

# NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

## Final appraisal determination

### Natalizumab for the treatment of adults with highly active relapsing–remitting multiple sclerosis

This guidance was developed using the single technology appraisal (STA) process.

## 1 Guidance

- 1.1 Natalizumab is recommended as an option for the treatment only of rapidly evolving severe relapsing–remitting multiple sclerosis (RES). RES is defined by two or more disabling relapses in 1 year, and one or more gadolinium-enhancing lesions on brain magnetic resonance imaging (MRI) or a significant increase in T2 lesion load compared with a previous MRI.
- 1.2 People currently receiving natalizumab, but for whom treatment would not have been recommended according to section 1.1 of this guidance, should have the option to continue therapy until they and their clinicians consider it appropriate to stop.

## 2 The technology

- 2.1 Natalizumab (Tysabri, Biogen Idec and Elan Pharma International Ltd) has a marketing authorisation as a single disease-modifying therapy in highly active relapsing–remitting multiple sclerosis for the following groups.

- Patients with rapidly evolving severe relapsing–remitting multiple sclerosis defined by two or more disabling relapses in 1 year,

and one or more gadolinium-enhancing lesions on brain MRI or a significant increase in T2 lesion load compared with a previous MRI. This patient group is referred to as the 'RES group'.

- Patients with high disease activity despite treatment with beta interferon. This group is defined as patients who have failed to respond to a full and adequate course of a beta interferon. Patients should have had at least one relapse in the previous year while on therapy, and have at least nine T2-hyperintensive lesions in cranial MRI or at least one gadolinium-enhancing lesion. This patient group is referred to as the 'suboptimal therapy group'.

2.2 The use of natalizumab may be associated with infections, urticaria, headache, dizziness, vomiting, nausea, arthralgia, infusion reactions and hypersensitivity reactions. Natalizumab has also been associated with an increased risk of progressive multifocal leukoencephalopathy (PML). For full details of side effects and contraindications, see the summary of product characteristics.

2.3 Natalizumab is administered by intravenous infusion; the recommended dose is 300 mg every 28 days. Natalizumab costs £1130 per 300 mg vial (according to the manufacturer's submission), so over a year the cost of the drug is approximately £14,730 per patient. Costs may vary in different settings because of negotiated procurement discounts. The manufacturer expects that monitoring for symptoms of immunogenicity (anti-natalizumab antibodies) and hypersensitivity will be needed.

### **3 The manufacturer's submission**

The Appraisal Committee (appendix A) considered evidence submitted by the manufacturer of natalizumab and a review of this submission by the evidence review group (ERG) (appendix B).

- 3.1 In its submission, the manufacturer compared natalizumab with beta interferon, glatiramer acetate and best supportive care (that is, no active treatment) for both the RES and the suboptimal therapy groups. The two major clinical outcomes examined were disability progression, defined as an increase in the expanded disability status scale (EDSS) score sustained for 12 or 24 weeks at 2 years, and annualised relapse rate.
- 3.2 The manufacturer presented data from the multinational, double-blind, randomised AFFIRM study (n = 942), which compared natalizumab with placebo. The study comprised people with relapsing–remitting multiple sclerosis, of which a subgroup had highly active relapsing–remitting multiple sclerosis. A post hoc subgroup analysis of AFFIRM (n = 209) provided clinical data for the RES group. The marketing authorisation for the suboptimal therapy group was based on data from the SENTINEL study (n = 1171), which compared natalizumab and beta interferon with beta interferon alone. However, the combination of natalizumab with beta interferon is not included in the marketing authorisation for natalizumab because of concerns over the risk of PML, and data from the SENTINEL study were not presented by the manufacturer. Instead, the manufacturer assumed that the intention to treat (ITT) population from AFFIRM is a suitable proxy for the suboptimal therapy group. The manufacturer provided additional data from two phase II studies. The manufacturer did not identify any studies that compared natalizumab with beta interferon or glatiramer acetate.
- 3.3 The AFFIRM study demonstrated that natalizumab statistically significantly reduces the probability of sustained disability progression compared with placebo in both the ITT and RES populations. The hazard ratios (HRs) varied between 0.46 and 0.58 in the ITT population, depending on the measure of disability progression (increase in EDSS sustained for 24 and 12 weeks

respectively), and between 0.36 and 0.47 in the RES group. In addition, natalizumab led to a reduction in relapse rate, with a relative risk reduction of 0.68 in the ITT population and 0.81 in the RES group. The manufacturer presented evidence that showed that, compared with placebo, natalizumab significantly improved health-related quality of life when measured with the SF-36 instrument, although not when the MSQLI instrument was used.

3.4 Given the absence of study data comparing natalizumab directly with beta interferon and glatiramer acetate, the manufacturer carried out an indirect comparison. This adopted an existing method to compare the results of AFFIRM with systematic reviews of beta interferon and glatiramer acetate. The systematic reviews included people with relapsing–remitting multiple sclerosis rather than highly active relapsing–remitting multiple sclerosis and did not specifically examine the clinical effectiveness of the drugs in the RES or suboptimal therapy groups. Therefore, the manufacturer assumed that the treatment effect of beta interferon and glatiramer acetate in relapsing–remitting multiple sclerosis was equivalent to that in the RES and suboptimal therapy groups. The results of the indirect analysis showed that natalizumab was associated with a statistically significant reduction in relapse rates compared with beta interferon and glatiramer acetate, with relative risks of 0.63 and 0.57 respectively for the ITT population and 0.49 and 0.43 respectively for the RES group. The results of the indirect analysis for disability progression were submitted to NICE in confidence.

3.5 The AFFIRM study showed that natalizumab is not associated with a higher incidence of adverse events than placebo. The indirect comparison performed by the manufacturer found no statistically significant differences in adverse events between natalizumab and glatiramer acetate. However, compared with beta interferon, natalizumab was found to be associated with a statistically significant reduction in the incidence of influenza-like symptoms

and myalgia/arthralgia, with relative risks of 0.47 and 0.68 respectively.

- 3.6 The manufacturer presented a multistate Markov model based on the economic model developed by the School of Health and Related Research (SchARR) at Sheffield University that was used in 'Beta interferon and glatiramer acetate for the treatment of multiple sclerosis' (NICE technology appraisal 32). The manufacturer's model predicts disability progression and disease activity over a time horizon of 20 years using a series of 1-year cycles. The model took an NHS perspective for the majority of costs, but included carers' disutility in the base case.
- 3.7 The clinical data that populate the manufacturer's model come from the AFFIRM study and the systematic reviews of beta interferon and glatiramer acetate. Additional data on disability progression were derived from the London Ontario data set (a longitudinal study of more than 1000 people with relapsing–remitting multiple sclerosis followed for a mean of 25 years). Data on costs and utilities (based on EQ-5D scores) associated with EDSS states were derived from a cross-sectional study (the UK MS survey) commissioned by the manufacturer. This survey included people with relapsing–remitting, secondary progressive and primary progressive multiple sclerosis, and the results were based on 2048 responses (a 15.8% response rate).
- 3.8 The results of the manufacturer's analysis showed that the incremental cost-effectiveness ratios (ICERs) for the RES group compared with best supportive care, beta interferon and glatiramer acetate were £44,600, £32,000 and £34,600 per quality-adjusted life year (QALY) gained respectively. For the suboptimal therapy group the ICERs were £56,100, £43,400 and £44,300 per QALY gained respectively.

- 3.9 Sensitivity analysis demonstrated that the variables that had the greatest effect on the ICERs were the time horizon over which costs and outcomes are evaluated and changing the source of the disability progression data from AFFIRM to the London Ontario dataset. Extending the time horizon to 30 years, for example, reduced the ICERs for natalizumab versus beta interferon to £24,600 and £34,200 per QALY gained in the RES and suboptimal therapy groups respectively. In contrast, changing the source of the disability progression data from AFFIRM to the London Ontario dataset increased the ICERs to £42,300 and £55,300 per QALY gained for natalizumab versus beta interferon in the RES and suboptimal therapy groups respectively.
- 3.10 The ERG expressed a number of concerns about the manufacturer's submission. The ERG recognised the general uncertainty associated with indirect analyses and that the data for the comparators was derived from people with relapsing–remitting multiple sclerosis rather than highly active relapsing–remitting multiple sclerosis. The ERG stated that this might alter the conclusions of the analysis, although the magnitude and direction of any such effect was unknown.
- 3.11 The ERG recognised that the approach adopted by the manufacturer in its economic modelling was pragmatic given the absence of better quality data. However, it expressed concern about the extrapolation of 2-year data from the AFFIRM study to a 20-year time horizon. The ERG also expressed concern that the utility and cost data, which were based on the UK MS survey, were not exclusively derived from people with highly active relapsing–remitting multiple sclerosis; in addition the survey may not have been representative because of the low response rate.
- 3.12 The ERG commented on the limitations of the EDSS instrument, which suffers from limited responsiveness and inter- and intra-rater

variability. In addition, the ERG expressed concern that, although the transition probabilities in the manufacturer's model were based on data from AFFIRM, the model appeared to predict a higher rate of sustained disability progression at 2 years than reported in AFFIRM. The ERG stated that this might overestimate the effectiveness of natalizumab, and might therefore lead to more favourable ICERs in the model. The ERG also highlighted the limited evidence for the assumption in the manufacturer's model that natalizumab reduces progression from relapsing–remitting multiple sclerosis to secondary progressive multiple sclerosis.

- 3.13 Full details of all the evidence are in the manufacturer's submission and the ERG report, which are available from [www.nice.org.uk/TAxxx](http://www.nice.org.uk/TAxxx) [This will be available when the final guidance is issued]

## 4 Consideration of the evidence

- 4.1 The Appraisal Committee reviewed the data available on the clinical and cost effectiveness of natalizumab for highly active relapsing–remitting multiple sclerosis, having considered evidence on the nature of the condition and the value placed on the benefits of natalizumab by people with multiple sclerosis, those who represent them, and clinical specialists. It was also mindful of the need to take account of the effective use of NHS resources.

### ***Clinical effectiveness***

- 4.2 The Committee considered the data on the clinical effectiveness of natalizumab in the subgroup of people whose multiple sclerosis has failed to respond to treatment with beta interferon, that is, the suboptimal therapy group. It noted that the ITT population from the AFFIRM study, which showed that natalizumab significantly reduces relapse rate and delays disability progression compared with placebo, was used in the manufacturer's submission as a

proxy for this group. The Committee was aware that the SENTINEL study was used to inform the licence for the suboptimal therapy group but that the study considered the use of natalizumab in combination with beta interferon; this combination is not licensed because of safety concerns. The Committee noted that there is no direct evidence about the clinical effectiveness of natalizumab monotherapy in the suboptimal therapy group. In addition, the clinical experts confirmed that, although natalizumab may be used in this situation, there are no clinical study data to indicate how clinically effective it is in this group. The Committee therefore concluded that the clinical effectiveness of natalizumab in the suboptimal therapy group has not been fully established.

- 4.3 The Committee considered the data on the clinical effectiveness of natalizumab in the RES group. The Committee was aware that a post hoc analysis of the AFFIRM study population indicated that natalizumab significantly reduces relapse rate and delays disability progression compared with placebo in the RES group. It noted the results of an indirect analysis performed by the manufacturer showing that natalizumab reduces relapse rate more effectively than beta interferon or glatiramer acetate. The Committee also heard the views of the clinical and patient experts that natalizumab has a clinically important effect on disability progression in people with highly active forms of multiple sclerosis that has not been seen with other disease-modifying therapies. The Committee agreed that natalizumab is clinically effective in the RES group compared with placebo, beta interferon and glatiramer acetate.

### ***Cost effectiveness***

- 4.4 Although the Committee had reservations about the data on the clinical effectiveness of natalizumab in the suboptimal therapy group (as indicated in section 4.2), it reviewed the manufacturer's cost-effectiveness analysis for this group and the ERG's

comments. The Committee noted that the base case ICERs estimated by the manufacturer for the suboptimal therapy group were £43,400 per QALY gained or higher. It therefore concluded that natalizumab would not be a cost-effective use of NHS resources in this group of people.

4.5 The Committee noted that the base case ICERs estimated for the RES group by the manufacturer ranged from £32,000 per QALY gained (natalizumab compared with beta interferon) to £44,600 per QALY gained (natalizumab compared with best supportive care).

4.6 The Committee considered which of the comparators used in the manufacturer's cost-effectiveness analysis for the RES group best reflected current clinical practice. The Committee noted that, as described in NICE technology appraisal 32, beta interferon and glatiramer acetate were not recommended by NICE for the treatment of multiple sclerosis on the basis of their cost effectiveness. However, it was aware that, following the Institute's assessment of beta interferon and glatiramer acetate, a risk sharing scheme had been set up by the Department of Health. This allowed the continued use of these technologies with the financial risk being shared between the NHS and the participating pharmaceutical companies. The Committee also noted the information from consultees that treatment with beta interferon is the current standard of practice in the RES group. It was persuaded, therefore, that the most appropriate comparator for determining cost effectiveness in the RES group is beta interferon.

4.7 The Committee noted the views of the ERG that the results of the manufacturer's economic model were associated with considerable uncertainty and that alternative assumptions would substantially increase or decrease the ICERs (see sections 3.9 and 3.12). However, the Committee concluded that the ICER of £32,000 per QALY for natalizumab compared with beta interferon presented by

the manufacturer was more likely to be an overestimate. The Committee considered that, for a disease which presents in early life and has limited effect on life expectancy, a time horizon longer than 20 years would be appropriate, which would lower the ICER. In addition it was persuaded that the disutility of relapses may have been underestimated in the model. In addition, the Committee took into account the high degree of clinical need among people in the RES group and the innovative nature of the technology. The Committee therefore concluded that the use of natalizumab for people with RES would be a cost-effective use of NHS resources and that it should be recommended for use within the NHS for the treatment of people with RES.

## **5 Implementation**

5.1 The Healthcare Commission assesses the performance of NHS organisations in meeting core and developmental standards set by the Department of Health in 'Standards for better health' issued in July 2004. The Secretary of State has directed that the NHS provides funding and resources for medicines and treatments that have been recommended by NICE technology appraisals, normally within 3 months from the date that NICE publishes the guidance. Core standard C5 states that healthcare organisations should ensure they conform to NICE technology appraisals.

5.2 'Healthcare Standards for Wales' was issued by the Welsh Assembly Government in May 2005 and provides a framework both for self-assessment by healthcare organisations and for external review and investigation by Healthcare Inspectorate Wales. Standard 12a requires healthcare organisations to ensure that patients and service users are provided with effective treatment and care that conforms to NICE technology appraisal guidance. The Assembly Minister for Health and Social Services issued a Direction in October 2003 that requires local health boards and

NHS trusts to make funding available to enable the implementation of NICE technology appraisal guidance, normally within 3 months.

- 5.3 NICE has developed tools to help organisations implement this guidance (listed below). These are available on our website ([www.nice.org.uk/TAxxx](http://www.nice.org.uk/TAxxx)). *[Note: tools will be available when the final guidance is issued]*

## 6 Recommendations for further research

- 6.1 The Committee considered that further research into the clinical effectiveness of natalizumab for the treatment of highly active relapsing–remitting multiple sclerosis in the suboptimal therapy group is needed.

## 7 Related guidance

- 7.1 NICE has issued the following related technology appraisal guidance and clinical guidelines.
- Multiple sclerosis: management of multiple sclerosis in primary and secondary care. NICE clinical guideline 8 (2003). Available from: [www.nice.org.uk/CG008](http://www.nice.org.uk/CG008)
  - Beta interferon and glatiramer acetate for the management of multiple sclerosis. NICE technology appraisal guidance 32 (2002). Available from: [www.nice.org.uk/TA032](http://www.nice.org.uk/TA032)

## 8 Review of guidance

- 8.1 The review date for a technology appraisal refers to the month and year in which the Guidance Executive will consider whether the technology should be reviewed. This decision will be taken in the light of information gathered by the Institute, and in consultation with consultees and commentators.

8.2 The guidance on this technology will be considered for review in June 2010.

David Barnett  
Chair, Appraisal Committee  
June, 2007

## **Appendix A. Appraisal Committee members and NICE project team**

### **A. Appraisal Committee members**

The Appraisal Committee is a standing advisory committee of the Institute. Its members are appointed for a 3-year term. A list of the Committee members who took part in the discussions for this appraisal appears below. The Appraisal Committee meets twice a month except in December, when there are no meetings. The Committee membership is split into three branches, with the chair, vice chair and a number of other members attending meetings of both branches. Each branch considers its own list of technologies, and ongoing topics are not moved between the branches.

Committee members are asked to declare any interests in the technology to be appraised. If it is considered there is a conflict of interest, the member is excluded from participating further in that appraisal.

The minutes of each Appraisal Committee meeting, which include the names of the members who attended and their declarations of interests, are posted on the NICE website.

#### **Professor Keith Abrams**

Professor of Medical Statistics, University of Leicester

#### **Dr Jeff Aronson**

Reader in Clinical Pharmacology, Radcliffe Infirmary

#### **Dr Darren Ashcroft**

Senior Clinical Lecturer, School of Pharmacy and Pharmaceutical Sciences, University of Manchester

#### **Professor David Barnett (Chair)**

Professor of Clinical Pharmacology, University of Leicester

**Dr Peter Barry**

Consultant in Paediatric Intensive Care, Leicester Royal Infirmary

**Professor Stirling Bryan**

Director of the Health Economics Facility, University of Birmingham

**Professor John Cairns**

Public Health and Policy, London School of Hygiene and Tropical Medicine

**Dr Mark Charkravarty**

Head of Government Affairs and NHS Policy, Procter and Gamble  
Pharmaceuticals (UK) Ltd

**Professor Jack Dowie**

Health Economist, London School of Hygiene and Tropical Medicine

**Lynn Field**

Nurse Director, Pan Birmingham Cancer Network

**Professor Christopher Fowler**

Professor of Surgical Education, University of London

**Dr Fergus Gleeson**

Consultant Radiologist, Churchill Hospital, Oxford

**Ms Sally Gooch**

Former Director of Nursing and Workforce Development, Mid Essex Hospitals  
Services NHS Trust

**Mrs Barbara Greggains**

Lay member

**Mr Sanjay Gupta**

Former Stroke Services Manager, Basildon and Thurrock Universities  
Hospitals NHS Trust

**Dr Mike Laker**

Medical Director, Newcastle Hospitals NHS Trust

**Mr Terence Lewis**

Mental Health Consultant, National Institute for Mental Health in England

**Professor Gary McVeigh**

Professor of Cardiovascular Medicine, Queens University, Belfast

**Dr Ruairidh Milne**

Senior Lecturer in Health Technology Assessment, National Coordinating Centre for Health Technology

**Dr Neil Milner**

General Medical Practitioner, Sheffield

**Dr Rubin Minhas**

General Practitioner, CHD Clinical Lead, Medway PCT

**Dr John Pounsford**

Consultant Physician, North Bristol NHS Trust

**Dr Rosalind Ramsay**

Consultant Psychiatrist, Adult Mental Health Services, Maudsley Hospital, London

**Dr Stephen Saltissi**

Consultant Cardiologist, Royal Liverpool University Hospital

**Dr Lindsay Smith**

General Practitioner, East Somerset Research Consortium

**Mr Cliff Snelling**

Lay member

**Dr Ken Stein**

Senior Lecturer, Peninsula Technology Assessment Group (PenTAG),  
University of Exeter

**Professor Andrew Stevens**

Professor of Public Health, University of Birmingham

**B. NICE project team**

Each technology appraisal is assigned to a team consisting of one or more health technology analysts (who act as technical leads for the appraisal), a technical adviser and a project manager.

**Zoe Charles, Prashanth Kandaswamy**

Technical Leads

**Dr Elisabeth George**

Technical Adviser

**Reetan Patel**

Project Manager

## Appendix B. Sources of evidence considered by the Committee

- A The following manufacturer/sponsor provided a submission for this appraisal:
- Biogen Idec UK and Elan Pharma International
- B The evidence review group (ERG) report for this appraisal was prepared by Peninsula Technology Assessment Group, University of Exeter:
- Ruth Garside, Colin Green, Martin Hoyle, et al. The effectiveness and cost effectiveness of natalizumab for multiple sclerosis: an evidence review of the submission from Biogen, February 2007.
- C The following individuals were selected from clinical specialist and patient advocate nominations from the professional/specialist and patient/carer groups. They gave their expert personal view on natalizumab for the treatment of multiple sclerosis by providing written evidence to the Committee. They are invited to comment on the appraisal consultation document.
- Professor David Miller, nominated as a clinical expert by the Association of British Neurologists
  - Professor Alan Thompson, nominated as a clinical expert by the Multiple Sclerosis Society
  - Megan Burgess, nominated as a clinical expert by the Royal College of Nursing
  - Mrs Caroline Haynes, nominated as a patient expert by the MS Trust
  - Mr Mark Priest, nominated as a patient expert by the MS Trust

## Appendix C. List of organisations involved in this appraisal

The following organisations accepted the invitation to participate in this appraisal. They are also invited to comment on the appraisal consultation document and supporting evidence. Consultee organisations have the opportunity to appeal against the final appraisal determination.

### I Professional/specialist, patient/carer groups and other organisations:

- Association of British Neurologists
- Multiple Sclerosis Society
- Multiple Sclerosis Trust
- Primary Care Neurology Society
- Royal College of Nursing
- Royal College of Physicians
- UK Multiple Sclerosis Specialist Nurse Association
- Department of Health
- Oldham PCT
- Welsh Assembly Government

### II Commentator organisations (without the right of appeal):

- Amgen (mitoxantrone)
- Biogen Idec UK (interferon beta-1a)
- British National Formulary
- Department of Health, Social Services and Public Safety for Northern Ireland
- Medicines and Healthcare products Regulatory Agency (MHRA)
- Multiple Sclerosis Group, University of Bristol

- National Coordinating Centre for Health Technology Assessment
- National Collaborating Centre for Chronic Conditions
- NHS Quality Improvement Scotland
- Peninsula Technology Assessment Group, University of Exeter
- Schering Health Care (interferon beta-1b)
- Serono (interferon beta-1a)
- Teva Pharmaceuticals Ltd (glatiramer acetate)