
Cost-benefit analysis of vaccination against tick-borne encephalitis among French troops

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Record Status

This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology

The health intervention examined in the study was a vaccine against tick-borne encephalitis (TBE) administered to French troops during their tours of duty in the Balkans. A hypothetical TBE vaccine with characteristics combining those of available TBE vaccines in Western Europe was considered. The vaccination protocol was assumed to be three injections at 0, 7 and 28 days with a booster injection at 3 years.

Type of intervention

Primary prevention (vaccination).

Economic study type

Cost-effectiveness analysis.

Study population

The study population comprised the French army in the Balkans, a geographical zone where TBE is endemic.

Setting

The setting was the military context. The study was carried out in France.

Dates to which data relate

Effectiveness data were derived from studies published between 1985 and 2002. Resource use data came from sources published between 1999 and 2003. The price year was 2004.

Source of effectiveness data

The effectiveness evidence came from a synthesis of published studies.

Modelling

A two-part decision tree was constructed to assess the costs and benefits of the vaccination programme in comparison with no vaccination. The first tree represented the management of a TBE case, while the second tree was used in the pharmacoeconomic evaluation in order to compare the vaccination programme with no vaccination. Infected individuals could develop meningoencephalomyelitis (MEM), meningoencephalitis (ME) or meningitis. Patients could either die or develop sequelae. A similar tree was applied to patients who developed a serious adverse event related to TBE vaccination. The pharmacoeconomic model considered vaccine efficacy, seroconversion, and possible development of infection. A graphical representation of the model was provided. The time horizon of the model was 10 years (2004 to 2014).

Outcomes assessed in the review

The clinical outcomes obtained from the literature were rates of incidence of TBE and sequelae (exposure risk, mortality, etc.), vaccine efficacy and tolerability, and the size of the military population eligible for the study.

Study designs and other criteria for inclusion in the review

A systematic review was undertaken to identify relevant primary studies. Limited information on the design and other characteristics of the primary studies was provided. Some clinical inputs were derived from follow-up studies or case series. The size of the military population came from French demographic statistics.

Sources searched to identify primary studies

PubMed was searched from 1970 to 2004 using the search term 'tick borne encephalitis'. Studies in English, German, or French languages were selected. References of primary studies were also searched for further studies.

Criteria used to ensure the validity of primary studies

Not stated.

Methods used to judge relevance and validity, and for extracting data

Not reported.

Number of primary studies included

Fifteen primary studies plus national statistics were used as the source of clinical evidence.

Methods of combining primary studies

It appears that the authors selected the most valid estimates when multiple sources were available. For the seroconversion rate, the most conservative approach against the vaccination programme was used in the base case.

Investigation of differences between primary studies

Not stated.

Results of the review

The risk of TBE exposure was 0.58.

The rate of seroconversion for anti-TBE antibodies (rate of those at risk) was 834 per 100,000 person-years.

The incidence of clinically apparent disease (% of seroconverted individuals) was 33%.

The disease distribution (% of clinically apparent disease cases) was 48% for meningitis, 43% for ME 43%, and 9% for MEM.

The mortality rate (% of clinically apparent disease cases) was 1.5%.

The rate of sequelae (% of clinically apparent disease cases) was 12%.

Vaccine doses were administered at 0, 7, and 28 days.

Vaccine efficacy was 98.2%.

The incidence of moderate/transitory adverse effects was 17.8% of first dose.

The incidence of severe adverse effects was one per 1 million vaccinations.

225,555 individuals were potentially eligible for vaccination.

Measure of benefits used in the economic analysis

The summary benefit measure was the number of TBE cases that vaccination would prevent in comparison with no vaccination. No discount rate was applied to health benefits.

Direct costs

The analysis of costs was carried out from the perspective of the French Department of Defence and aimed to calculate the difference between vaccination costs and costs saved by the vaccination. Vaccination costs included vaccine acquisition and administration and moderate adverse events associated with the TBE vaccine (medical treatment and hospitalisation). Costs saved included all direct costs associated with TBE, such as medical evacuation flights, hospitalisation and stay in a rehabilitation centre. Extensive information on quantities of resources used and unit costs was provided. Most costs were estimated from sources of the French Department of Defence, and some economic studies were also used. Resource use was mainly estimated from published sources, although some assumptions were also made. The price year was 2004. Discounting was relevant as costs were incurred over a long time frame and a 5% annual rate was applied. An inflation rate of 1% was used.

Statistical analysis of costs

Costs were treated deterministically.

Indirect Costs

Indirect costs, namely the costs associated with absence from work and compensation for serious adverse effects, were included in the analysis since such costs were borne by the French Department of Defence. Compensation costs referred to the amount paid by the Department of Defence for either the onset of permanent and disabling sequelae of a disease acquired during service (disability pension), or death related to a disease attributable to service (death-related pensions, survivors' pension). Compensation costs were derived from the French Department of Defence. Details on the calculation of compensation costs were extensively reported. Some costs depended on military rank. Resource consumption was derived from published studies. The price year was 2004. As in the analysis of direct costs, a 5% annual discount rate was applied and an inflation rate of 1% was used.

Currency

Euros (EUR). The exchange rate from Euros to US dollars (\$) was EUR 1 = \$1.2.

Sensitivity analysis

Univariate sensitivity analyses were performed on selected model inputs to assess the robustness of the costs results. The following variables were changed: frequency and costs of adverse effects, disease distribution, hospitalisation and rehabilitation direct costs, compensation costs paid for death, disability pension paid, and discount rate. Justification for the alternative values tested was provided. In addition, two alternative scenarios were considered: one favourable and one unfavourable to the vaccination strategies. The values of the clinical and economic inputs used in each scenario were reported. Finally, the implementation of a vaccination protocol broadened to all the military personnel was also tested. For each sensitivity analysis, the authors reported the calculation of the threshold values for the seroconversion rate of TBE with a corresponding cost-saving of zero.

Estimated benefits used in the economic analysis

121 TBE cases could be prevented by vaccination, with 2 deaths and 15 cases of serious and permanent sequelae.

Cost results

Under base case assumptions, total vaccine programme costs were EUR 10.05 million and total costs averted were EUR 4.37 million. The main categories of costs averted were those related to hospitalisation and rehabilitation, medical evacuation flight and disability pension pay. Thus, the extra costs of vaccination were EUR 5.68 million. The ratio of costs incurred and saved was EUR 2.30.

The break-even point (when the vaccine programme costs are equal to the cost savings) was a seroconversion rate of 1,936 per 100,000 person-years, i.e. 280 TBE cases for the period considered.

The sensitivity analysis showed that in the favourable scenario the extra costs were EUR 2.86 million (break-even seroconversion rate: 1,206), while in the unfavourable scenario they were EUR 17.63 million (break-even seroconversion rate: 6,343). If the vaccine was applied to the whole army, then the extra costs of vaccination would be EUR 25.7 million (break-even seroconversion rate: 6,971). The incidence of disease had a large impact on the estimated costs. However, in no case did vaccination lead to cost savings.

Synthesis of costs and benefits

A synthesis of costs and benefits was not relevant as a cost-consequences analysis was performed. In effect, costs and benefits were not combined.

Authors' conclusions

The authors concluded that the current policy of not vaccinating French troops against TBE is appropriate because the low incidence of TBE does not justify the extra costs of vaccination.

CRD COMMENTARY - Selection of comparators

The selection of the comparator, no vaccination, was appropriate since this is the current pattern of care for the French army in the Balkans. You should decide whether this is a valid comparator in your own setting.

Validity of estimate of measure of effectiveness

The effectiveness data were estimated from published studies, which were identified through a systematic review of the literature. Some details of search methods were reported. Primary estimates were not combined, and the selection of the most appropriate published estimates was based on the authors' opinions. However, ranges of published values were used in the sensitivity analysis. Some information on the design of the studies used to derive clinical estimates was provided, but the validity of the primary sources was not discussed. A conservative approach against the vaccination programme was used for some clinical estimates.

Validity of estimate of measure of benefit

No summary benefit measure was used in the analysis because a cost-consequences analysis was conducted. See the commentary reported above under 'Validity of estimate of measure of effectiveness'.

Validity of estimate of costs

The economic analysis appears to have included all relevant categories of costs, which were consistent with the stated perspective. The authors provided extensive details on all resources and unit costs, which enhance the possibility of replicating the analysis of costs in other settings. The source of data was explicitly stated and was consistent with the perspective adopted in the study. Costs were treated deterministically but several sensitivity analyses were carried out. Thus, the impact of changes in clinical and economic inputs on total costs was extensively investigated. The price year was reported, which will facilitate reflation exercises to other time periods.

Other issues

The authors stated that comparisons with the results of other studies are not easy due to the substantial differences in the perspective adopted and the costs included. The issue of the generalisability of the study results to other settings was not explicitly stated, but the extensive use of sensitivity analyses and the details on costs and quantities of resources enhances the external validity of the study. The authors noted that their estimate of disease incidence, which was the most relevant model parameter in the sensitivity analysis, was highly uncertain; the model did not consider the fact that some military personnel are exposed several times during their service and that some of them undergo greater risks because of the nature of their mission.

Implications of the study

The study results do not support the implementation of a TBE vaccination strategy for French troops in endemic areas.

Source of funding

None stated.

Bibliographic details

Desjeux G, Galois-Guibal L, Colin C. Cost-benefit analysis of vaccination against tick-borne encephalitis among French troops. *Pharmacoeconomics* 2005; 23(9): 913-926

PubMedID

16153134

Other publications of related interest

Harabacz I, Bock H, Jungst C H, et al. A randomized phase II study of a new tick-borne encephalitis vaccine using three different doses and two immunization regimens. *Vaccine* 1992;10:145-50.

Hedenstrom M, Heberle U, Theobald K. Vaccination against tick-borne encephalitis (TBE): influence of simultaneous application of TBE immuno-globulin on seroconversion and rate of adverse events. *Vaccine* 1995;13:759-62.

Indexing Status

Subject indexing assigned by NLM

MeSH

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