Institution: Newcastle University

Unit of Assessment: UoA-1

Title of case study: Improving the quality and length of the lives of Duchenne muscular dystrophy patients through the application of multidisciplinary care

1. Summary of the impact

In the 1960s boys with Duchenne muscular dystrophy would die at around the age of 14 to 15 years; by the 1990s survival had risen to around 19 years. Young men with this condition can now live to around 30 years of age. This significant improvement is possible where patient management involving coordinated multidisciplinary care is implemented. Such an approach was developed as a result of research and clinical practice pioneered by the Newcastle Muscle Group. Guidelines for the care of patients with Duchenne muscular dystrophy, published in 2010, were developed by an international working group led by Professor Kate Bushby of Newcastle University. These guidelines achieved NICE process accreditation in the UK and have been adopted globally as the definition of best practice.

2. Underpinning research

Key researchers

The research was led by Professor Kate Bushby, in collaboration with: Professor Volker Straub, co-PI on TREAT-NMD; and Professor Hanns Lochmuller, co-investigator on TREAT-NMD and CARE-NMD.

Background

Duchenne muscular dystrophy (DMD) is a rare inherited disorder that affects only boys. The incidence is 1 in 3,500 live male births. Prevalence data (Orphanet) suggests that around 1,500 boys/young men are living with the condition in the UK. Without intervention, affected boys will lose the ability to walk by the age of 13 years, develop severe postural problems and respiratory and cardiac failure, leading to an average age at death of 19 years.

Research

While there is no cure for DMD, it was recognised by the Newcastle Muscle Group that patients treated in the North East of England were surviving better (longer and with higher quality of life) than was reported elsewhere in the UK and abroad. This was the impetus to establish and publish evidence for this observation, and then for the group to ascertain, implement and evaluate best practice recommendations in a systematic way to promote care worldwide.

A retrospective study (R1) reviewed the treatment and management of DMD in Newcastle between 1967 and 2002. In the 1960s, age at death averaged 14.4 years and by 1990 this had risen to 19 years. This research was the first to demonstrate the significant positive impact of home nocturnal ventilation (mechanical help with breathing during sleep) on survival of patients in the care of the Newcastle Muscle Group, at a time when few centres worldwide offered this support. By 2002 survival was 25 years in ventilated patients. In 2007 a study of long-term data (R2) revealed further improvements in survival following the inclusion of spinal surgery within a comprehensive multidisciplinary approach, with average survival age in Newcastle now 30 years.

In 2008, Professor Bushby was selected by her peers to manage a large scale international research project, the 'Duchenne Muscular Dystrophy Care Considerations Working Group', funded and supported by the USA's *Centers for Disease Control and Prevention* to develop care recommendations for this condition. The research effort involved evaluation of the assessment and interventions used worldwide in the management of a wide range of aspects of DMD. The results of this study were presented in two Lancet Neurology papers (R3, R4). These articles provide a framework for: (i) recognising the multisystem primary manifestations of DMD and the secondary complications that can arise; and (ii) the positive benefits of providing coordinated multidisciplinary care to those boys affected.

3. References to the research

(Citation counts from Scopus at July13, Newcastle authors in bold.)

R1. **Eagle M, Baudouin SV, Chandler C, Giddings DR, Bullock R, Bushby K**. Survival in Duchenne muscular dystrophy: improvements in life expectancy since 1967 and the impact of home nocturnal ventilation. *Neuromuscul Disord*. 2002 Dec;12(10):926-9. doi**:** 10.1016/S0960-8966(02)00140-2. **Cited by 257**

R2. **Eagle M, Bourke J, Bullock R, Gibson M, Mehta J,** Giddings D, **Straub V, Bushby K.** Managing Duchenne muscular dystrophy--the additive effect of spinal surgery and home nocturnal ventilation in improving survival. *Neuromuscul Disord*. 2007 Jun;17(6):470-5. doi**:** 10.1016/j.nmd.2007.03.002. **Cited by 65**

R3. **Bushby K**, Finkel R, Birnkrant DJ, Case LE, Clemens PR, Cripe L, Kaul A, Kinnett K, McDonald C, Pandya S, Poysky J, Shapiro F, Tomezsko J, Constantin C; DMD Care Considerations Working Group. Diagnosis and management of Duchenne muscular dystrophy, part 1: diagnosis, and pharmacological and psychosocial management. *Lancet Neurol*. 2010 Jan;9(1):77-93. doi: 10.1016/S1474-4422(09)70271-6. **Cited by 178**

R4. **Bushby K**, Finkel R, Birnkrant DJ, Case LE, Clemens PR, Cripe L, Kaul A, Kinnett K, McDonald C, Pandya S, Poysky J, Shapiro F, Tomezsko J, Constantin C; DMD Care Considerations Working Group. Diagnosis and management of Duchenne muscular dystrophy, part 2: implementation of multidisciplinary care. *Lancet Neurol*. 2010 Feb;9(2):177-89. doi**:** 10.1016/S1474-4422(09)70272-8. **Cited by 102**

Researchers and funding.

Together with the key researchers named above, Drs Michelle Eagle, Elaine McColl, John Bourke and Rob Bullock also contributed significantly.

Funding came from public sources in the EU, USA and UK and charities, notably the Muscular Dystrophy Campaign.

The Newcastle Muscle Centre grant support 2008-2011 in total was £339,421.

4. Details of the impact

Multidisciplinary care

The guidelines for care of DMD-affected individuals produced in 2010 by the group led by Bushby and published in Lancet Neurology (hereafter the Guidelines), describe best practice for multidisciplinary care that has become the expected standard for these patients globally.

Since DMD affects a number of body systems, coordination of clinical care is a crucial component of best practice for the management of DMD. This is best provided in a multidisciplinary care setting in which the DMD-affected individual and their family can access the range of expertise needed for the multisystem management of DMD. The expertise required falls into eight categories and the focus of the system is the patient.

1. Diagnostics. Including Genetic testing and muscle biopsy and interventions such as genetic counselling and family support.
2. Rehabilitation management. Assessments of strength, posture etc and interventions such as providing adaptive equipment and physiotherapy.
3. Orthopaedic management. Various assessments are conducted and interventions such as tendon surgery and posterior spinal fusion offered.
4. Psychosocial management. Assessments of speech and language and how the patient and family are coping are made and interventions can include psychotherapy and other supportive care.
5. Cardiac management. Monitoring the heart is important and standard medical interventions are offered as appropriate.
6. Pulmonary management. Monitoring lung function is another key tool in multisystem

management and interventions such as home nocturnal ventilation have been shown to have significant benefit.

7. Gastrointestinal, speech/swallowing, nutrition. Upper and lower GI investigations are conducted and medical or surgical interventions offered as necessary.
8. Corticosteroid management. The patient's age, stage of disease and risk factors for side-effects are considered and affect the choice of drug regimen.

(For more detail see R3, page 79.)

Influencing public debate, policy and practice

In 2009, while the DMD Care Considerations Working Group research was ongoing, Newcastle researchers gave evidence to the UK All Party Parliamentary Group for Muscular Dystrophy. The subsequent *Walton Report* stated: '*We praise the work of the Newcastle Muscle Centre, which well deserves its international reputation for excellence in all aspects of research, diagnosis, care and support for children and adults with neuromuscular conditions*' (Ev a, p48). The report also notes;

> *'…the clinical audit data from the South West region which show the mean age of death at 19 years of age for patients with Duchenne Muscular Dystrophy compares starkly with published survival data showing the average of death for similar patients in the North East region has reached 30 years of age … In any decent, civilised society these variances are unacceptable and we cite them here as evidence of service failures that must be addressed with the utmost urgency.'* (Ev a, p11).

In evidence to the All Party Parliamentary Group, representatives from a number of health authorities, including the South West of England, noted that they were conducting reviews of their services (Ev a, p47-51).

In 2011, the robustness of the guidelines on multidisciplinary care was accredited for the NHS by NICE (Ev b), resulting in the first such accredited guidelines for neuromuscular diseases and, indeed, for rare diseases in general. The guidelines are thus established in the UK, until at least 2016, as the standard of care required for patients with DMD.

National and international implementation of care guidelines

UK regions outside the North East of England are implementing the multidisciplinary care approach, following reviews of services. In Northern Ireland the Guidelines have been implemented through the combined efforts of a parent-activist and a paediatric consultant following visits to Newcastle. The Guidelines formed the basis of a case made to the Northern Irish Assembly seeking improved investment in care for patients with neuromuscular disease. The parent-activist has stated that the Guidelines '*greatly strengthened the case we presented*'. The care network in Northern Ireland has subsequently grown to a multidisciplinary team (Ev c).

The wider reach of the guidelines is under active examination. The European Commission Executive Agency for Health and Consumers funded a large multinational project, CARE-NMD, to study the implementation of the Guidelines throughout the UK and in Denmark, Germany, Czech Republic, Bulgaria, Poland and Hungary. Interim findings from CARE-NMD show that boys attending the centres of expertise in each nation, (i) have greater access to services due to the implementation of the Guidelines within the centres and (ii) report greater satisfaction with their treatment (Ev d). The Guidelines have been summarised and made available to American clinicians via the *National Guideline Clearinghouse* of the US Department for Health and Human Services (Ev e). The *Centers for Disease Control and Prevention* have recently funded a study, led by the University of Rochester Medical Center, New York State, to examine the implementation of the Guidelines in the USA and will begin data collection in late 2013.

In Southern India, a service based on the Guidelines was established in 2011, with Bushby's help. The Director of the Molecular Diagnostics, Counseling, Care & Research Centre, Coimbatore has described how the Newcastle approach to multidisciplinary care was implemented, saying; *'The Lancet Guidelines have stood as the basic framework on which we have based our assessments and recommendations… and the confidence we give* [parents] *that whatever is available internationally we offer our kids is a great sense of relief* [for them]*'* (Ev f). The implementation of

DMD care in Australia is also based on the Guidelines (Ev g).

Helping professionals, patients and their carers

The CARE-NMD website includes open access to a 'training toolkit', developed in 2011 from the Guidelines by the Newcastle team, and colleagues, for the benefit of the neuromuscular community and wider public (Ev e).

The EU-funded Network of Excellence projects, TREAT-NMD (Chair: Lochmuller) and CARE-NMD, within which the Newcastle Muscle Group lead implementation in the UK, in 2011 produced an English language family-friendly version of the Guidelines entitled *'A Guide for Families'* in collaboration with patient groups. The source file has been distributed to organisations around the world, such as the US Centers for Disease Control and Prevention, for further dissemination and translations have been produced by recipients. By 2013 it had been translated into 26 other languages covering developed and developing nations (Ev h). These are available on the TREAT-NMD and CARE-NMD websites and have been downloaded over 3000 times (Ev i). Physical copies are printed locally where required and so there is scant data on distribution, though it has been reported that around 5,000 Japanese language guides have been printed and distributed throughout Japan (Ev i). The guide has also been disseminated by national and international patient groups. The Vice President of the American organization Parent Project Muscular Dystrophy has provided evidence that the guide has been viewed or downloaded 4865 times since 2011. They have also mailed 869 copies to individuals and have provided 750 copies of the document to clinics since 2010 (Ev j).

5. Sources to corroborate the impact

Ev a. The Walton report is available online at:
http://www.specialisedservices.nhs.uk/document/access-to-specialist-neuromuscular-care-walton-report-2009/search:true

Ev b. The listing for the accreditation is available online, guidance is titled "Duchenne Muscular Dystrophy Working Group - diagnosis and management of duchenne muscular dystrophy"

http://www.nice.org.uk/aboutnice/accreditation/AccreditationDecisions.jsp

A pdf document of the final accreditation report is available from this link or on request.

Ev c. Correspondence is available from the parent/activist (who is also a GP), which details the impact the Newcastle Muscle Team and the Guidelines for care have had in developing the service offered to Duchenne muscular dystrophy patients and their families in Northern Ireland.

Ev d. The CARE NMD project is ongoing and the PI has agreed to be contacted to discuss the interim findings on the implementation of the multidisciplinary approach to DMD care in Europe.

Ev e. The summary for clinicians is available at the following URL and the Guidelines (R3 & R4) are the first two entries listed in a general search for DMD.
http://www.guideline.gov/search/search.aspx?term=duchenne+muscular+dystrophy

Ev f. Correspondence from the Director, Molecular Diagnostics, Counseling, Care & Research Centre, Coimbatore, India is available and contact details can be made available on request.

Ev g. For examples, see the Australian Neuromuscular Network: http://www.ann.org.au/duchenne-muscular-dystrophy/. The Guidelines also featured in Australian Neuromuscular Network newsletters (300 members).

Ev h. The CARE-NMD project website is: http://en.care-nmd.eu/. The 'training toolkit' is available by clicking the 'Resources' tab and the Family Guide and a full list of the languages in which it is available can be found at http://en.care-nmd.eu/international/family-guide/

Ev i. The TREAT-NMD Web Development Officer is able to corroborate the number of downloads. Contact details available on request.

Ev j. Contact details for the vice president of the patient organisation Parent Project Muscular Dystrophy in the USA are available on request.