

Organizing Multidisciplinary Care for Children with Neuromuscular Diseases

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The Academic Medical Center (AMC) Amsterdam, The Netherlands, recently opened a center for children with neuromuscular diseases. Neuromuscular diseases is the generic term for a broad set of disorders which impair the functioning of the muscles via muscle or nerve pathology. Most of the diseases are progressive in time, sometimes leading to an early death of the patient. Most neuromuscular diseases have no cure, so the goal of the treatment is to reduce symptoms, and increase both mobility and life expectancy. Children with neuromuscular diseases typically need care from various physicians and therapists. To drastically reduce the required number of hospital visits, and to improve the coordination of care, the AMC decided to cluster the expertise of these care providers each several weeks in the ‘Children’s Muscle Center Amsterdam’ (CMCA). This paper describes how Operations Research supports the AMC in the design and operations of the center.

Accurate coordination of the multidisciplinary treatment is crucial to achieve high quality of care. If such coordination is insufficient, under- or overtreatment may take place, treatments may be performed in a non-optimal order, or certain aspects of the disease may be overlooked. However, since the different disciplines are accommodated at different locations within the hospital, this coordination is a challenging task. Through the establishment of the CMCA, children and their parents will generally visit the hospital only once a year, while previously they visited on average six times a year. This is a major improvement, because the hospital visits are both physically and psychologically demanding for the patients. Consequently, the CMCA will simultaneously increase quality of care and patient-centeredness.

This paper shows how combining integer linear programming, simulation, and queuing theory helps the AMC in organizing care for children with neuromuscular diseases. The treatment center embodies a transformation from supply-driven to demand-driven patient care. Customized diagnostics and treatment can be offered in a combined visit. To realize this, all practical constraints and preferences were collected and incorporated in an ILP by which feasible day schedules for multiple patient visits can be constructed. Simulations give insight in the capacity of the CMCA, given the availability of staff and equipment and estimates on patient demand in the number of arrivals and required appointments. Finally, a Markov model predicts the access time distributions for diagnostic patients based upon the simulation outcomes.

The first patients visited the CMCA in January 2012 in a pilot phase of the entire treatment concept. During this pilot phase, the nurse practitioner enters the needs of the patients in an Excel sheet. Given a set of patients with prescribed consultations and examinations, and the availabilities of the staff and equipment, the optimal schedule is determined using AIMMS. Since the schedules are heavily constrained, construction by hand would be very time consuming and does not guarantee the best solution. The next step is that the scheduling algorithm will be incorporated in the new hospital-wide electronic agenda system that is currently under construction. Modern ICT systems for hospital organization increasingly often embrace OR/MS solutions, in particular, in capacity evaluation and appointment scheduling. In the near future, advanced qualitative schemes, as the one presented in this paper, should become a standard part of hospitals’ integral ICT support, for transparent and efficient planning of high quality care.