

Diagnostic and Advisory Service for Neuromyelitis Optica (NMO)

Oxford University Hospitals NHS Trust

Annual Report 12th September 2012

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Outcomes that cant be quantified.....



J.S, NMO patient having a gliding lesson.



A.M on her honeymoon

"The new NMO booklets have been a massive support to me. I can't explain what a difference they have made, they have taken me out of the wilderness and put me back in the world" **S.W, Cirencester, 2011**



E.B, learning to climb

"I am so grateful and lucky to have such a fantastic team. I feel in safe hands and confident in there care." (From anonymous "patient experience questionnaire" feedback, 2011)

"My experience with the NMO staff has been very good, informative and even pleasant. I'm grateful to have access to the JR Hospital and all its staff. The care is of the highest standard." (From anonymous "patient experience questionnaire" feedback, 2012)

1. Service Overview

The Diagnostic and Advisory Service for NMO at the Oxford Radcliffe Hospital (Herein referred to as the “NMO Service”) combines a specialist laboratory with a dedicated clinical service to offer a multidisciplinary service for patients across the south of the country.

The NMO team comprises of:

Clinical team

Dr Jackie Palace	Consultant Neurologist (service lead)
Dr M Isabel Leite	Consultant Neurologist, Senior Clinical Research Fellow
Dr Saleel Chandratre	Consultant Paediatric Neurologist
Mr John Elston	Consultant Ophthalmic Surgeon
Dr Joanna Kitley	NMO Clinical Fellow
Jon Revis	NMO Specialist Nurse
Kay Day	Occupational Therapist
Kate Browne	NMO Physiotherapist
Julia Goodgame	Clinical Service Manager, NMO/CMS
Annaliza Rye	NMO Service Coordinator

Laboratory Team

Prof Angela Vincent	Honorary Consultant in Immunology
Dr Patrick Waters	Senior Postdoctoral Scientist
Dr Mark Woodhall	Postdoctoral Scientist
Georgios Tserpes	NMO Assay Administrator

The service performs around 140 patient activities per year, in a combination of outpatient, inpatient and day case episodes, depending on clinical need. Patients are offered a full multidisciplinary experience when they come to clinic, with assessments from neurologists, ophthalmologists, specialist nurse and a team of therapists. For patients who are unable to attend (possibly due to disability) remote advice from the relevant team specialist is offered to local neurologists and GPs, as well as an advice email and phone line for patients to call with any queries.

To ensure ease of access, the service aims to ensure all appointments and investigations are completed within one visit. All patients are discussed within a multi-disciplinary meeting attended not only by clinicians, but also by laboratory and administrative staff to ensure a holistic and thorough assessment as well as a good communication to patients about appointments.

The service has the ability to admit patients who require urgent review to a dedicated neurosciences unit, with access to specialist therapies such as plasma exchange. A “relapse” (or exacerbation) of NMO can be a medical

emergency, so the team liaise closely with bed managers to ensure rapid admission and treatment.

Most patients are on long term oral medication, but the few who need intravenous medication can be admitted as a day case to the neurology investigations unit, where trained nurses can administer medication such as Rituximab. Education links have been developed between the NMO team and the ward staff to ensure continuity of care.

For the period April 2011 to March 2012 the Laboratory team for the Diagnostic and Advisory Service for NMO (Oxford John Radcliffe Hospital) tested a total of 4431 samples (this is the total of all samples received from eligible and non-eligible countries worldwide) of which 3644 were new patient serum/CSF samples. Of these 3644 new patient samples received, 164 (4.5%) were reported positive for AQP4 antibodies.

An important part of developing a truly national service is closely linking with our sister NMO team in Liverpool. This is done through a combination of face to face meetings, teleconferences and jointly hosting and attending conferences relevant to the field of NMO. At these meetings, collaboration can be fostered in a supported environment to ensure continual developments in standardised care and evidence based practice for NMO patients.

2. Service Objectives, Outcomes and Performance measures

The purpose and goals of the service are set out in the service specification **[Appendix 4]:**

- To make a definitive clinical and laboratory based diagnosis of patients with suspected Neuromyelitis Optica Spectrum Disorder (NMOSD).
- To optimise NMO assay reporting time, this in turn speeds up the diagnostic process.
- To ensure that NMO patients are quickly started on the correct long term immunotherapy to reduce the likelihood of having further relapses. Preventing a relapse is associated with a much better outcome than treating a relapse after it has occurred.
- To involve patients in their own care and allow them to feedback on their own experiences.
- Develop patient / health care professional information.

These are measured using the following outcomes:

Activity levels

- Number of new and follow up outpatient episodes, day cases and inpatient stays.
- Number of AQP4 antibody tests performed in the laboratory.

Performance indicators

- Certainty of diagnosis
- Time to report NMO assay
- Annual relapse rates
- Mortality rate
- ↓ 20% unsatisfactory replies in patient feedback questionnaires

Miscellaneous

- Geographical access to the service
- Time from the service receiving the referral to being offered a clinical consultation by the service.

Activity Figures

The service activity is monitored and recorded on a monthly basis so that the centre can meet the demands of a shifting patient demographic and case load.

In the April 2011-March 2012 period the service received 42 new patient referrals from eligible areas. A large proportion of the patients seen in an outpatient setting are followed up at the centre on an annual or bi-annual basis whilst also visiting their local neurologist.

The clinical service activity for 2012-13 is under predictions for the period of April-July, however the activity for August has increased to be roughly in line with prediction work. This will be monitored and reported as necessary. Current activity can be seen in. Since 2012, the service has increased the number of clinics per year from 24 to 28 per year, to cope with increased demand. This equates to roughly 20 patient appointments.

Another area which has not been formally quantified is remote advice. This includes communication by email, phone, fax and letters between the NMO team and other consultants, GPs, other healthcare professionals and patients. A large proportion of this advice is regarding patients who have not been seen by the clinical first hand, although in some cases, this has led to a full referral and consultation. This gives a good access to the service for physically disabled/unwell patients or those who live far away and would have difficulty in travelling to the clinic.

Certainty of diagnosis

The NMO service has access to highly specialist investigations (including the laboratory test for AQP4 antibodies, highly specific for the diagnosis of NMO) as well as review with experienced clinicians to ensure that patients receive an accurate diagnosis of their condition.

Due to the difficulties in differentiating NMO from other demyelinating and inflammatory disorders, many patients will come to the service with an unclear diagnosis, or in some cases an incorrect diagnosis. **Figure 2** shows that 97% of patients leave with a confirmed diagnosis after assessment at the NMO service.

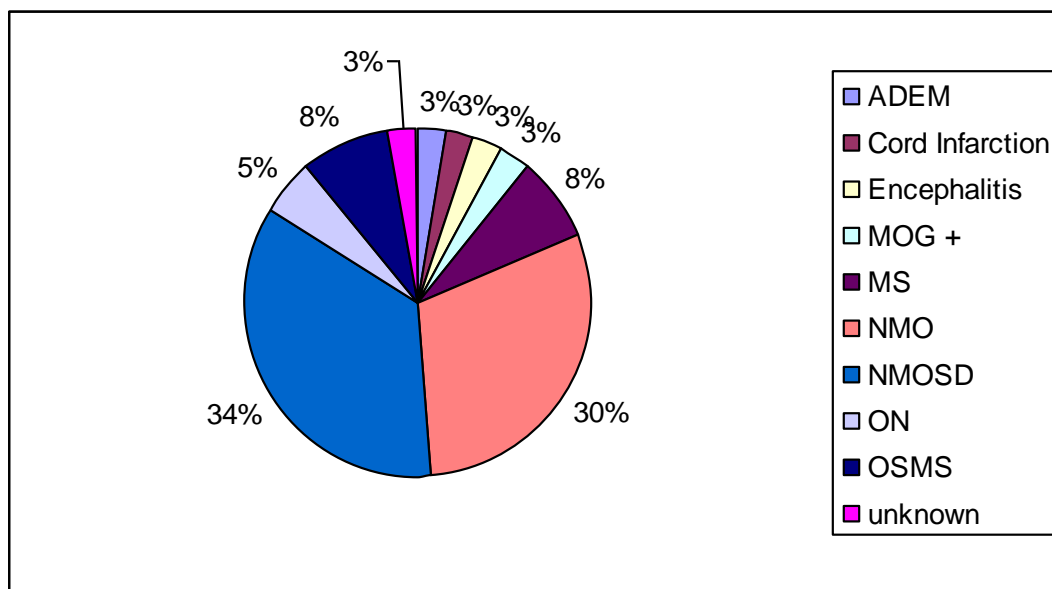


Figure 2. % of patients with a diagnosis from the NMO Service, Oxford.

The service saw 42 new referrals between April 2011 and March 2012. 14 of these patients were assessed to have a different diagnosis to the one they had been given at their local hospital. The impact of an incorrect diagnosis can be devastating, for example, work by doctors Palace and Leite in 2008

suggested that treating NMO patients with interferon- β , used in relapsing remitting multiple sclerosis can increase the number of relapses a patient may have.

Service discharge

The service has an overall discharge rate of 24.5%. Approximately half of these patients have MS and were discharged back to their referring neurologist. The remaining discharged patients had other demyelinating conditions, such as ADEM or idiopathic transverse myelitis. These have a significantly lower risk of relapses and often do not require long term immunosuppression or review from the NMO service. In any case, we ensure that the referring clinician can re-refer the patient if there are any further problems.

Speed of reporting results of NMO antibody test

NMO can be a devastating disease if left undiagnosed and untreated. This can be compounded further by incorrect diagnosis. Therefore the service aims to assess and diagnose patients as rapidly as possible.

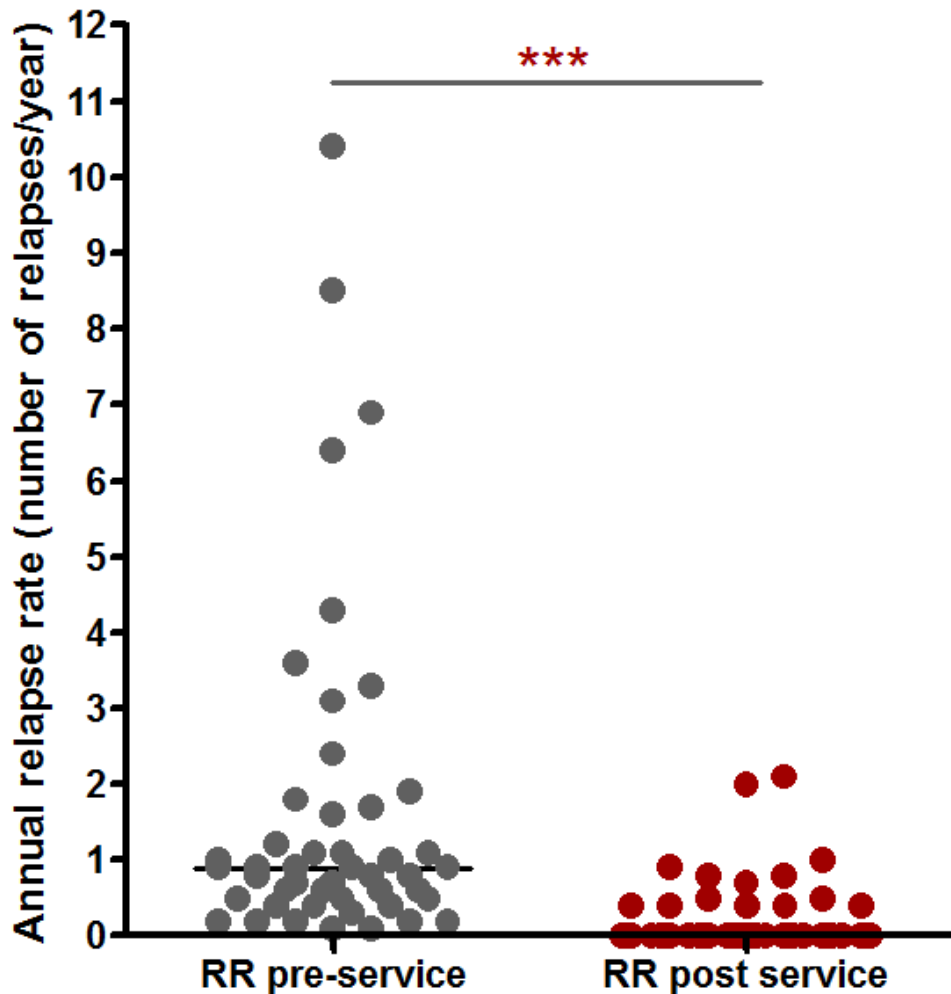
Since the last service year (Apr-10 to Mar-11) the service has seen a 16.2% increase in the number of NMO assay tests being performed. However even with an increase in samples received during this period, 95.9% of all assays completed were reported within 5 days of receiving the sample with the remaining being reported within 11 days. This compares with the previous service year where 90.5% were completed in 5 days with the remainder being reported in 16 days.

To ensure that all relevant correspondence and imaging from the referring centre has been transferred to the NMO service, a figure of 8 weeks from receiving referral to assessing the patient was agreed. From April 2011 to March 2012 patients were seen on average in 51 days (7.2 weeks) from receiving a referral.

Annualised relapse rate

Of the 106 patients that have been seen since the clinical service was commissioned, 60 patients have NMO or NMOSD, the majority of which are antibody positive. To ensure accuracy, patients without this diagnosis (e.g. monophasic diseases or MS) were not included in this analysis.

The annualised relapse rate was 1.7 relapses pre-service and 0.2 relapses post service. This corresponds to a decrease in the relapse rate of 88.3%. Please see the graph below.



Graph showing relapse rate (annualised) pre service vs. post service

This significant reduction could be mostly due to:

- Reaching a correct diagnosis.
- Ensuring that the treatment is the most appropriate.
- Providing patient education to increase compliance with treatments and prevention of associated complications.
- Facilitating good communication links between the service, patient, GP and other healthcare professionals.

This reduction in relapse rate is very encouraging considering the service tends to see the most severely affected patients for long term follow up and the relapse rates may rise in the future due to rationing of the service.

Mortality rate

Since the service commenced in April 2010, no patients seen within the service have died. A meeting is planned between Oxford and Liverpool NMO services to discuss mortality and morbidity in NMO patients.

Patient feedback

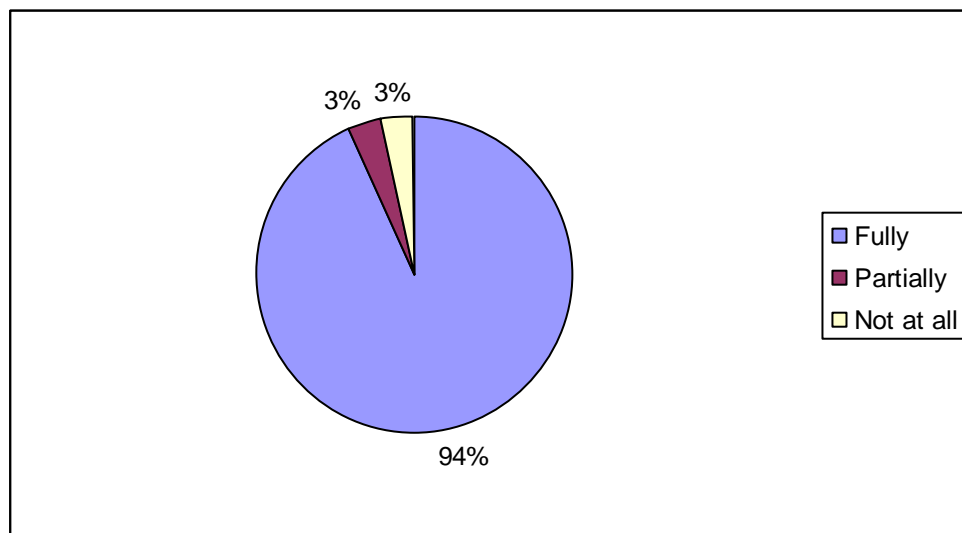
The service should be geared towards the needs of the patients and should be sensitive to any suggestions or complaints that are made. To ensure that patients feel they are free to speak freely, they are provided with anonymous questionnaires which focus on their experiences from receiving an appointment through to being seen. This also looks at any remote contact (emails, phone calls) that the patient may have had.

Only the section asking “Was Neuromyelitis Optica (NMO) as a disease fully explained to you in a way you were able to understand?” highlighted a >20% unsatisfactory response rate. This may be explained by the fact that over 30 % of patients visiting the clinic do not have NMO. Therefore, the wording of the questionnaire will be changed for this year.

Between Apr 2011 – Mar 12

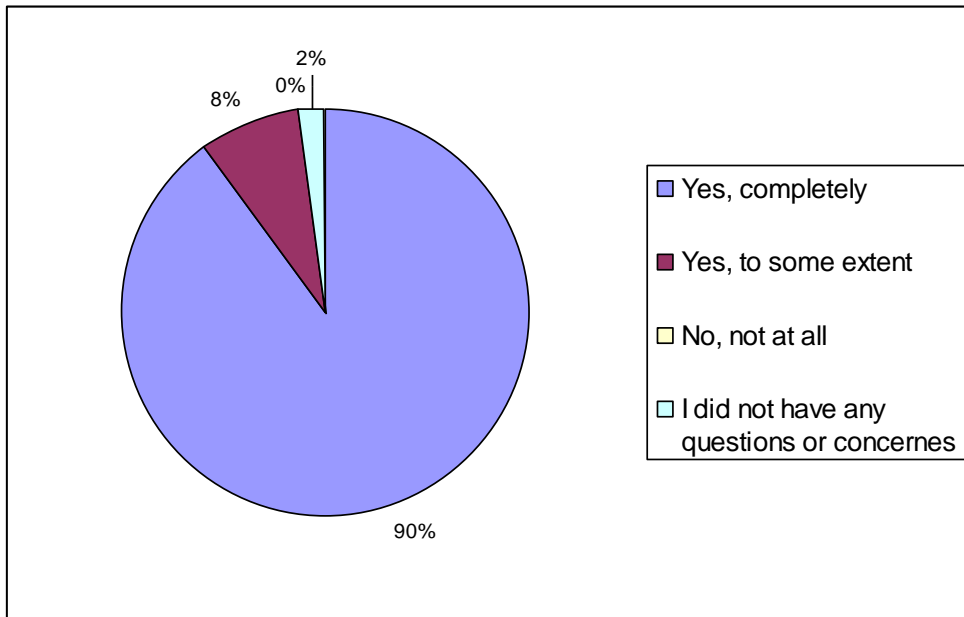
Remote access

Q) How did you feel your remote (phone/telephone/letter) query was dealt with?



Clinic Experience

Q) Did you feel that the clinical team listened to your concerns or questions?

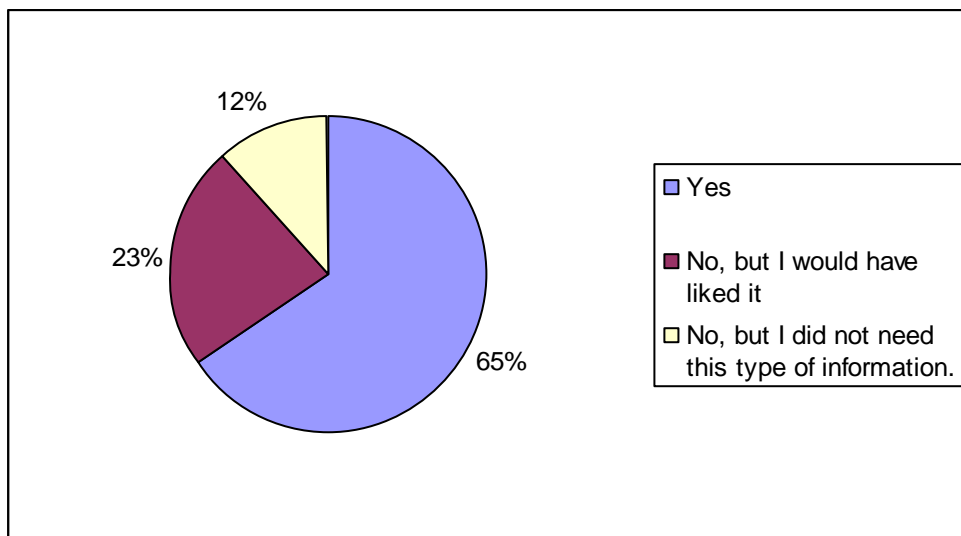


Patient Information

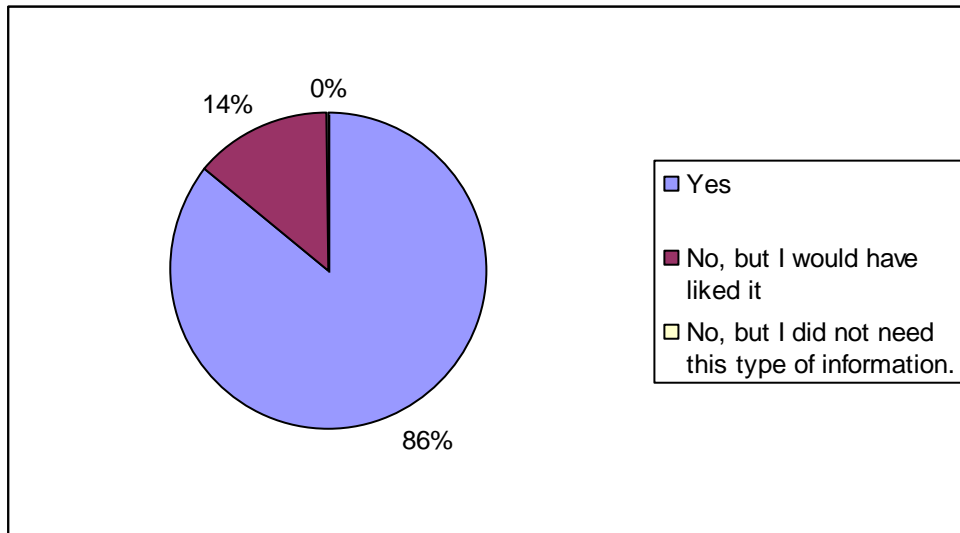
An area which required improvement was written information for patients. With the aid of a generous QIDIS grant, the service was able to produce 4 booklets covering all aspects of what NMO is and how patients can manage their condition. These were released at the end of March 12. Below is a comparison of the questionnaire responses before and after the booklets were released.

Q) Were you given any written or printed information about your condition or treatment?

Apr 11 – Mar 12



Apr 12 – Aug 12



Potential explanations for the 14% of patients who came to clinic after the booklets became available but didn't receive written information could include:

- The patient had a disease other than NMO and the booklets were not appropriate.
- The patient was visually impaired (these booklets will be available in audio format in the near future).

Geographical access to service

As a national service for NMO, Oxford aims offer equal access to the diagnostic and management expertise at the centre to patients from across the south of England. However, many patients cite transport costs as a limiting factor in their decision to attend clinic in Oxford. In cases where the patients are physically unable to attend outpatient clinic remote advice is offered to their local clinician regarding their diagnosis and management. **Figure 5** details the new referral distribution across regional geographical areas.

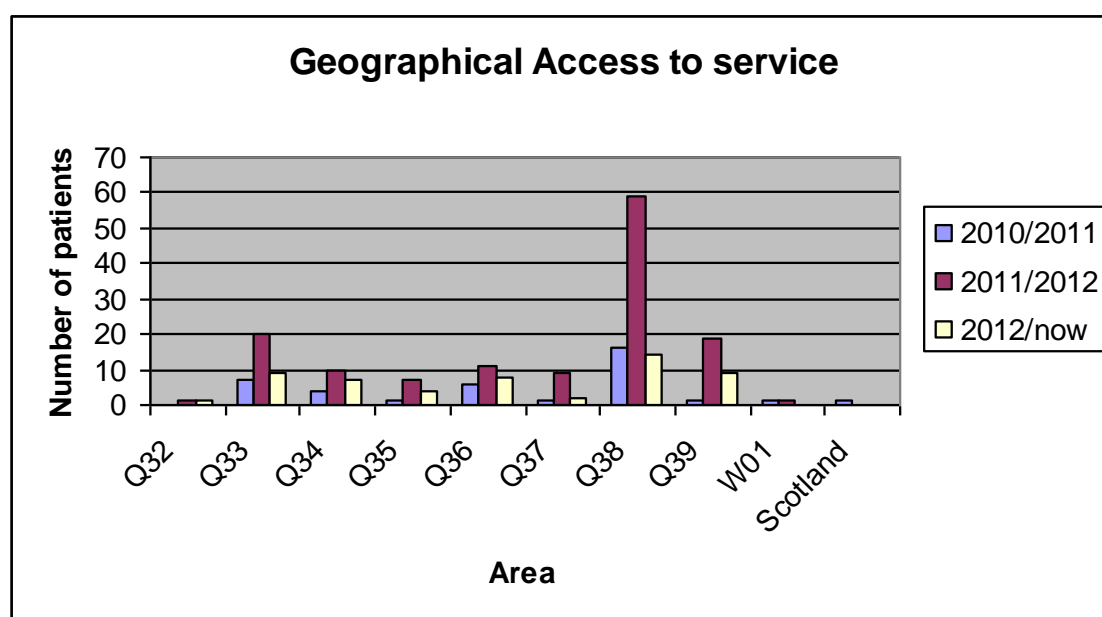


Figure 5. New Referral demographic figures for 2010-11, 2011-12 and 2012-13 (at time of report).

Speed of access to clinic

To ensure that all relevant correspondence and imaging from the referring centre has been transferred to the NMO service, a figure of 8 weeks from receiving referral to assessing the patient was agreed. From April 2011 to March 2012 patients were seen on average in 51 days (7.2 weeks) from receiving a referral.

3. Financial Update

To be presented by the ORH Financial team lead by Ann Gilbert, NTSS – Assistant Business Partner, Oxford.

4. Service Developments

An important part of developing a truly national service is closely linking with our sister NMO team in Liverpool. This is done through a combination of face to face meetings, teleconferences and jointly hosting and attending conferences relevant to the field of NMO. At these meetings, collaboration can

be fostered in a supported environment to ensure continual developments in standardised care and evidence based practice for NMO patients.

Joint/Outreach Clinics

The second joint clinic was held earlier this year with Dr Cheryl Hemmingway at Great Ormond Street Hospital (GOSH), members of the National NMO Service and paediatric neurologists with an interest in NMO.

A joint clinic was held in Southampton earlier this year with Dr Christopher Halfpenny at the Southampton General Hospital and members of the National NMO Service. This is hoped to be repeated in the future.

This concept of “outreach” clinics is set to continue, with a therapist and nurse outreach clinic at Plymouth Hospital planned for later in the year. This link allows good practice to be shared between the centres, as well as adding to the team’s expertise, and the aim is to use this to aid the development of national standards of care for NMO.

Addition of therapy support

The service was lucky enough to have the services of Kate Browne, a Physiotherapist (PT) with experience in many clinical areas. Kate runs the joint PT, OT and Nursing clinic with Kay Day and Jon Revis, where all patients are seen after their neurology appointment. Kate provides advice in mobility and independence for NMO patients and has been invaluable for clinic experience.

QIDIS

Both specialist centres have worked together in the development of written and web based patient info, which has been very well received.

The Oxford outpatient experience improvement scheme

This involves developing a document library in outpatients for the use of patients who come to clinic. Our OT, Kay Day, has spent the past few months collecting the relevant patient info sheets from external support groups and charities and other relevant HCP’s. This will be presented using mobile leaflet trolleys that can create a separate area for NMO patients in outpatients.

Optic neuritis in neuromyelitis optica spectrum disorders.

This QIDIS multicentre project was lead by the Oxford national centre - Department of Neurology and Eye Hospital. The aim was to identify specific features of ON in NMOSD to facilitate early diagnosis and treatment of this condition and reduce severe visual impairment.

Dr J George clinical fellow working in the team reviewed retrospectively the clinical notes of patients with a confirmed diagnosis of NMOSD with optic neuritis (63 patients with at least one attack of ON) and (1) evaluated the presentation of ON, including clinical manifestations and, where available neuro-ophthalmological signs; (2) compared those data with those of other

patients with ON associated with MS (71 cases); (3) analysed the data collated including the demographics, clinical features and the time from the first manifestation of ON to the diagnosis of NMOSD (see supplementary information sheet).

Dr J George and Dr M I Leite prepared relevant information, advice & guidelines to ophthalmologists and other clinicians, to raise awareness of the condition. This information is now being published in the UKNMO website and is next being published in a neuro-ophthalmology journal (see same appendix)..

A final protocol for the investigation & appropriate referral of suspected NMOSD associated ON has also been prepared and is under revision by Mr Elston.

The NMO clinical Dashboard has been designed to give up to date reports on certain outcomes within the service. This project is outlined in.

5. Service Engagement and Communication

Expertise in NMO is developed by seeing as many patients in our catchment area as possible. It is imperative to share the experiences and observations that are made on this cohort not only with service users, but also referring clinicians, healthcare professionals and researchers interested in NMO. As NMO is a rare condition, the upmost effort has been made to promote knowledge of NMO and the service provided to healthcare professionals who may come into contact with a patient who may have NMO.

This engagement is carried out in a number of ways

NMO service positive patient follow up questionnaires

The NMO assay service has sent out information to all UK Immunology departments explaining the availability of the AQP4 assay, emphasizing it being free of charge in England and Scotland. In addition a new simplified questionnaire form has been sent to all UK Immunology departments requesting clinical information is sent on all samples received for AQP4 testing. All positive AQP4 samples received from England and Scotland are followed up with a questionnaire to the referring clinician (if not received with the sample initially), to audit the quality of the assay (to confirm the sensitivity and specificity) and for clinicians to gain more clinical information to understand the full spectrum of the disease.

To date, 255 questionnaires have been sent out requesting clinical information on the new AQP4 positive patients identified in the NMO assay service for England and Scotland. **Table 4** shows a return rate of 35% for the service period April 2010 to March 2011, increasing to 41% for the period April 2011 to March 2012. The data was analysed for time to diagnosis (date of onset to date of first antibody assay), which showed a mean of 3.1 years (0.04 – 17.6 years).

Table 4. Summary of questionnaires sent to new AQP4 positive patients identified in the NMO assay service from April 2010 to August 2012.

Period: April 2010-March 2011	
Number of questionnaires sent on new AQP4 positive patients	113
Number of questionnaires received:	40
% of questionnaires returned	35.40%

Period: April 2011-March 2012	
Number of questionnaires sent on new AQP4 positive patients	117
Number of questionnaires received:	48
% of questionnaires returned	41.03%

Period: April 2012- August 2012	
Number of questionnaires sent on new AQP4 positive patients	25
Number of questionnaires received:	14
% of questionnaires returned	56.00%

Research Developments

In the past 12 months the NMO team (both clinical and laboratory teams) have demonstrated that the assays used in the UK are the most sensitive assays available (Waters *et al* 2012) and they remain highly specific. Although not in routine use the Laboratory team have also used quantitative flow cytometry (FACS) on transiently transfected HEK cells to confirm low positive results in a quantitative manner every few months. However, there are still patients classified as NMO by clinical criteria that are AQP4 antibody negative. In order to further examine this group of patients the Laboratory team have set up an assay to detect antibodies against myelin oligodendrocyte glycoprotein (MOG) as others groups had previously shown that patients with similar inflammatory diseases have these antibodies transiently. The NMO team thought that this would be important to determine if any of the patients diagnosed as NMO had another antibody that could exclude a diagnosis of NMO and perhaps indicates a milder disease requiring less severe treatment. The NMO team identified 4 patients out of 27 diagnosed as NMO or NMOSD who were positive for MOG antibodies (Kitley *et al* Neurology 2012). The Laboratory team are continuing to improve this assay and use it routinely to identify new patients in order to gain a better understanding of them clinically.

Meetings/Conferences

NMO Patient information day, March 2012

To follow on from last years patient information day in Birmingham, the Oxford and Liverpool NMO services jointly organised a full day of talks and interactive sessions for patients, friend and families of those affected by NMO. Although the majority of attendees were known to the 2 services, a few patients and families who were unknown also came along, after seeing advertising on the MS society, and other websites. This led to new referrals to the NMO service at the John Radcliffe Hospital.

People attending were encouraged to network, which led to patients setting up support groups on social sites, such as Facebook as well as a section on the NMO UK website for web forums and local support groups.

3rd Guthy-Jackson Conference, Los Angeles, USA, November 2011

Members of the UK NMO service attended and Prof. Vincent presented “an international perspective” of NMO on behalf of the UK.

3rd Guthy-Jackson patient and carer day, Los Angeles, USA, November 2011

Dr Palace and Dr Leite were involved in a specialist panel for a question and answer session and Dr Palace also ran group workshops at this meeting.

UKMSSNA (UK MS Specialist Nurse Association) regional meetings

The NMO specialist nurses in Liverpool and Oxford have kept a strong link with the MS Nurse Association, MS Trust and MS Society

Presentation to Welsh MS nurses and Neuro nurses, July 12

Jon Revis, NMO nurse, spent a morning with a large group of Welsh MS specialists, going through areas such as diagnosis, symptoms and how to support patients with NMO.

NMO patient and healthcare professional information

Written information

In line with funding from QIDIS, the UK NMO service has created four comprehensive patient information booklets, which have been available since the beginning of March 2012. The four booklets are titled:

- Neuromyelitis Optica – A guide to the condition,
- Living with NMO – Independence in daily life,
- Living with NMO – Movement, mobility and travel
- Living with NMO – Work and money.

These booklets are also available in PDF format and soon to be in audio format.

NMO scientific/medical publications and presentations

One of the best ways to inform other healthcare providers about work going on within the field of NMO is to publish journal articles. These articles often form the basis of a presentation to other HCP and scientists at various meetings.

Web based information

To ensure information is available on as many mediums as possible, The NMO Service has developed a website designed mainly for patients, but with sections for healthcare professionals. This website will hold PDF copies as well as audio files of all written info, up to date news and information about relevant events, trials and research updates as well as an area for patients to use as a forum. It has been set up in association with the RNIB to ensure easy access for all.

This website is hosted by The Walton Centre NMO Team.

6. Future Development Plans

Paediatric relapse treatment trial

Dr Jacob, alongside a group of paediatric neurologists has applied for funding to set up a study looking at the best management for relapses. This will compare a standard treatment (IV Steroids) against a dual therapy approach (IV steroids + IVIg).

Relapse prevention trial

Dr Palace has been closely liaising with pharmaceutical companies interested in relapse prevention; however a study would need to be organised at international level to ensure reliability.

Quality, improvement, development and initiative scheme (QIDIS)

The clinical team are using QIDIS funding to develop a bespoke database for the NMO service. This will act as a hub to collect patient info and will be an essential tool to streamline data collection, to improve patient outcomes and also to recruit for research projects. This will be a major step forward for the team.

Service promotion/healthcare professional education

Annual ABN Meeting, October 2012

Members of both clinical and laboratory teams are presenting research, clinical observations and posters relevant to NMO.

Annual MS Trust Meeting, November 2012

Both Liverpool and Oxford NMO Nurses will be presenting on the differences between NMO and MS to an audience of Neurologists, Nurse Specialists and specialist MS Therapists.

7. Publications

Detrimental role of granulocyte-colony stimulating factor in neuromyelitis optica: clinical case and histological evidence.

Jacob A, Saadoun S, Kitley J, Leite MI, Palace J, Schon F, Papadopoulos MC.. *Mult Scler.* 2012 Aug 15. [Epub ahead of print] PubMed PMID: 22495946.

A practical guide to the treatment of neuromyelitis optica

Palace J, Leite I, Jacob A.. *Pract Neurol.* 2012 Aug;12(4):209-14. PubMed PMID: 22869762.

[*Prognostic factors and disease course in aquaporin-4 antibody-positive patients with neuromyelitis optica spectrum disorder from the United Kingdom and Japan.*](#)

Kitley J, Leite MI, Nakashima I, Waters P, McNeillis B, Brown R, Takai Y, Takahashi T, Misu T, Elson L, Woodhall M, George J, Boggild M, Vincent A, Jacob A, Fujihara K, Palace J. *Brain*. 2012 Jun;135(Pt 6):1834-49. Epub 2012 May 9.

[*Myasthenia gravis and neuromyelitis optica spectrum disorder: a multicenter study of 16 patients.*](#)

Leite MI, Coutinho E, Lana-Peixoto M, Apostolos S, Waters P, Sato D, Melamud L, Marta M, Graham A, Spillane J, Villa AM, Callegaro D, Santos E, da Silva AM, Jarius S, Howard R, Nakashima I, Giovannoni G, Buckley C, Hilton-Jones D, Vincent A, Palace J. *Neurology*. 2012 May 15;78(20):1601-7. Epub 2012 May 2.

[*Neutrophil protease inhibition reduces neuromyelitis optica-immunoglobulin G-induced damage in mouse brain.*](#)

Saadoun S, Waters P, MacDonald C, Bell BA, Vincent A, Verkman AS, Papadopoulos MC. *Ann Neurol*. 2012 Mar;71(3):323-33. doi: 10.1002/ana.22686. Epub 2012 Feb 28.

[*Reduced serum uric acid levels in neuromyelitis optica: serum uric acid levels are reduced during relapses in NMO.*](#)

Min JH, Waters P, Vincent A, Lee S, Y Shin H, H Lee K, Kim BJ. *Acta Neurol Scand*. 2012 Feb 6. doi: 10.1111/j.1600-0404.2012.01643.x. [Epub ahead of print]

[*Serologic diagnosis of NMO: a multicenter comparison of aquaporin-4-IgG assays.*](#)

Waters PJ, McKeon A, Leite MI, Rajasekharan S, Lennon VA, Villalobos A, Palace J, Mandrekar JN, Vincent A, Bar-Or A, Pittock SJ. *Neurology*. 2012 Feb 28;78(9):665-71; discussion 669. Epub 2012 Feb 1.

[*Glycine receptor antibodies are detected in progressive encephalomyelitis with rigidity and myoclonus \(PERM\) but not in saccadic oscillations.*](#)

Iizuka T, Leite MI, Lang B, Waters P, Urano Y, Miyakawa S, Hamada J, Sakai F, Mochizuki H, Vincent A. *J Neurol*. 2012 Aug;259(8):1566-73. Epub 2012 Jan 4.

[*Autoantibodies associated with diseases of the CNS: new developments and future challenges.*](#)

Vincent A, Bien CG, Irani SR, Waters P. *Lancet Neurol*. 2011 Aug;10(8):759-72. Review.

[*Cerebrospinal fluid/serum gradient of IgG is associated with disability at acute attacks of neuromyelitis optica.*](#)

Kim SM, Waters P, Vincent A, Go MJ, Park KS, Sung JJ, Lee KW. *J Neurol*. 2011 Dec;258(12):2176-80. Epub 2011 May 19.

[*T cell deficiency does not reduce lesions in mice produced by intracerebral injection of NMO-IgG and complement.*](#)

Saadoun S, Waters P, Macdonald C, Bridges LR, Bell BA, Vincent A, Verkman AS, Papadopoulos MC. *J Neuroimmunol*. 2011 Jun;235(1-2):27-32. Epub 2011 Apr 13.

[Antiglycine-receptor encephalomyelitis with rigidity.](#)

Mas N, Saiz A, Leite MI, Waters P, Baron M, Castaño D, Sabater L, Vincent A, Graus F. J Neurol Neurosurg Psychiatry. 2011 Dec;82(12):1399-401. Epub 2010 Dec 10.

Reduced EDSS progression in multiple sclerosis patients treated with modafinil for three years or more compared to matched untreated subjects
Bibani R, Tench C, George J, Manouchehrinia A, Palace J, Constantinescu C. Multiple Sclerosis and Related Disorders 1 July 2012;vol1(issue 3):131-135

Myelin-oligodendrocyte glycoprotein antibodies in adults with a neuromyelitis optica phenotype. Kitley J, Woodhall M, Waters P, Leite MI, Devenney E, Craig J, Palace J, Vincent A.. Neurology. 2012 Aug 22. [Epub ahead of print] PubMed PMID: 22914827.

Presence and pathogenic relevance of antibodies to clustered acetylcholine receptor in ocular and generalized myasthenia gravis.

Jacob S, Viegas S, Leite MI, Webster R, Cossins J, Kennett R, Hilton-Jones D, Morgan BP, Vincent A. Arch Neurol. 2012 Aug 1;69(8):994-1001. PubMed PMID: 22689047.

Prognostic factors and disease course in aquaporin-4 antibody-positive patients with neuromyelitis optica spectrum disorder from the United Kingdom and Japan.

Kitley J, Leite MI, Nakashima I, Waters P, McNeillis B, Brown R, Takai Y, Takahashi T, Misu T, Elson L, Woodhall M, George J, Boggild M, Vincent A, Jacob, A, Fujihara K, Palace J. Brain. 2012 Jun;135(Pt 6):1834-49. Epub 2012 May 9. PubMed PMID: 22577216.

Myasthenia gravis and neuromyelitis optica spectrum disorder: a multicenter study of 16 patients

Leite MI, Coutinho E, Lana-Peixoto M, Apostolos S, Waters P, Sato D, Melamud L, Marta M, Graham A, Spillane J, Villa AM, Callegaro D, Santos E, da Silva AM, Jarius S, Howard R, Nakashima I, Giovannoni G, Buckley C, Hilton-Jones D, Vincent A, Palace J. Neurology. 2012 May 15;78(20):1601-7. Epub 2012 May 2. PubMed PMID: 22551731; PubMed Central PMCID: PMC3348852.

Influence of pregnancy on neuromyelitis optica spectrum disorder

Kim W, Kim SH, Nakashima I, Takai Y, Fujihara K, Leite MI, Kitley J, Palace J, Santos E, Coutinho E, Silva AM, Kim BJ, Kim BJ, Ahn SW, Kim HJ.. Neurology. 2012 Apr 17;78(16):1264-7. Epub 2012 Apr 4. PubMed PMID: 22491862.

Serologic diagnosis of NMO: a multicenter comparison of aquaporin-4-IgG

assays Waters PJ, McKeon A, Leite MI, Rajasekharan S, Lennon VA, Villalobos A, Palace J, Mandrekar JN, Vincent A, Bar-Or A, Pittock SJ. Neurology. 2012 Feb 28;78(9):665-71; discussion 669. Epub 2012 Feb 1. PubMed PMID: 22302543; PubMed Central PMCID: PMC3286228.

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