A BENEFIT-COST ANALYSIS OF THE NEW ZEALAND SHEEP MEASLES CONTROL PROGRAMME

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SUMMARY Benefit-cost analysis of the New Zealand sheep measles (Cysticercus ovis) control programme showed that it would be uneconomic to continue with the programme after true hydatids (Echinococcus granulosus) is eradicated. However, the incidence of C. ovis in lambs and sheep under no control and the benefits associated with market access for cysticercosis-free meat were difficult to quantify.

INTRODUCTION In 1959 the Government initiated a compulsory programme to eradicate Echinoccus granulosus (true hydatids) and Taenia hydatigena from New Zealand. The legislation was amended in 1969 to include eradication of another tapeworm of dogs, Taenia ovis, whose intermediate stage, Cysticercus ovis (sheep measles), causes a blemish in sheep meat.

Lamb or mutton carcases infected with C. ovis may be condemned or downgraded at meat inspection, thus lowering their market value. Some importing countries will only accept carcases with no observable cysts while others will take carcases with 5 or less cysts if trimmed. When the incidence of T. ovis in dogs was observed to be increasing between 1959 and 1968, eradication was considered necessary to protect New Zealand's export markets for sheep meats.

It is anticipated that true hydatids will be eradicated by 1990. By contrast, the eradication of sheep measles does not appear achievable, so to determine whether the programme to control sheep measles should continue after true hydatids has been eradicated, an economic benefit-cost study of the current programme was undertaken. The programme is compared with that of no control of sheep measles.

SHEEP MEASLES CONTROL PROGRAMME The present control programme is based on compulsory dosing of rural dogs with a cestocide every 6 weeks to kill tapeworms and the prohibition of feeding untreated sheep meat to dogs. Sheep meat either must be frozen to -10°C for 7 days or cooked to kill C. ovis cysts before feeding to dogs. The programme is backed by education of dog owners and farmers about the risks the disease presents to the national economy and the measures they must take to prevent further dog infection.

Progress with the programme is monitored by testing faecal samples for T. ovis from a proportion of dogs each year and by recording the numbers of sheep and lamb carcases shown at meat inspection to have C. ovis. Effort is made to trace infected stock back to the farm of origin and to explain to the farmer how further infection can be prevented.

A statutory body, the National Hydatids Council, prescribes measures for controlling hydatids and sheep measles in New Zealand. Administrative and technical support is supplied to the Council by the Ministry of Agriculture and Fisheries. Territorial authorities implement the Council's policies. Collectively, they employ around 250 hydatid control officers who regularly dose dogs with a cestocide and carry out inspection and educational work.

The sheep measles control programme is funded jointly by dog owners through licence fees to territorial authorities and by Government. Farmers who feed sheep meat to dogs bear the cost of treating the meat. The programme costs around $10 million per year to run (table 1).

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Table 1: Annual costs of sheep measles control in 1984 dollars (thousands)

Year	Treatment sheep meat	Cestocide tablets	Publicity	Manpower	Operating & capital	Total costs
1	3 448	1 600	35	3 263	2 486	10 832
to 5	3 448	1 600	35	3 263	2 486	10 832
6	2 624	1 600	35	3 263	2 486	10 008
to 15	2 624	1 600	35	3 263	2 486	10 008

LOSSES FROM SHEEP MEASLES Sheep measles is a disease affecting product quality. Loss occurs when carcases are condemned or downgraded at meat inspection. The labour costs incurred in inspecting and trimming such carcases also represent a loss to society. The losses calculated in this study are based on the market requirements presently set by importing countries.

Statistical data collected from all export slaughterhouses in New Zealand since 1974 show that the amount of loss is related to the incidence of C. ovis infected carcases detected at meat inspection. To estimate future losses from sheep measles, it was predicted that the incidence of C. ovis in sheep and lambs under the present control programme would remain at 5.24% and 0.65% respectively and if control was totally removed, the incidence in sheep would rise to 5.4% from year 1 and in lambs would rise to 2.8% in year 1 and 5.0% from year 2.

On average, 1.1% and 0.89% of sheep and lamb carcases with C. ovis are condemned and around 2% of sheep and lamb carcases are downgraded. Approximately 55% of hearts from C. ovis affected carcases are condemned. It costs about $1.00 per carcase to trim off visible cysts and where the incidence of C. ovis is greater than 4%, inspection of carcases slows down the killing chain resulting in a cost of $1.00 per infected carcase in lost productivity. The benefits that accrue to the sheep measles control programme from reducing these losses are summarised in table 2.

Table 2: Annual benefits of sheep measles control 1984 dollars (thousands)

Year	Condemned carcases	Condemned hearts	Downgraded carcases	Labour	Total benefits
1	159	20	120	760	1 059
2	322	41	240	3 208	3 810
to 15	322	41	240	3 208	3 810

ECONOMIC EVALUATION The study showed that if the present control programme for sheep measles is continued after the eradication of true hydatids, and if it is no more successful than at present, the scheme will result in an economic loss of $52.7 million at a discount rate of 10% over the 15 year life of the programme. The scheme is also uneconomic at a discount rate of 5%.

DISCUSSION A major problem with the analysis was predicting what levels the incidence of C. ovis in sheep and lambs at slaughter would attain once control was removed. A survey before the introduction of the hydatids eradication scheme in 1959 showed the incidence in dog faeces of E. granulosus as 6.56%. T. hydatigena as 12.00%, and T. ovis as 0.24%. By 1968, the incidence of E. granulosus had fallen to 0.92% and of T. hydatigena to 4.55%, while that of T. ovis had risen steadily to 3.35%.

In 1969, T. ovis was brought under the eradication programme. Initially the feeding of untreated sheep meat to dogs was discouraged and then in 1972, was made illegal. In 1975, 6 weekly dosing of dogs with a cestocide was introduced and a year later the incidence of E. granulosus fell further to 0.09%, T. hydatigena to 0.19%, and T. ovis to 0.24%. Since 1976, the incidence of T.ovis has climbed steadily again to reach 1.51% in 1984.

The rise in the incidence of T. ovis with the introduction of hydatids control has been ascribed to farmers feeding more sheep meat to dogs when feeding offal was prohibited and to the increased susceptibility of dogs to T. ovis as a consequence of the reduced exposure to infection with T. hydatigena and E. granulosus (1). Measures introduced against T. ovis from 1969 to 1976 did reduce the infection rate considerably and the rise from 1977 onwards may be caused by farmers placing too much reliance on 6 weekly dosing and taking less care with dog feeding practices.

There is little historical data available on levels of C. ovis in sheep and lambs at slaughter but rates in 1968-70 before intensive dosing of dogs with a cestocide was introduced were around 5.4% and 4.5% in sheep and lambs respectively. Rates used in the analysis under the no control option are based on these levels with that of lambs forecast to approach more closely the sheep level.

An empirical research trial has been proposed to investigate what levels C. ovis in lambs might rise to with no control. However, sensitivity analysis showed that the incidence of C. ovis would have to reach 15% for the programme to become economic. It is considered unlikely that the incidence would ever reach this level thus obviating the need for expensive research.

The analysis assumes that the market conditions governing the maximum acceptable levels of C. ovis cysts in sheep meats will remain as at present. There is no way of knowing whether market requirements will change in the future nor is it easy to quantify the marketing advantage conferred on New Zealand sheep meats by the existence of a control programme for the disease. However, if it is decided that the programme is necessary to endorse the quality of New Zealand sheep meat, the cost is now transparent to the farming industry who can decide whether or not to fund it.

The control programme could be replaced with a voluntary one in which dog owners are encouraged to dose their dogs regularly with a cestocide and take care with feeding sheep meat. The production loss associated with sheep measles would be passed directly onto the farmer submitting infected stock for slaughter rather than it being spread over all farmers as at present.

The problem with leaving sheep measles control up to individual farmers is that the parasite is readily spread over large areas and so conscientious control by one farmer does not guarantee that his sheep will not be infected from neighbouring properties. In addition, it is possible that by allowing lambs to gradually build up immunity to C. ovis, the disease can be controlled nearly as effectively as by invoking expensive control measures. Benefit-cost analysis, while not answering all questions, has assisted in clarifying the decision to be made by Government and the meat industry.

REFERENCES (1) New Zealand Government (1967) Report of the Committee of Inquiry into Hydatids Eradication, p35.