

CASE STUDY

Coordinated, Cost-effective Care for Rare Disease: The Cystinosis Outpatient Consultation Program at RoMed

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The treatment of rare diseases poses special coordination challenges when patients need care and monitoring by multiple specialists. RoMed, an integrated health system serving the region around Rosenheim, Germany, established a specialized outpatient consultation program for treating the genetic disorder cystinosis, which results in excess lysosomal accumulation of the amino acid cystine and affects fewer than 200 patients in the entire country at any given time. RoMed's Cystinosis Outpatient Program offers a model for cost-effective coordinated care.

KEY TAKEAWAYS

- » The Cystinosis Outpatient Consultation (COC) program at RoMed Rosenheim is a multidisciplinary, integrated practice unit dedicated to diagnosis and treatment of the rare disease cystinosis.
- » By regularly bringing leading experts from different institutions together to run 2-day outpatient clinics for many patients, the COC is able to improve patient outcomes and reduce costs at the same time.
- » The COC strictly follows the strategy of the value-based geography model of care.¹
- » Its comprehensive and cost-effective approach to managing complex diseases over a long-lasting patient journey can be applied to other rare diseases.

The Challenge

Patients with rare diseases are not rare. More than 4 million children and adults, approximately 5% of Germany's total population, are suffering from one of the 7,000 to 8,000 rare diseases known today.² However, despite the high number of affected people, the patient population for any individual disease is usually extremely small.

Linking a patient's first clinical symptoms to a rare disease and confirming the diagnosis by running complex diagnostic procedures can be cumbersome. Initiation of treatment often starts late, after disease progression. A comprehensive referral program for rare diseases can provide expertise to obviate these problems.

Most rare diseases are genetic disorders affecting multiple organ systems and are associated with a broad variety of functional and cognitive impairments. Left untreated, rare diseases often result in deteriorating health and premature death. Thankfully, intensive research into underlying disease mechanisms has improved our ability to cure some patients with rare diseases and to alleviate symptoms of those who cannot be cured today.

Nephropathic cystinosis is a rare genetic metabolic storage disease characterized by the abnormal accumulation of the amino acid cystine in nearly all organs and tissues of the body, leading to widespread parenchymal tissue and organ damage.^{3,4} In Germany, approximately 130 individuals are currently diagnosed with cystinosis.

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Before treatment became available, children with nephropathic cystinosis developed end-stage renal failure and died at an early age.⁵ In the early 1980s, cystine-depleting therapy with cysteamine bitartrate was introduced as a treatment and has transformed cystinosis from a lethal disorder into a chronic disease.⁶⁻⁸ However, cysteamine does not reverse damage already done to multiple organs.

At the moment, cystinosis cannot be cured. Hence, the focus of all medical activities is on retaining quality of life at the highest possible level.

Cystinosis patients typically develop clinical symptoms like vomiting, failure to thrive, polyuria, and polydipsia in their first or second year of life.⁹ Early diagnosis, initiation of cysteamine treatment, and therapy adherence are closely correlated to long-term organ function and prognosis.^{10,11} Consequently, it is crucial to regularly evaluate the health status of a patient already diagnosed with cystinosis and to modify organ-specific therapy wherever necessary.¹²

Germany has a universal multi-payer health care system that is covered by a combination of statutory and private health insurance. Depending on their income, individuals either are insured by mandatory statutory health insurance or can choose between statutory and private health plans. Virtually all German citizens have either private or public health insurance covering the full spectrum of inpatient and outpatient care services.

In the German health care system, outpatient care is provided mainly through specialists in single practices. Patients with cystinosis are usually treated by nephrologists, because the kidney is the first and most severely affected organ. The health care system requires that individuals transfer from pediatric to adult care at the age of 18. Whereas pediatricians also concentrate on other relevant aspects of their patients, such as growth, endocrinology, and nutrition, nephrologists who treat adults focus solely on renal disease. When adults are suffering from rare diseases, care coordination is mostly lacking. Consequently, adult patients have to manage appointments with other specialists on their own.

In Germany, outpatient care of rare disease patients has several shortcomings:

- The fewer patients affected by a disease, the smaller the chance that there is an outpatient center for specialized treatments.
- Diagnostics and treatment of rare diseases that affect multiple organs require an experienced multidisciplinary team and diligent coordination of care.
- German sick funds pay outpatient specialists on a fee-for-service basis, but they do not reimburse for cooperating or coordinating care, nor for the sharing of information across facilities.

The Goal

By chance, in 2011, a patient with cystinosis came to our clinic. As we treated her, we realized that she had experienced significant deficits in diagnosis and therapy for her disease with negative consequences for the patient and her family. Upon further investigation, we discovered that these deficits extended to cystinosis patients in Germany in general. To improve outcomes of cystinosis care for all of these patients over their whole journey, we established Cystinosis Outpatient Consultation (COC), a periodic coordinated care program at the RoMed Hospital Rosenheim, as a joint effort together with the cystinosis patient support group. Cystinosis, like other rare diseases, typically affects multiple organ systems and thus needs well-coordinated care by various specialists across the entire care cycle.^{13,14} Specialists involved in treatment of a particular rare disease typically know one another well and are ready to work closely together to improve patients' lives. Therefore, establishing a temporary integrated practice unit¹⁵ for cystinosis should serve as an example for value-based rare disease care, providing better outcomes at lower costs.

The Execution

RoMed is a regional health system located in southern Germany, serving a population of 350,000 with four hospitals and several outpatient care centers.

Established in 2012, the interdisciplinary COC program at RoMed is fully dedicated to the diagnosis and treatment of children and adults with cystinosis. It is an integrated practice unit for diagnosing the effects of cystine accumulation in each relevant organ system and providing patients with the complete spectrum of care. The COC program creates 2-day concentrated outpatient clinic meetings where all relevant specialists convene to see cystinosis patients.

Anyone in Germany diagnosed with cystinosis automatically qualifies to receive care through the COC program. A case manager coordinates patient appointments and organizes the 2-day outpatient meeting. The case manager is responsible for running the clinical facilities, mapping out the timetables of the various specialists, and scheduling the patients visiting the center. They are also responsible for maintaining close communication with patients and their families regarding travel itineraries, accommodation, and other aspects of their visit.

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Sixteen patients can be accommodated at each COC session. They follow a standardized care pathway through the center. Within 12 hours over the course of 2 days, these 16 patients will have appointments with experts from 13 different specialties. At the end of each day, the specialists gather to discuss the day's findings and to prepare a comprehensive document describing each patient's condition and care plan. In addition, details and changes in treatment are discussed with each patient's local physician. To further enhance care coordination, primary care physicians can meet with experts via a secured videoconference hosted by the COC.

Out of the estimated 130 cystinosis patients in Germany, 95 are seen in our clinic. Normally, patients are seen once a year, though some may visit more than once if they are experiencing complications from their condition. Participation in our program is encouraged through the patient support group and the Cystinosis Foundation Germany.

The COC is financed partially by health insurance and partially by the Cystinosis Foundation Germany. The German health insurance plans reimburse part of the costs on a fee-for-service basis that does not cover the intensive coordination. Costs that are not covered by the patient's health insurance, such as the case manager, travel, and accommodation expenses for providers that are not centered in Rosenheim, and travel and accommodations for patients, are borne by the Cystinosis Foundation Germany.

The COC's model is the first of its kind in Germany. It corresponds largely to a model recently introduced by the European Union in 2017.¹⁶ The EU established European Reference Networks (ERN) to improve diagnosis and treatment for patients with rare diseases. These virtual networks involve health care providers across Europe and aim to “facilitate discussion on complex or rare diseases and conditions that require highly specialized treatment and concentrated knowledge and resources.” Our project is a model-case that corresponds largely to these EU initiatives. Therefore, RoMed currently has applied for accreditation as a member of the ERN for rare kidney diseases, ERKNet.

Hurdles

Some of the major challenges we have faced during the establishment of the COC have been financing, organization, and the documentation of patients' conditions.

Financing: Since the health care system does not provide financial support for many necessary activities, we established the [Cystinosis Foundation Germany](#) in 2015. The foundation is funded by contributions from industry, other foundations, and individuals.

Organization: Various aspects must be coordinated to successfully run the COC program. Due to the lack of financial resources during the first 4 years of the program, we had to take care of all organizational activities by ourselves on top of our day-to-day work, which was extremely time-consuming. The foundation funded the hiring of a case manager, who took over all of these coordination functions.

The case manager is now responsible for managing the clinical facility, including organizing the various specialists and the patients as well as their families. Furthermore, the case manager is responsible for maintaining close communication with patients and their families regarding travel itineraries, accommodation, and other costs associated with their COC visits.

Documentation: Detailed and long-term documentation is a crucial step toward successfully treating and eventually curing rare diseases. Unfortunately, there are very few standardized documentation systems available allowing children and adults to be managed and treated together by different specialists in one location. As a result, clinicians often find themselves confronted with distinct, individual reports on each flare-up rather than one collective medical record of the entire care cycle. The transfer of documents between institutions and different IT systems is time-consuming, error-prone, and technically challenging.

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To address this problem, the COC created a documentation system named SAVE, in cooperation with the Medical Informatics Group of the University of Frankfurt, Goethe-University, to collect clinical data. It is based on a standardized and broadly accessible IT platform, the OSSE registry

Table 1. Medical Specialties Involved in the Cystinosis Outpatient Center at RoMed

Pediatric nephrologist (Rosenheim)
Adult nephrologist (Rosenheim)
Pediatric cardiologist (Rosenheim, Mainz)
Pediatric and adult orthopedic surgeon (Munich)
Pediatric and adult physiotherapist (Traunstein)
Dietitian (Innsbruck)
Speech therapist (Traunstein)
Pulmonologist (Traunstein, Rosenheim, Würzburg)
Endocrinologist (Rosenheim, Munich)
Ophthalmologist (Munich)
Dermatologist (Salzburg)
Neurologist (Rosenheim, Traunstein)
Pediatric and adult fertility (Rosenheim, Muenster)
Sonography (Wiesbaden, Rosenheim)
Specialists at the RoMed Health Cystinosis Outpatient Center

Source: RoMed.

software (also called the Open Source Registry System for Rare Diseases), which provides a flexible framework for registry development with high data-quality standards to be compliant with European data protection rules.¹⁷

Clinical, imaging, laboratory, and outcome data are documented in one electronic patient record that can be accessed by clinicians at the outpatient center, the patient's primary care doctor, and a network of leading experts in cystinosis care (with the patient's consent). Distinct forms were created for each specialty involved in the COC to collect all relevant information pertaining to that specialty. Because all data elements are entered and stored in a structured way, the data can be used for research as well as cooperation with national and international patient registries. SAVE is a generic tool that could be adapted to other diseases as well.

The Team

The COC is a "one-stop approach," gathering a multidisciplinary team of experts from nine different institutions and locations across Germany and Austria under one roof (Table 1).

Metrics

Since the opening of the COC in 2012, 98 cystinosis patients (52 children and 46 adults) representing 75% of cystinosis patients in Germany, have been seen during 346 patient visits (210 for children and 136 for adults) with the multidisciplinary team. The COC's comprehensive approach has enabled the care team to adjust treatments and improve life-threatening complications. The benefit of the multi-professional care concept can be assessed in several ways.

Reestablishing cysteamine treatment. Halitosis represents a serious side effect of cysteamine treatment. This unpleasant, foul odor results from the metabolism of cysteamine to dimethylsulfide, a volatile sulphur compound exhaled via the lung and also excreted through perspiration.¹⁸ Halitosis can lead to social difficulties and exclusion beginning in childhood, and is the main reason for patients to discontinue systemic treatment or to take cysteamine irregularly. Out of 44 adult patients, 18 (41%) had discontinued systemic cysteamine treatment. Four of these individuals showed serious clinical symptoms with impaired lung function, dysphagia, and

peripheral myopathy. An additional eight exhibited peripheral myopathy.^{19,20} We were able to reintroduce cysteamine treatment with the full dose in six patients and partially in nine patients out of 18 (83%).

Fertility therapy. Before joining the COC, the adult patients had been seen only by nephrologists and ophthalmologists, which left other organ manifestations of the disease untreated. Primary hypogonadism occurs in all male patients and causes testosterone deficiency, which primarily affects fertility and bone metabolism.^{21,22} None of the adult patients had been evaluated for gonadotropic involvement. In two male patients, the COC was able to effectively initiate fertility therapy.

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Improved eye health. Local cysteamine therapy is the only way of preventing cornea deposits of cystine crystals, which lead to band-keratopathy and a need for corneal transplantation.²³ As patients age, they tend to comply less with regular therapy because of the discomfort and inconvenience of using eyedrops and because they adapt to changes in vision and may not realize that it has deteriorated to a critical point. More than 40% of older patients did not adhere to local therapy. In nearly all these cases, the COC was able to reintroduce therapy for these patients by raising awareness of the therapeutic benefits.

Orthopedic issues. All adult patients showed orthopedic abnormalities — for example, bone pain, foot deformities, thoracic abnormalities, and spine alterations.²⁴ Patients were assigned to appropriate physiotherapy or corrective surgery.

Transplants. One patient was determined to be eligible for a kidney transplant after spending 5 years on hemodialysis, and another two patients were transferred to another center for corneal transplant.

Cost and Benefits

The COC is highly cost-effective compared with standard care, which is largely incomplete and fragmented. Instead of patients and their families setting up individual appointments with the respective specialists, the COC provides comprehensive care by a single team in one dedicated place over 2 days.

Because the COC model gives patients access to specialist care that they ordinarily do not get at all, as well as access to care coordination services between those specialists and the patient’s primary care physician, it is difficult to draw a precise and complete parallel between costs for COC care compared with standard care.

Table 2. Costs Avoided Due to Participation in COC Program

Procedure		Cost (USD)	Number of Patients	Savings (USD)
Corneal Transplant		\$5,000	3	\$15,000
Fertility Surgery		\$6,000	3	\$18,000
Renal Survival				
	(dialysis)	\$10,000/year	5	\$50,000/year
	(transplant)	\$40,000	5	\$200,000
Avoidance of Disability (Muscle)		\$50,000/year	8	\$400,000/year
Avoidance of Hospitalization		\$10,000	10	\$100,000

Source: RoMed.

However, there are several ways to roughly calculate the value of the COC model. First, the COC pays an average of \$550 daily (U.S. dollars) to each external specialist who participates in the clinic, and also pays the care manager. These costs add up to \$5,800 for a 2-day outpatient consultation session taking care of 16 patients. Another \$330 per patient is paid for hospital services, including the specialists employed at RoMed, or \$5,280 for 16 patients. Thus, the total cost of care through the COC over 2 days is \$11,080, or \$693 per patient.

In standard care settings providing services by doctors in single practice over time, the cost would be \$1,130 per patient.²⁵ Therefore, the COC is providing superior, coordinated care with better outcomes at 38% lower cost. Neither calculation includes costs for patient travel or lost work time for patients or their parents.

Second, one could calculate the savings documented by the COC's provision of comprehensive care by a single team. At a minimum, the COC has obviated the need for the following procedures and saved these estimated costs because of improved compliance with cysteamine treatment, which prevents renal and nonrenal complications (Table 2).

Finally, the COC provides improved quality of life. Patients experience fewer swallowing difficulties, less muscle weakness, better lung function, and elimination of photophobia. They are better able to be gainfully employed, and the care they receive through the COC prevents other complications of their disease and allows them to delay or avoid dialysis or the need for organ transplant.

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