UK Press Release Only

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BIOGEN'S SPINRAZA® (NUSINERSEN) RECEIVES RECOMMENDATION FROM NICE FOR THE TREATMENT OF INFANTS, CHILDREN AND ADULTS WITH 5q SPINAL MUSCULAR ATROPHY

Maidenhead, UK – May 15, 2019 – The National Institute for Health and Care Excellence (NICE) has recommended funding for Spinraza (nusinersen) on the National Health Service (NHS). The positive recommendation, subject to a five-year managed access agreement (MAA), is for the treatment of infants, children and adults with 5q spinal muscular atrophy (SMA), including pre-symptomatic and SMA types I, II and III. SMA is a rare, debilitating and life-threatening disease that results in severe progressive muscular atrophy and weakness.[1]

Terry O'Regan, Vice President and Managing Director of Biogen UK and Ireland, said:

"The NICE recommendation of nusinersen for infants, children, and adults with 5q SMA, including pre-symptomatic, SMA types I, II and III, is a momentous occasion for patients and their families who have fought tirelessly for access to this life-changing medicine. This positive outcome has been achieved through intensive and collaborative working between the SMA community, NICE, NHS England, and Biogen. We will continue to work with health authorities to ensure this welcome decision translates into access as soon as possible for those awaiting treatment, which includes providing NHS England with access to nusinersen for type I patients immediately."

NICE's evaluation of nusinersen was based on the largest body of clinical evidence currently available across all types of SMA, with six years of data including more than 300 patients treated with pre-symptomatic, infantile (type I) and later-onset (types II and III) SMA.[2] To date, more than 7,500 patients worldwide have been treated with nusinersen, from infants to adults.[2]

The decision builds on Biogen's commitment to f ind solutions to provide broad access to innovative therapies through collaborating closely with governments and communities around the world on new business models. In Europe, a key component of that work is Biogen's portfolio of biosimilars — cost-saving biologic medicines that are similar to currently available biologic therapies known as originators. Biosimilar products are strategically important in creating scope in healthcare budgets for patients to access innovative medicines, as Biogen works with payers and health systems globally to achieve this goal. In Europe, approximately 145,000 patients have been treated with a Biogen

biosimilar and, based on internal estimates, Biogen expects the uptake to contribute an estimated healthcare savings of up to 1.8 billion Euros in 2019.[2]

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About Spinraza® (nusinersen)
Spinraza (nusinersen) is licensed globally for the treatment of 5q SMA. Currently, patients in 24 European countries (and many more around the world) have access to nusinersen via regular reimbursement, with most countries making nusinersen available to treat a broad range of patients.[3]

Nusinersen is an antisense oligonucleotide (ASO), using Ionis' proprietary antisense technology that is designed to treat SMA caused by mutations or deletions in the Survival Motor Neuron 1 (SMN1) gene located in chromosome 5q that leads to SMN protein deficiency. Nusinersen alters the splicing of SMN2 pre-mRNA in order to increase production of full-length SMN protein.[4] ASOs are short synthetic strings of nucleotides designed to selectively bind to target RNA and regulate gene expression. Through use of this technology, nusinersen has the potential to increase the amount of full-length SMN protein in individuals with SMA, which delivers therapies directly into the cerebrospinal fluid (CSF) around the spinal cord, where motor neurons degenerate in individuals with SMA due to insufficient levels of SMN protein.

Nusinersen must be administered via intrathecal injection, which delivers therapies directly to the cerebrospinal fluid (CSF) around the spinal cord,[5] where motor neurons degenerate in individuals with SMA due to insufficient levels of SMN protein.[6]

Following the assessment of nusinersen in patients affected by SMA, results from the ENDEAR end of study analysis indicate that some infants achieved motor milestones including full head control, ability to roll, sit, and stand.[5] Additionally, infants treated with nusinersen demonstrated a statistically significant reduction in the risk of death or permanent ventilation compared to sham.[5]

Nusinersen demonstrated a favourable benefit-risk profile. The most common adverse events were headache, vomiting and back pain, considered related to the lumbar puncture procedure. The incidence and severity of these events were consistent with events expected to occur with lumbar puncture. Thrombocytopenia and coagulation abnormalities, including acute severe thrombocytopenia, and renal toxicity have been observed after administration of some ASOs, however this was not demonstrated in the clinical trials of nusinersen. The primary route of elimination is expected via urinary excretion of nusinersen and its metabolites.[5] Adverse reactions and complications including serious infection, such as meningitis, may occur as part of performing the lumbar puncture procedure. Hydrocephalus, not related to meningitis or bleeding, has been reported in patients treated with nusinersen, however causality has not been demonstrated. [5]

More about Spinal Muscular Atrophy (SMA)
At any one time, it is thought that there are between 650 and 1,300 children and adults in the UK living with SMA (all types).[7]

Whilst type I SMA (infantile onset) develops in babies less than six months old and can typically lead to death within the first few years of life, type II appears in infants who are 7-18 months old.[8] Type III develops after 18 months of age and type IV begins in adulthood.[8]

About Biogen

At Biogen, our mission is clear: we are pioneers in neuroscience. Biogen discovers, develops and delivers worldwide innovative therapies for people living with serious neurological and neurodegenerative diseases as well as related therapeutic adjacencies. One of the world's first global biotechnology companies, Biogen was founded in 1978 by Charles Weissmann, Heinz Schaller, Kenneth Murray and Nobel Prize winners Walter Gilbert and Phillip Sharp. Today, Biogen has the leading portfolio of medicines to treat multiple sclerosis (MS) and is also focused on advancing research programmes in spinal muscular atrophy, advancing neuroscience research programmes in MS and neuroimmunology, Alzheimer's disease and dementia, movement disorders, neuromuscular disorders, acute neurology, neurocognitive disorders, pain and ophthalmology. Biogen is one of only a handful of companies with the deep scientific expertise needed to produce biosimilars of advanced biologics. To learn more, please visit: www.uk.biogen.com.

We routinely post information that may be important to investors on our website at www.biogen.com. To learn more, please visit www.biogen.com and follow us on social media – Twitter, LinkedIn, Facebook, YouTube.

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