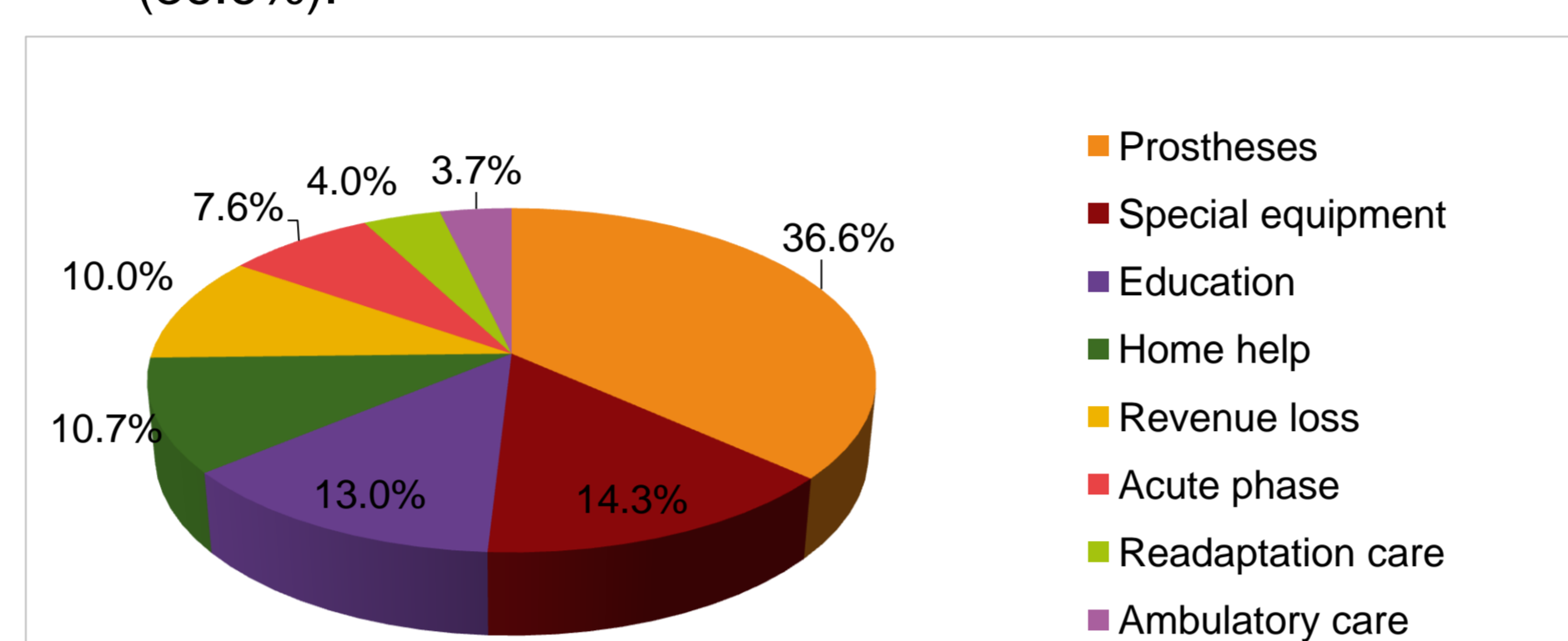


Figure 1: Total discounted cost by type of expense

- Mean annual discounted total cost is €10,679 (min: €8,125; max: €13,333).
- Half of total discounted cost is covered by NHI (€394,501; 51.3%), followed by publicly funded organisations (€272,541; 35.4%) and by patient and/or their private insurance (€101,833; 13.2% - respectively €173,134 - 11.9% undiscounted).
- The uncertainty around parameters affects mostly the cost covered by the NHI because of the large uncertainty around unit cost of prostheses (€2,098 to €10,015 depending on the type of prosthesis), which are financed 100% by NHI.

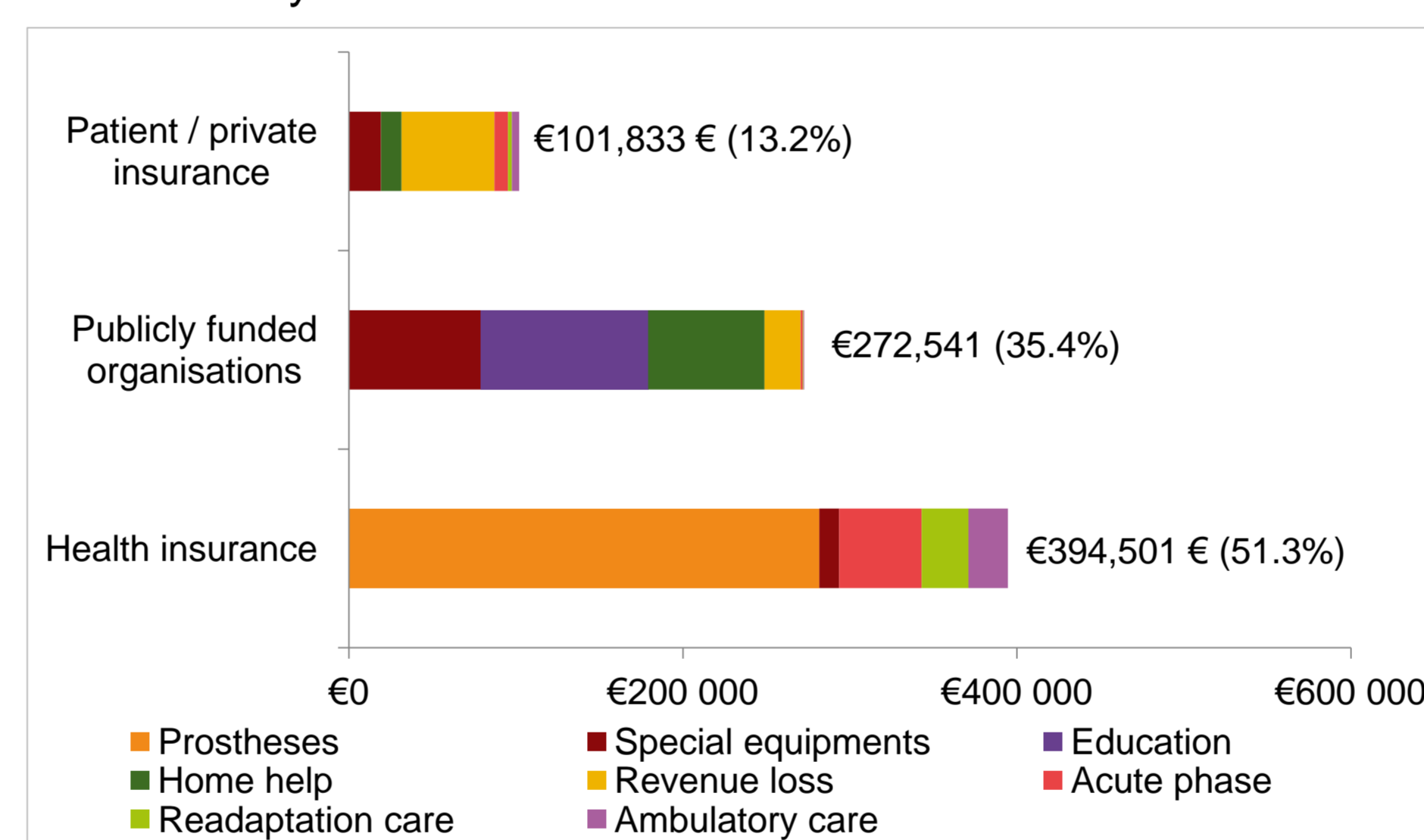


Figure 2: Discounted costs by type of expense and by payer

- When CRI is added, the total cost increases to €1,480,546 instead of €768,875.

Table 1: Summary of discounted and undiscounted costs

	Discounted	Undiscounted
Scenario A		
Total	€768,875	€1,453,492
1 st year (%)	€166,890 (21.7%)	€166,890 (11.5%)
Scenario A + CRI		
Total	€1,480,546	€3,369,558
1 st year (%)	€167,577 (11.3%)	€167,577 (5.0%)

Scenario B

- Meningitis with severe neurological sequelae results in a lifelong discounted cost of €1,924,475 (min: €1,279,617; max: €2,740,387).
- The most important cost driver is the cost of education (43.4%), followed by cost of adult institution (34.8%).

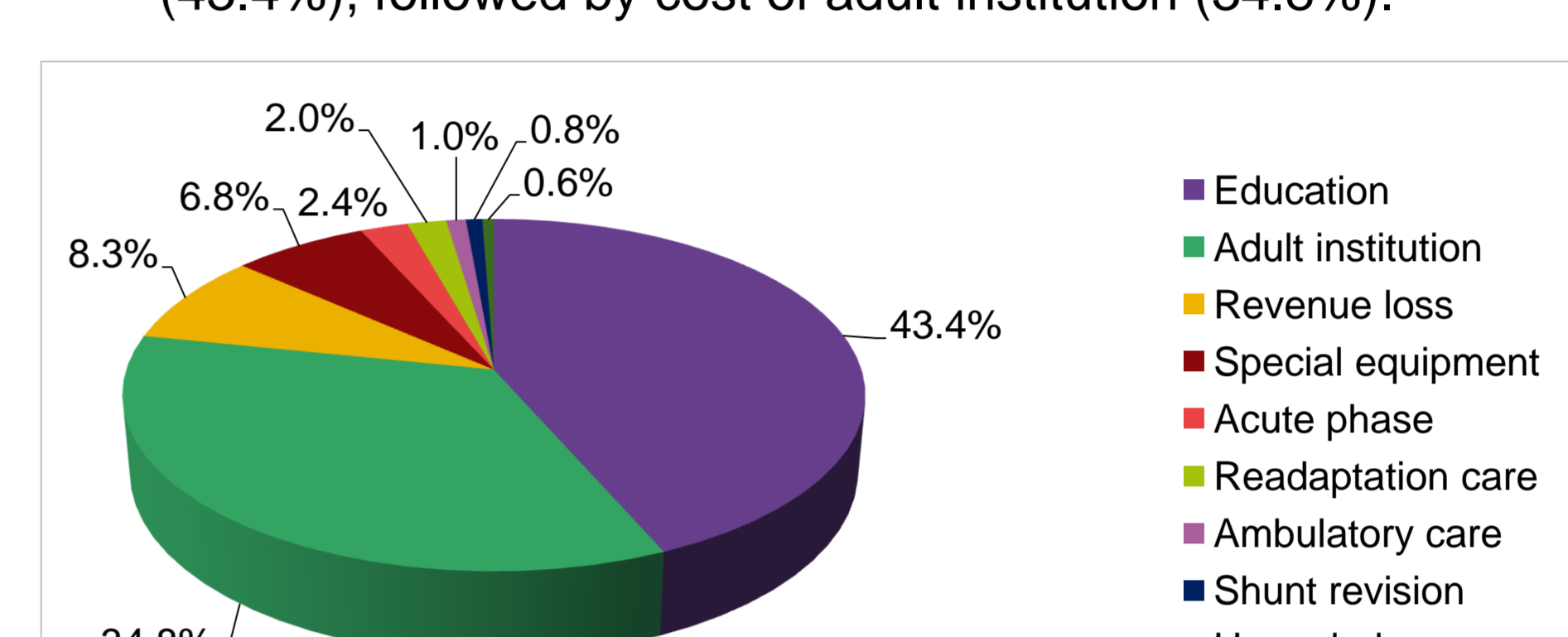


Figure 3: Total discounted cost by type of expense

- Mean annual discounted total cost is €36,311 (min: €24,144; max: €51,705).
- Half of total discounted cost is covered by NHI (€967,469; 50.3%), followed by publicly funded organisations (€698,189; 36.3%) and by patient and/or their private insurance (€258,817; 13.4% - respectively €447,163 - 11.4% undiscounted).
- The uncertainty around parameters affects mostly the costs covered by the NHI and publicly funded organisations because of the uncertainty around the cost of car adaptation, child institution and adult institution.

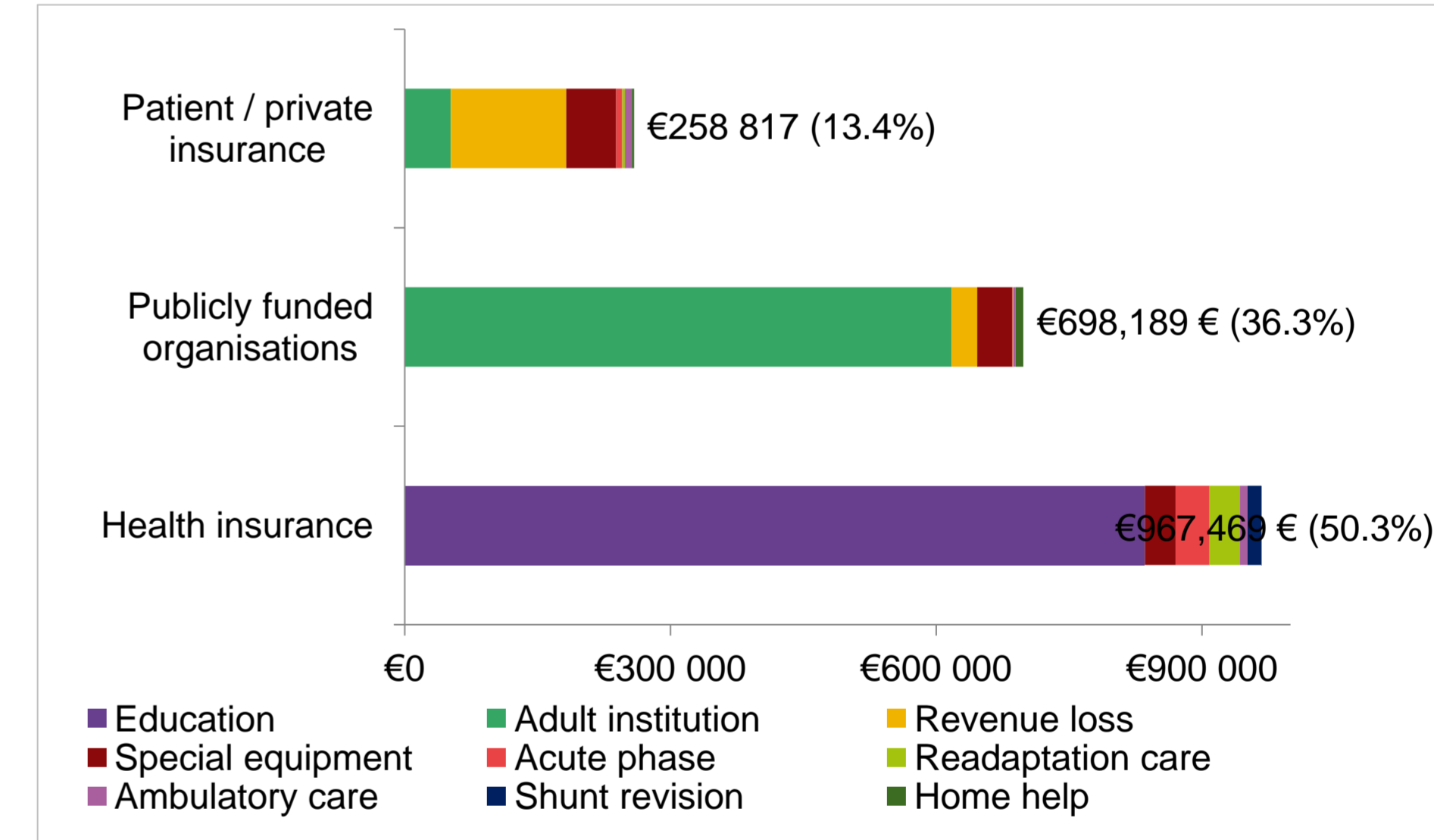


Figure 4: Discounted costs by type of expense and by payer

- When epilepsy and deafness are added, the total cost increases to €2,267,251 instead of €1,924,474.

Table 2: Summary of discounted and not discounted costs

	Discounted	Undiscounted
Scenario B		
total	€1,924,475	€3,921,857
1 st year (%)	€160,648 (8.3%)	€160,648 (4.1%)
Scenario B + profound deafness and epilepsy		
total	€2,267,251	€4,579,218
1 st year (%)	€210,316 (9.3%)	€210,316 (4.6%)

CONCLUSION

- Purpura fulminans* with amputations is associated with a lifelong discounted cost of €768,875 (undiscounted: €1,453,492). Adding CRI doubles the amount: €1,480,546 (undiscounted: €3,369,558).
- Meningitis with severe neurological sequelae results in a lifelong discounted cost of €1,924,475 (undiscounted cost: €3,921,857). Adding profound deafness and epilepsy slightly increases the total cost: €2,267,251 (undiscounted: €4,579,218).
- Overall, NHI covers half of total cost, publicly funded organisations 1/3 and patient/private health insurance for the remainder.
- Results of this study are in line with those published in January 2013 by the MRF in the UK⁹.
- This study has the following limitations: the uncertainty around unit

cost of prostheses is high, costs of CRI were obtained from Blotière et al. manuscript which is not well detailed and finally some costs were not included as they were very difficult to measure (e.g. child care for brothers and sisters or indirect costs related to patients).

However, this study fills a gap in the body of knowledge on IMD sequelae care and costs, as there is very limited published information about this currently available in France.

In the end, the financial impact of disability associated with IMD is very high over lifetime and especially the 1st year, not only for NHI and publicly funded organisations but also for families. Therefore, these results should be considered for the assessment of funding measures related to IMD in France.

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