

CONFERENCE REPORT

6th World Conference on CDG
(WCCDG) for families and
professionals

FIRST WORLD CDG ADVOCACY,
POLICY AND LEADERSHIP ACADEMY

6TH WORLD CONFERENCE ON CDG

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20 - 23 July 2023
Costa da Caparica
Portugal

CONFERENCE REPORT 2023

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Portugal, 20 - 23 July 2023



NOTE TO THE READER

The Conference Report integrates brief summaries of all lectures, pitches, live interviews, and think tank discussions conducted from 20 to 23 July in Costa da Caparica, Portugal (2023), during the 6th World CDG Conference on CDG. The Report serves as a resource for those who attended the conference, as well as for individuals interested in understanding the advancements and collaborative efforts within the field of CDG research, drug development, daily care and management. The main goals of the Conference Report are:

1. To inform and disseminate a comprehensive overview of the key insights, breakthroughs, and significant contributions made in the last years by the outstanding CDG professionals (clinicians, other healthcare professionals, researchers and pharmaceutical companies);
2. To serve as a platform to share families' and patients' personal live experiences aiming to find solutions for the challenging demands encountered by people living with this threatening disease and to help and encourage other peers in similar situations;
3. To share the latest advancements and innovations in the CDG field to improve disease care and management, quality of life, and well-being.

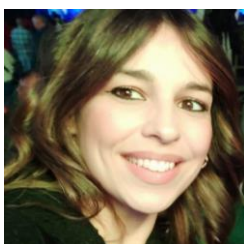
The report was crafted by the Medical Writers Luisa de Andrés Aguayo and Joana Poejo and revised by Carlota Pascoal and Ana Verde under the expert supervision of Vanessa dos Reis Ferreira.

MEET THE MEDICAL WRITERS

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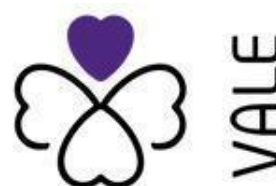
ACKNOWLEDGEMENTS

VOLUNTEERS AND DONORS

The 6th World Conference on CDG was made possible through the joint efforts of the Portuguese Association for CDG and CDG & Allies in collaboration with worldwide CDG patient advocacy groups, advocates, families, researchers, donors, and supporters.

The exceptional dedication and unwavering commitment demonstrated by the CDG volunteers in orchestrating the event shaped the success of the 6th World Conference on CDG. Their altruistic spirit and passion were evident throughout the event, culminating in a seamless and enriching experience for all attendees. We extend our heartfelt gratitude to **Vanessa dos Reis Ferreira, Paula Videira, Pedro Granjo, Carlota Pascoal, Rita Francisco, Ana Verde, Joana Poejo, Luisa de Andrés Aguayo, Claudia de Freitas, Ksenia Lebedeva, Pedro Recover, Fabien Kramer, Alison Slade, Thomas Smith, Tatiana Vassilevskaia, Mariana Barbosa, Beatriz Pereira, Joana Cunha, Ines Teodoro, Marta Falcao, Tiago Azevedo, Madalena Parrado, Dolores Gamito and Patricia Mexia** whose efforts made this conference a resounding success. Thank you, volunteers!

We express profound gratitude to our donors and supporters for their steadfast dedication to our cause, as it is their unwavering commitment that made the 6th World Conference on CDG possible.



PANEL OF EXPERTS

At the 6th World Conference on CDG, an exceptional assembly of the world's foremost experts showcased the latest advancements in CDG clinical research and technological innovations. They not only shared their valuable insights and advice but also provided informative sessions to the community. We wish to convey our deep gratitude to the panel of experts, which was composed by:

- **Eva Morava**, Mayo Clinic, and Frontiers in Congenital Disorders of Glycosylation Consortium (FCDGC), USA.
- **Christina Lam**, Associate Professor, Division of Genetic Medicine Medical Director, Biochemical Genetics, Seattle Children's Hospital, USA.
- **Andrew C. Edmondson**, FCDGC and Metabolic Disease Program and the Division of Human Genetics at Children's Hospital of Philadelphia, USA.
- **Peter Witters**, Centre for Metabolic Diseases, UZ Leuven, Belgium.
- **Stephanie Grünewald**, Great Ormond Street Hospital, London, UK.
- **Mel McSweeney**, Great Ormond Street Hospital, London, UK.
- **Karen Morici**, CDG Care, Patient Advocate, USA.
- **Tristen Moors**, Vice President, Clinical Operations at Glycomine, Inc., USA.
- **Raquel Marques**, President Sanfilippo Association Portugal.
- **Marc Patterson**, Mayo Clinic and FCDGC, USA.
- **Christin Johnsen**, University Medical Center Göttingen, Clinic for Pediatrics and Adolescent Medicine, Germany.
- **Erik Eklund**, Pediatrics at Lund University, Sweden.
- **Gert Matthijs**, Laboratory for Molecular Diagnostics at the Center for Human Genetics in Leuven, Belgium.
- **Tadashi Suzuki**, RIKEN Institute, Japan.
- **Lan Lin**, Children's Hospital of Philadelphia and FCDGC, USA.
- **Saadet Andrews**, Associate professor and biochemical geneticist at the University of Alberta, Canada.
- **Peter McWilliams**, Chief Business Officer at Glycomine, Inc., USA.
- **Ethan Perlstein**, Perlara, USA.
- **Holly Charmichael**, Patient Advocate, Chief Operating Officer of GT Independence, USA.
- **Claudia de Freitas**, Researcher at Institute of Public Health, University of Porto, Portugal.
- **Ksenia Lebedeva**, CDG & Allies - Professionals and Patient Associations International Network (CDG & Allies-PPAIN)

CONFERENCE FACILITATORS

We also want to extend our heartfelt appreciation to the facilitators for their exceptional contributions during the congress. The facilitators demonstrated exemplary skill and dedication in guiding the discussions and ensuring the seamless progression of sessions. Their ability to engage participants and foster insightful dialogues greatly enhanced the overall conference experience. The Conference facilitators were:

- **Vanessa dos Reis Ferreira**, Portuguese Association for CDG (APCDG) and World CDG Organization (WCDGO), CDG & Allies – Professionals and Patient Associations International Network (CDG & Allies-PPAIN), NOVA School of Science and Technology, NOVA University Lisbon, Caparica, Portugal.
- **Paula Videira**, Research Unit on Applied Molecular Biosciences (UCIBIO), NOVA School of Science and Technology (FCT-NOVA), APCDG and CDG & Allies-PPAIN, Portugal.
- **Dulce Quelhas**, Clinical Laboratory Geneticist at Centro de Genética Médica Jacinto de Magalhães, Centro Hospitalar do Porto, APCDG and CDG & Allies-PPAIN, Portugal.
- **Ana Ferreira**, APCDG and CDG & Allies-PPAIN, Portugal.
- **Carlota Pascoal**, UCIBIO, FCT-NOVA, APCDG and CDG & Allies-PPAIN, Portugal.
- **Pedro Granjo**, UCIBIO, FCT-NOVA, APCDG and CDG & Allies-PPAIN, Portugal.
- **Thomas Smith**, Independent Patient Engagement Consultant, UK.
- **Rita Francisco**, Survey Junior Manager, EURORDIS, France.
- **Ksenia Lebedeva**, CDG & Allies-PPAIN, Portugal.
- **Alison Slade**, Switzerland.
- **Cláudia de Freitas**, Researcher at Institute of Public Health, University of Porto, Portugal
- **Angelina Palma**, Assistant Professor at UCIBIO, FCT-NOVA, Portugal.

TESTIMONIALS

This section presents a compilation of testimonials shared by clinicians, CDG parents, and volunteers. The testimonials underscore the importance of unity and collaboration within the CDG community, emphasizing the need for active engagement and cooperation to address common challenges and achieve shared goals.

“These conferences are important to connect families, researchers, and clinicians” - Dr. Ruqaiyah Altassan – Clinician at the King Faisal Specialist Hospital and Research Center, Saudi Arabia

” To meet each other and to talk with people with similar interests” - Josef Janeček - father of Ludmila, CDG Czech

“For me as a father of a CDG affected girl and representative of GlycoKids, it was a really amazing to exchange with families, professionals and members of other associations from all over the world in a very friendly environment”- Andreas Bozsza, father of Frida – Glycokids, Germany

“This is the first time we attend the World Conference on CDG and we are very grateful, both to the organizers, to the doctors and scientists. They were very generous in sharing not only knowledge but their time and love with the patients and families. It was an unforgettable experience that brings a lot of hope. I hope these conferences continue to be held, they are a great blessing.” - Ernesto Romo, father of Martim, Spain

“The World CDG Conference is a unique platform, a kind of a melting pot that brings together families, patients and professionals with different backgrounds, from different countries. From a professional point of view it offers a privileged space for networking, sharing best practices, and showcasing our work. It is a special place where what we do acquires a different, more tangible meaning!” - Rita Francisco, CDG & Allies – PPAIN volunteer

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OVERVIEW OF THE CONFERENCE

Finding comprehensive answers to Congenital Disorders of Glycosylation (CDG) is a major challenge in medical research and healthcare. CDG presents numerous obstacles in the areas of research, treatment, support, advocacy, care, and management. Addressing the various and complicated features of CDG requires a collaborative effort including a wide range of stakeholders, from professionals and researchers to families and policymakers.

The 6th World Conference on CDG (WCCDG) for families and professionals was held at NOVA School of Science and Technology, FCT NOVA, in Caparica, Portugal, between July 20 and 23 (2023). The main purpose of the 6th World Conference on CDG was to build and strengthen community-centric activities to promote and accelerate CDG research and drug development and identify and create potential solutions for the challenging demands of people living with CDG aiming to improve care, disease management, and well-being. The Conference created a collaborative agenda strategy to assist CDG families and professionals in achieving meaningful objectives. The 6th World Conference on CDG was divided in three instructional tracks:

1. The **"World Think Metabolic, Think CDG Academy"** featured pre-conference sessions delivered online, in video format, allowing attendees to access the latest developments on CDG at their own pace and convenience. The purpose was to provide knowledge to attendees for the in-person World Conference on CDG, as well as to involve them in advocacy activities and CDG daily care and management. These workshops were designed for people living with CDG, their families, academics, medical doctors, and industry representatives and are available on worldcdg.org.
2. The **"First World CDG Advocacy, Policy, and Leadership Academy"** offered in-person sessions. It represented an unprecedented and transformative initiative that gathered experts, practitioners, families, and advocates under a single banner to deliberate, collaborate, and innovate. This academy served as a pivotal platform where the collective expertise of professionals and the lived experiences of families converged, fostering an environment of knowledge exchange, empathy, and solution-oriented thinking. Workshops established the basis for the discussions held during the 6th World Conference on CDG.
3. The **"6th World Conference on CDG"** featured a diverse range of sessions intended for the whole CDG community, encompassing short talks and pitches, interactive question-and-answer segments, live interviews with CDG experts and patients, and dynamic think

tanks that encouraged collaborative brainstorming to address challenges within the CDG community.

FIRST WORLD CDG ADVOCACY, POLICY AND LEADERSHIP ACADEMY

During the academy, various workshops happened, each with a specific goal. These workshops aimed to understand the issues, come up with creative ideas, involve people's experiences, promote teamwork, and plan for the future of CDG care.

The academy's goals were:

- **Identify Challenges:** Pinpoint urgent matters in CDG research, regulation, drug development, care, and daily support, aiming to establish the foundations for future actions.
- **Innovate:** Use unique methods like need-led innovation, World Café discussions, and Human-Centered Design to craft practical, creative solutions for challenges.
- **Look for Empathetic Solutions:** Understand behavioral hurdles for CDG individuals via human-centered design, creating effective and empathetic solutions.
- **Collaborate:** Stress the importance of working together among families, professionals, and stakeholders to build a stronger CDG community and shared responsibility.
- **Design the Future Roadmap:** Work collaboratively to create a comprehensive plan to guide future actions and approaches for CDG interventions. Covering research, policies, and practical steps reflects the community's united vision for enhancing lives affected by CDGs.

Workshops served not only for immediate discussion but as part of a forward-thinking approach. The three most critical needs identified during these sessions were chosen as the main focus for specialized think tanks during the subsequent 6th World Conference on CDG.

Enclosed within the following pages are summarized descriptions outlining the workshops that took place during the "First World CDG Advocacy, Policy, and Leadership Academy".

DAY 1 OF THE FIRST WORLD CDG ADVOCACY, POLICY AND LEADERSHIP ACADEMY (20TH JULY)

JOURNEY TOWARDS HOPE: UNLEASHING THE POTENTIAL OF CDG RESEARCH AND DRUG LIFECYCLE

Patient and Public Involvement (PPI) is essential for tailoring therapies to patient needs and enhancing the discovery, development, and evaluation of new medicines by collaborating on unmet needs, research priorities, study design, and regulatory aspects.

Facilitators: Vanessa dos Reis Ferreira and Ana Ferreira

Gather together, meet, and work

The event commenced with an introductory overview, setting the stage for the academy workshops and emphasizing their objectives and agenda. The initial workshop aimed to gather insights from diverse stakeholders, allowing them to interact, identify shared traits, and connections. Vanessa dos Reis Ferreira presented the evolution of the World Conference on CDG, highlighting its growth into a unifying platform that shapes research, spurs change, and now includes innovative think tanks. The academy, as the latest innovation, represents a collaborative approach towards patient-centered solutions. Participants discussed the challenges within the CDG community that justify the need for such an academy, including the importance of comprehensive knowledge, advocacy skills, bridging gaps, raising awareness, addressing language barriers, and empowering patients and families. The academy stands as a valuable space dedicated to learning, fostering unity, and empowering the CDG community.

Introduction to advocacy. Examples of advocacy in rare diseases

The workshop engaged participants in exploring the concept of advocacy. Attendees were prompted to envision what advocacy meant to them, with responses ranging from heroic imagery to impactful interactions like a mother addressing a group. This led to parallel discussions, both spoken and in the online chat, highlighting the importance of information dissemination, accuracy, constancy, teamwork, expertise, and the pursuit of change.

Advocacy, as discussed, operates on multiple levels - from individual efforts to systemic change, with important intermediary stages. Attendees shared personal experiences, including the positive impact of advocacy in facilitating access to orphan drugs through the creation of policies incentivizing their development.

The role of patient advocates has expanded significantly, now encompassing advising regulatory agencies on innovative treatments. Notable achievements in the field of CDG were highlighted, including engagement with regulatory bodies like the FDA, a significant milestone.

Education and empowerment of patients and families emerged as a central theme. Advocacy strives to make information accessible to all stakeholders, ensuring informed decision-making and fostering collaboration.

In summary, the workshop emphasized the diverse aspects of advocacy, its far-reaching effects, and its critical role in shaping policies, gaining access to treatments, and empowering the entire healthcare community.

Addressing CDG Challenges through Need-led Innovation and the World Café method: A Journey towards people-centric solutions (Part I)

To uncover the daily needs and challenges of the CDG community, facilitators conducted an interactive exercise. The insights garnered from this session played a pivotal role in determining the focal points for the forthcoming Think Tank discussions during the conference. Each pre-established group from the academy was assigned a distinct topic to discuss such as research, drug development, regulatory aspects, access to medications, daily care and management, and other relevant areas in the context of CDG. Throughout these discussions, each group engaged in brainstorming sessions, generating a range of ideas that were collected and compiled from the online chat and the physical room. These ideas were meticulously recorded in a list, forming the foundation for the upcoming session scheduled for the following day.

Concluding the session, families were given the opportunity to introduce themselves. Among them were familiar faces from previous editions of the World CDG Conference, while others were new attendees, some having received the diagnosis recently. Many of these families exhibit remarkable activity and enthusiasm toward the academy, driven by the shared objective of enhancing the lives of their CDG-affected loved ones. For them, engaging with the community signifies hope and serves as a form of healing through the mutual support of encountering fellow families.

DAY 2 OF THE FIRST WORLD CDG ADVOCACY, POLICY AND LEADERSHIP ACADEMY (21ST JULY)

Addressing CDG Challenges through Need-led Innovation and the World Café method: A Journey towards people-centric solutions (Part II)

Facilitators: Vanessa dos Reis Ferreira and Ana Ferreira

The next phase of the activity involved each group's selection of the three primary challenges from the list they had compiled the previous day. The outcomes were as follows:

1. Access to treatments: The key challenge identified in this field was the need for an online central resource that provides up-to-date information about access to both approved and experimental treatments and accounts for the diverse legal aspects inherent to different countries. This resource should prove beneficial to all stakeholders.
2. Clinical Research Challenges: Three main challenges emerged regarding clinical research:
 - Patient Scarcity and Accessibility: Finding enough patients for studies remains a challenge due to factors like underdiagnosis, cultural differences, and the difficulty in locating specialist centers, especially in smaller countries.
 - Setting Up Registries and Bio-banks: Establishing registries, bio-banks, and obtaining samples for understanding the natural disease progression pose significant hurdles, yet these are crucial for documenting the course of the disease.
 - Access to Clinical Trials: The process of participating in clinical trials proves challenging, particularly when trials are conducted far from the patient's location and for those from different countries.
3. Regulatory Challenges in Drug Development: In terms of regulatory considerations within drug development, participants outlined three important challenges:
 - Approval and Clinical Outcome Assessments: Gaining regulatory approval during the development phase is hindered by the lack of comprehensive clinical outcome assessments, which relies on a deep understanding of the disease and its underlying mechanisms.
 - Complex Procedural Steps: The extensive paperwork and numerous procedural steps result in prolonged timelines, posing significant challenges in the development process.
 - Global Process Variation: The presence of varying regulatory processes in different countries and regions complicates matters, underlining the need for prioritizing standardization efforts.
4. Challenges in Basic and Translational Research: The three critical challenges identified were:
 - Empathy and Awareness Building: Creating understanding and empathy among individuals unfamiliar with CDG.
 - Impact Explanation: Explaining the tangible impact of basic research on the daily lives of CDG-affected relatives and establishing the link between basic and translational research.
 - Biomarkers and Clinical Outcomes: Establishing a connection between biomarkers and clinical outcomes and translating biomarker findings into meaningful clinical implications.

Once each group selected their three main challenges, they proceeded to choose one challenge from the trio. The selected challenges served as foundations for the think tank sessions celebrated throughout the conference in the coming days.

DESIGN THINKING FOR SOLVING BEHAVIORAL ISSUES IN CDG

Welcome and introduction to Design Thinking for solving behavioral issues in CDG

Facilitator: Ksenia Lebedeva

The workshop was divided into two parts. In the first part, Ksenia Lebedeva briefly introduced the concept of design thinking. In the second part, she guided participants through a practical exercise using the design thinking approach to address behavioral challenges related to CDG. This topic gained significance in the last edition of the World CDG conference, marking its exploration as a priority issue.

Design thinking is a method for solving problems that focuses on understanding what users need, coming up with creative ideas, and continuously improving solutions. The first step is to recognize the challenges and gaps in knowledge that arise when using this approach. Design thinking promotes understanding the experiences and challenges of users. For example, in the case of CDG, it means understanding the lives of parents, friends, teachers, doctors, and medical staff who are part of the daily routines of those with CDG.

Once these gaps in knowledge are identified, design thinking encourages brainstorming and generating ideas to create new solutions. These solutions can be tested through prototypes. The main aspects of design thinking are: (1) it is centered around the people's needs, involving users in the design process to create solutions that directly address their needs and challenges, (2) it is about trying out new ideas and learning from them, adapting and improving over time, and (3) it is collaborative, bringing together people with different backgrounds to work together effectively.

Each team addressed a distinct behavioral challenge in CDG. The challenges were formulated based on the outcomes of a previously conducted survey. This survey was developed collaboratively with the research community through prior online workshops.

Participants began by reading about the challenge and reflecting on it, answering questions about its origin, impact on their lives, and resulting needs. After sharing their insights, they proceeded to reframe the problem statement in various ways, later selecting a version and sharing it with the group, leading to a consensus decision. Subsequently, the chosen problem statement was documented.

Seven distinct problem statements or challenges were posed:

1. Repetitive Behaviors: Some individuals with CDG engage in repetitive behaviors and communication, which can be frustrating. The focus shifted to understanding why these behaviors occur and how to help families and communities in dealing with them.
2. Impact on Family Quality of Life: The difficulties families face when dressing and bathing CDG patients impact their overall quality of life. The challenge focused on finding ways to reduce this impact.
3. Communication Refusal: People with CDG may refuse to communicate, affecting interactions with teachers and peers. The challenge evolved to address the lack of alternative communication methods and help individuals feel included.
4. Disruptive Behavior: Disruptive behavior in class can result from neurological involvement, including intellectual disabilities, learning disorders, and mental health challenges. The goal was to accommodate these limitations, improve academic and psychosocial outcomes, and educate their peers and caregivers.
5. Concentration and Rest: Difficulty concentrating and the need for frequent pauses and rest were highlighted.
6. Verbal Communication Challenges: Challenges in verbal communication lead to frustration and isolation. This challenge was broadened to encompass societal empathy, access to expertise, and the need to break the cycle of discrimination.
7. Task Transition and Tantrums: Resistance to changing tasks and difficulties transitioning between activities can lead to tantrums. The focus was on understanding the communication difficulties that contribute to frustration and temper outbursts.

This activity laid the groundwork for the upcoming conference sessions' discussions on the following day, with the aim of generating solutions.

Towards the conclusion of the session, families were provided with a chance to express their opinions. They unanimously acknowledged the significance of addressing behavioral issues as crucial challenges, particularly due to their historically lower prioritization within the CDG community's concerns.

6TH WORLD CONFERENCE ON CDG

The 6th World Conference on CDG offered in-person sessions dedicated to the CDG community, with simultaneous interpretation from English to Portuguese and from English to Spanish. Additionally, the Conference included online transmission in response to numerous requests from professionals and families to ensure that the latest CDG advances reached all interested individuals around the world.

The sessions of the 6th World Conference on CDG included:

- Short Talks and Pitches followed by sessions of Questions and Answers (Q&A);
- Live interviews, where panels of experts in CDG discussed the main hot topics and patients and families shared their live experiences;
- Interactive Think Tanks, which gathered all the participants together, to brainstorm and share novel potential ideas to overcome some of the challenges that the CDG community is facing.

The main thematic points addressed during these three days of the Conference were:

- Research drug development, therapies, and clinical trials;
- CDG care, management, daily life, and mental well-being.

The following pages contain brief descriptions of the sessions conducted during the 6th World Conference on CDG.

DAY 1 OF THE 6TH WORLD CONFERENCE ON CDG (21ST JULY)

WELCOME SPEECH

Vanessa dos Reis Ferreira started the speech by extending a warm welcome to all attendees and highlighting the 10th Congress anniversary, emphasizing the transition from conventional sessions to a more interactive format since the first edition in 2013. She encouraged all attendees to embark on this exciting journey and pointed out the significance of participants' input in shaping the conference's agenda and addressing community needs.

Vanessa dos Reis Ferreira underscored the importance of engaging in discussions and sharing ideas and perspectives. She brought attention to the challenges faced by the CDG community

and stressed the importance of listening to families' perspectives. Afterwards, a series of videos of families' interviews were introduced aiming to shed light on the challenges and set the tone for the conference discussions.

VOICES OF CDG FAMILIES AND ADVOCATES: INSPIRING STORIES AND INSIGHTS

Sarah Aymar, CDG Canada

During the interview, Sara Aymar emphasized three key priorities for addressing CDG: research, awareness, and education. She stressed the importance of these foundations for both new and existing CDG families to access better medical knowledge. Sarah often finds herself educating specialists, highlighting the need for increased awareness and knowledge dissemination within the medical community. Regarding research priorities, Sarah expressed a strong desire for research into treatments, with the ultimate goal of finding a cure. She believes that treatment research can significantly enhance the quality of life for CDG patients and their families.

Sanja Juric, CDG Croatia and CDG Germany

Sanja, whose daughter has a rare CDG (COG4-CDG), told us about her journey in seeking information about the condition. When they first received the diagnosis, they were told that her daughter would be dependent throughout her life, but the geneticist couldn't provide much more information. Sanja began searching for information, which proved challenging as she found only two medical articles on her daughter's CDG type, each with limited information. However, Sanja's breakthrough came when she discovered a CDG family group, which was invaluable to her. This group provided support, connections with others experiencing similar symptoms, and access to vital information. Sanja's experience highlights the importance of patient groups and social media in connecting and supporting those affected by CDG, but it also underscores the lack of information accessible to families.

Raquel Pinheiro and Juliana Mansur, CDG Brasil

Raquel and Juliana's experience sheds light on a critical issue within the CDG community: most physicians, especially in Brazil, lack awareness and knowledge about CDG. This lack of awareness often leads to considerable challenges for affected families. In Brazil, there are only two specialized centers equipped to perform the necessary diagnostic tests for CDG. Given the vast geographic expanse of Brazil and the limited availability of these specialized centers, many

families face enormous difficulties in accessing a timely and accurate diagnosis for their loved ones.

Amy Dann, CDG Australia

In the interview, Amy discussed her son Louie's CDG diagnosis. Louie seemed healthy initially, but at around four months old, he experienced seizures and breath-holding spells, leading to an intensive care unit stay. After extensive testing, ALG1-CDG was suspected.

Genome testing confirmed the diagnosis. Initially, they believed it was a mild case, but it turned out to be severe, requiring palliative care. Amy highlighted the shock and lack of information surrounding CDG at the time of diagnosis, emphasizing the challenges many CDG families face.

Tobias Puhe, Glycokids, CDG Germany

In this interview, Tobias told us about his 12-year-old daughter, Anna, who was diagnosed with PMM2-CDG. Their journey to the diagnosis began with concerns about their daughter's developmental delay. After numerous tests, a perceptive physician noticed inverted nipples, which led to the diagnosis.

Upon hearing the diagnosis, the family experienced shock and disbelief, but they found solace in Anna's cheerful disposition. They also received significant emotional and practical support from family and friends. Tobias likened their journey to unexpectedly ending up in a beautiful place despite not wanting to be there initially.

RESEARCH DRUG DEVELOPMENT, THERAPIES, AND CLINICAL TRIALS

Overview of the roadmap for CDG Research, Drug Development, Access, and Care and Management.

Marc Patterson and Eva Morava, together with participants of the "First World CDG Advocacy, Policy, and Leadership Academy".

During the talk, Marc Patterson and Eva Morava discussed the roadmap for CDG research, drug development, access, and care management. This roadmap was co-created with and for the CDG community.

Eva Morava introduced herself as the main principal investigator of the FCDGC (Frontiers in CDG Consortium). The consortium initially began as an informal network of clinicians, scientists, and patient advocates, and it eventually secured grants to support CDG research. The goals of the consortium include conducting natural history studies, biomarker discovery, clinical trial readiness, and education to raise awareness and train future professionals in CDG research. She also emphasized the importance of patient associations in driving research collaboration and the consortium.

Marc Patterson stressed the significance of collaboration and natural history studies in understanding CDG. He highlighted that patients and families play a crucial role in defining what matters in clinical trials and treatment. The talk also touched upon the challenges of drug development for ultra-rare diseases like CDG and the evolving regulatory landscape that adapts to these challenges. Marc Patterson and Eva Morava encouraged collaboration and unified efforts within the CDG community to advance research and therapy development.

Patient and Public Involvement (PPI) within the roadmap for CDG Research, Drug Development, Access, and Care and Management: is it a new fashion?

Vanessa dos Reis Ferreira and Ana Ferreira

The talk underscored the critical role of patients and citizens in research and drug development, highlighting their evolving roles from passive subjects to active collaborators. Regulatory authorities like the FDA and EMA are increasingly recognizing the importance of involving patients in decision-making processes to address their unique perspectives and needs effectively. This approach involves conducting research and drug development with and for the patient community, allowing patients to contribute significantly across the entire drug development spectrum, from initial research to post-approval phases. Ana Verde's personal journey served as a powerful example of how knowledge empowers patients and citizens even without prior experience in patient advocacy. She openly shared her personal educational journey, emphasizing the training and courses she actively pursued to gain this invaluable knowledge:

1. “Basics of patient engagement and how to apply it” offered by the Patient Focused Medicine Development (PFMD) initiative.
2. “Open Academy School on Scientific Innovation & Translational Research” offered by Eurordis
3. “Patient Expert Training Programme” offered by Eupati

Ana emphasized the practical applications of the knowledge gained through education and empowerment. Patients and citizens can actively guide research priorities, advocate for ethical practices and the rights of those with CDG and other diseases, engage in meaningful discussions, assist in project design and management, and develop various valuable skills like empowerment, networking, communication, empathy, leadership, self-confidence, and teamwork. The key message was that patients have the power to be involved in every stage of research and medicine development, from setting research priorities to post-approval processes. Continuous learning and self-empowerment are crucial for staying informed and making a meaningful impact in the field.

Q&A Panel

Following the insightful talks, Vanessa dos Reis Ferreira invited the panelists to discuss their experiences working with patient organizations and family caregivers in research and/or educational activities.

Several crucial points were addressed by the panelists. Firstly, the importance of a strong connection between CDG patients and their physicians was stressed as an initial step for those seeking guidance. The transformative impact of a CDG diagnosis on families, from newfound hope and action for children to the different perspectives of parents with adult patients, was also discussed. Additionally, the influence of patient advocates and their priorities in shaping research and clinical decisions was emphasized. The panelists highlighted the importance of the adoption of Patient-Reported Outcome Measures (PROMs) in CDG clinical trials and the associated challenges. Collaboration among patients, caregivers, clinicians, and researchers was pointed out as essential for advancing CDG research and treatment strategies. Overall, the panelists agreed on the significant role of patients and advocates in shaping CDG research, emphasizing the need for community collaboration.

Learnings and opportunities from NGLY1 deficiency with impact across all CDG

Tadashi Suzuki, RIKEN Institute, Japan

NGLY1 is a deglycosylating enzyme acting on N-linked glycans or asparagine-linked glycans. Although NGLY1 is not directly related to CDG, it is implicated in glycoprotein metabolism. Recent *in vivo* gene therapy studies for NGLY1 deficiency have been performed in Ngly1 knockout rats, a model that recapitulates some of the symptoms of NGLY1 deficiency patients. The model rats showed improvements in motor function following intracerebroventricular administration of the human NGLY1 gene.

The presentation unveiled a potential drug target for NGLY1 deficiency, Fbs2, identified through studies done in Ngly1 knockout mice. The significance of gene therapy as a therapeutic option for autosomal recessive genetic disorders was stressed contingent on a careful assessment of the therapeutic window and administration route. Additionally, modifier genes like Fbs2 emerged as hopeful targets for further research.

RNA-guided diagnosis for CDG patients: Updates, challenges, and opportunities

Lan Lin, Children's Hospital of Philadelphia and FCDGC, USA.

Lan Lin's presentation focused on efforts to develop an RNA-guided diagnostic for CDG. Her lab focuses on RNA genomics and employs long-read technologies for RNA research. They propose that RNA-guided diagnosis can aid in identifying mutations responsible for unresolved CDG

cases. Lan Lin emphasized the importance of studying RNA splicing in understanding genetic mutations' impacts. Current CDG diagnostic methods primarily rely on DNA sequencing, but an integrated approach utilizing RNA data and considering splicing-altering pathogenic variants could significantly enhance diagnostic rates. She also showcased an example where patient RNA analysis revealed unexpected transcript isoforms due to mutations, highlighting the advantages of long-read RNA sequencing. To address cost issues, a new sequencing technology called TEQUILA-seq was developed, enabling comprehensive transcript isoform analysis for CDG-related genes. This approach has the potential to advance CDG research and therapeutic development by providing valuable datasets and facilitating genetic diagnoses based on RNA analysis.

How are researchers translating CDG research into treatments?: The GNE Myopathy (GNE-CDG) case study

Mariana Barbosa, Glycoimmunology lab, UCIBIO-FCT NOVA, Portugal

Mariana Barbosa presented the ProdGNE project, a European joint-funded initiative aimed at developing novel therapeutic approaches for GNE myopathy, an ultra-rare disease that affects a small number of individuals. The team working in the program comprises experts in medicinal chemistry, biochemistry, molecular biology, and clinical research.

GNE myopathy primarily manifests in adulthood, initially causing muscle weakness and progressing to severe muscle atrophy. The disease is linked to mutations in the GNE gene that encodes for an enzyme implicated in the sialic acid pathway, resulting in low sialic acid levels. Currently, there are no approved effective therapies for GNE myopathy, despite prior clinical trials. She introduced a new class of drugs being developed as part of the ProdGNE program. These drugs are designed to be delivered directly to muscle cells and be activated within them, with the aim of restoring sialic acid levels in GNE myopathy patients. Promising preliminary results indicate that the newly synthesized compounds, known as PGNE compounds, are approximately ten times more effective at restoring sialic acid levels compared to the current clinical trial compound, ManNAc. The research is advancing towards animal models and, ultimately, clinical trials, offering hope for effective treatment options for GNE myopathy patients.

VOICES OF CDG FAMILIES AND ADVOCATES: INSPIRING STORIES AND INSIGHTS

Femke Van Der Maat-de-Deugd, CDG Netherlands

In this interview, Femke shared her family's journey in dealing with the CDG diagnostic process. Her two sons were diagnosed with ALG6-CDG, a rare condition with very few cases reported, and she discussed the challenges they faced in obtaining a definitive diagnosis. The diagnostic process took six years, involved various genetic tests and misdiagnoses, and required the persistent efforts of a geneticist who was determined to identify the condition accurately. Ultimately, a research team's collaboration and dedication played a crucial role in discovering a new mutation and confirming the diagnosis. The interview emphasized the importance of teamwork, persistence, and the role of dedicated medical professionals in diagnosing rare diseases and providing families with much-needed answers and support.

Live interview: What are the key ingredients to setting up clinical trials for rare diseases like CDG?

Femke's conversation highlighted the challenges and limitations that the community encounters when facing a CDG diagnosis. Firstly, the rarity of the condition means that fewer patients are identified and available to participate in clinical trials, hindering the research and development of potential treatments. Secondly, the delayed diagnosis process can have severe consequences such as delayed interventions. This allows the condition to progress further before treatment can begin, and in turn, this can negatively impact patient outcomes and quality of life. Also, coping with a rare disease, navigating the healthcare system, and dealing with uncertainty can be emotionally and psychologically taxing for families.

In this live interview, panelists from various backgrounds, including patient advocates, medical doctors, and researchers, explored numerous key points related to accelerating the diagnosis and clinical trials for CDG.

Several critical factors are required to accelerate the diagnosis of CDG. Finding healthcare providers with knowledge and a genuine interest in rare diseases is the first step. Also, patient advocates play an important role in increasing awareness and emphasizing the emotional toll that CDG has on families. This in turn can guide clinicians and researchers in their work. Building a strong patient network and organizing patient focus groups contribute to the effort by providing significant insights into the wide range of CDG symptoms and experiences.

Furthermore, even for parents with minimal scientific knowledge, creating links and collaborations with scientists is critical. Even a small amount of scientific knowledge can considerably improve communication between parents and doctors, thereby accelerating the CDG diagnosis process.

Clinical trials for CDG present unique challenges that require innovative approaches. A scarcity of eligible patients is one of the most important challenges; most clinical trials rely on having a sufficiently large and diverse patient group to produce statistically significant findings. Panelists also underlined the importance of early engagement with regulatory authorities such as the FDA in order to meet all requirements, as well as the active participation of patients' families in these dialogues. Furthermore, identifying adequate outcome measures for these conditions is difficult due to high symptom variability across individuals, particularly in neurodevelopmental characteristics, that frequently do not align well with trial timetables.

Panelists provided insights into innovative trial designs, such as crossover methods, to maximize statistical power when working with limited patient groups. Persistence, time, and creative thinking proved to be invaluable advantages in overcoming these clinical trial roadblocks. Notably, financial considerations lie large, considering the significant expenses connected with conducting such studies and the possibility that financing will be drained before completion.

Also, collaboration among research institutes, hospitals, and clinics is critical. This collaboration, however, is hindered by a lack of harmonization in regulatory frameworks across countries, which poses considerable hurdles to drug development and clinical trials. Patient advocates emerge as critical intermediaries in this situation, bridging the gap between researchers, regulators, and patients. Their role in promoting communication is critical in developing a more coherent and efficient global approach to rare diseases.

Tips and resources for successful clinical trials in CDG across countries

Peter McWilliams, Chief Business Officer at Glycomine, Inc., USA.

Peter McWilliams discussed the essential elements needed for conducting clinical trials, especially across different countries, in the context of rare genetic diseases like CDG. He emphasized the importance of three key elements: patients, clinical investigators and sites, and clinical outcome measures.

He highlighted the challenge of under-diagnosis in rare diseases like CDG and the need for greater awareness and accurate diagnosis. He gave an overview of the logistical challenges in conducting clinical trials across countries, including early engagement with country regulators and finding suitable clinical trial sites. The importance of proximity to patients, especially those with special needs, was emphasized. Peter McWilliams stressed the importance of defining

clinical outcome measures, including patient-reported outcomes, which capture the real impact of therapies on patients' lives. He discussed the need to listen to the patient community and advocated for patience and persistence in the pursuit of optimal clinical trial outcomes.

Patient-Driven innovation: Revolutionizing clinical trials with technological solutions, digital biomarkers, and collaborative data collection

Elisa Ferrer-Mallol, Patient Advocacy Manager, Aparito Ltd, UK.

Elisa Ferrer-Mallol, a patient advocacy manager at Aparito, a medical technology company supporting decentralized clinical trials, discussed the paradigm shift in patient assessment in clinical trials. She highlighted the challenges of traditional clinical trial models, such as the burden on patients and families, especially in rare diseases with limited patient populations. High dropout rates and complex trial protocols also pose challenges.

Elisa Ferrer-Mallol explored the benefits of decentralized and hybrid trial models, which involve remote patient assessments, reducing costs, and improving patient-centricity. These models enhance retention, patient access, and data quality, and provide a better reflection of patients' real-life experiences.

She emphasized the importance of user-friendly technology, access to technology, and the need for analytical and clinical validation of new outcome measures. Elisa also mentioned Aparito's software platform, Atom5, which supports decentralized trials by allowing patients to record assessments via a mobile app and integrates wearables. Additionally, she discussed co-creation with patient groups to develop meaningful outcome measures that matter to patients, ensuring technology acceptability and relevance in drug trials.

Diversity, inclusion, and equity in clinical trials

Andrew C. Edmondson, FCDGC and Children's Hospital of Philadelphia, USA.

Dr. Andrew Edmondson provided an introduction to the FCDGC work in CDG and the efforts to address diversity, equity, and inclusion in clinical trials.

In his presentation, Dr. Andrew Edmondson emphasized the importance of diversity, equity, and inclusion in clinical trials and outlined the definitions of these terms. Diversity encompasses various aspects of human differences, such as race, ethnicity, gender, age, and more. Inclusion involves recognizing the value of including diverse experiences, while equity focuses on ensuring fair access to resources and opportunities for all.

He highlighted the efforts to improve racial diversity in CDG natural history studies and shared findings that suggested discrepancies between the racial makeup of the enrolled CDG patients and the broader population of individuals with CDG in the United States. This raised questions

about potential barriers at different stages of the research process, from diagnosis to research enrollment.

Dr. Andrew Edmondson underscored the need to identify and address barriers, particularly those related to funding, government regulations, exclusion criteria, and trial design. He mentioned ongoing work, including focus groups and efforts to understand why some individuals decline participation in research studies and patient advocacy groups.

In conclusion, Dr. Edmondson emphasized the importance of reducing barriers and incentivizing diverse participation in clinical trials to ensure a broader representation of the human experience and advance research in the field of CDG.

Breaking barriers: Advancing Diversity, Inclusion, and Equity in Clinical Trials

Begonya Nafria, Patient Engagement in Research Area Coordinator, Institut de Recerca de Sant Joan de Déu, Barcelona, Spain.

Begonya Nafria discussed language discrimination in clinical trials, particularly in the context of European countries. She emphasized that clinical trial sites are not evenly distributed across Europe, leading to limited access in many regions. Europe has 24 official languages, resulting in considerable language diversity. This poses a significant obstacle for clinical trials that require participants to speak specific languages, excluding those who don't. These events raise ethical concerns and highlight the importance of making clinical trials inclusive.

She also mentioned that translation is needed not only during the clinical trials but also regarding informed consent processes, patient information sheets, and patient-reported outcome measures. Begonya Nafria acknowledged that language discrimination is a global issue, not limited to Europe.

Begonya Nafria is involved in research addressing language discrimination in clinical trials, aiming to facilitate cross-border access. Her research methodology involves analyzing data from thousands of clinical trials and gathering information from clinical trial sites, primary investigators, and patient organizations. The final goal, after reaching consensus among stakeholders, is to propose recommendations for making clinical trials more inclusive, with a focus on language diversity. She underlined the need to weigh the benefits and risks when it comes to making trials more accessible.

Begonya Nafria invited patients, families, and the research community to contribute to this important project aimed at promoting diversity and equity in clinical trials.

Round table Meet the experts (Q&A)

During the Q&A session a question was raised regarding the participation of people or patients from areas outside Europe and the USA, particularly from regions like Africa and Asia. Dr.

Andrew Edmondson acknowledged the importance of including diverse sites but highlighted the challenges. These challenges include finding clinicians interested in participating, dealing with regulatory bodies, and securing funding since many trials are USA-based. While there is a desire to reduce these barriers globally, it remains a significant challenge.

Another question was raised about age limitations in clinical trials, particularly the restriction for participants above 17 years old. Dr. Andrew Edmondson explained that these limitations often stem from safety and efficacy concerns. Clinical trials aim to show efficacy first, which might mean starting with a specific age group and then expanding if the intervention proves effective. However, in some cases, the opposite happens, and only adult participants are initially allowed due to safety considerations. The age limitations are determined based on a balance between safety and the potential benefits of the intervention.

Pitch: Buddy Service App, the solution to make travel and daily life accessible for all
Fabian Kramer, CEO, Buddy Service, Spain.

In the presentation, Fabian Kramer introduced a digital marketplace aimed at simplifying accessible travel services for individuals with disabilities. He emphasized the pressing need to eliminate the barriers that people with disabilities encounter when traveling, both in terms of logistical challenges and societal perceptions. Fabian Kramer underlined the importance of offering guarantees to travelers, ensuring they can readily access essential services when visiting different cities. Buddy Service's unique proposition lies in centralizing and standardizing the booking of a wide array of accessible products and services, including transportation, accommodations, assistance, and assistive devices. Furthermore, Fabian Kramer urged a shift in perspective, emphasizing that disability should be viewed as a societal norm rather than an exception, making cities more inclusive for all.

As pointed out in the presentation, the accessible travel app represents an opportunity to bridge the gap between travelers with accessibility needs and service providers, and also to empower travelers with disabilities, granting them confidence when exploring unfamiliar cities. Overall, the goal is to build smarter, more accessible cities that meet the needs of all residents and tourists, recognizing that inclusion is a moral as well as a practical and economic imperative.

Pitch: A rainbow is born of science with a touch of magic for PIGW-CDG: The path of a family - research partner
Kelsey Lents, family research partner for PIGW-CDG, USA

Kelsey's son, Hannes, was diagnosed with PIGW-CDG. During her presentation, she highlighted the significance of the meeting by emphasizing the importance of establishing conversations

within the rare disease community in order to drive change. She additionally pointed out the importance of collaboration and interaction within this group.

She shared her experience in the initiation of the drug repurposing project in January 2023, in collaboration with Perlara Lab. Regarding her collaboration in this project, Kelsey Lents stressed the personal connection that often leads individuals to join the rare disease community and how collective efforts can impact not just one individual but potentially many. She talked about the ripple effect of rare diseases and the importance of demonstrating their potential for a broad impact beyond isolated cases. Kelsey Lents also discussed the concurrent drug repurposing projects for various PIGW genes and their collaborative nature, highlighting how shared knowledge can accelerate progress. She mentioned the challenges of fundraising for such projects, emphasizing the importance of research, community, and persistence in driving them forward. Finally, she called for greater awareness among the medical community about these options, easier platforms for family advocacy, and more labs to support rare disease and family-initiated projects.

Pitch: Empowering tomorrow's scientists: Building the Young Scientists for Congenital Disorders of Glycosylation (CDG) Network

Pedro Granjo, CDG & Allies-PPAIN, Portugal

Pedro Granjo presented the Young Scientists for CDG network. This international network, consisting of PhD students, postdocs, clinicians, and healthcare providers, was formed following the EUROGLYCAN Network meeting in Prague (June 2023). It currently comprises 21 members from eight European countries, including Lisbon, Barcelona, Italy, France, Belgium, Netherlands, Germany, and the Czech Republic.

The network's primary objective is to build a structure based on three pillars: Patient and Families Outreach, Education and Awareness, and Networking and Support:

The Patients and Families Outreach pillar aims to collaborate with global patient organizations to provide information and support to families affected by CDG.

The Education and Awareness pillar intends to raise awareness of CDG and related diseases among students pursuing biomedical fields. This includes creating curricula for different audiences and delivering lectures at universities and summer schools.

Lastly, the Networking and Support pillar aims to connect members internationally. It facilitates collaboration on research models, lab techniques, and resources, reducing duplication of efforts and offering mutual support.

Round table Meet the experts (Q&A)

The round table discussion centered on addressing the unique needs of individuals with CDG and the importance of collaboration among stakeholders. Dr. Christina Lam highlighted the potential of the Buddy Service App to cater to the daily life needs of CDG families, especially when they travel to new places. The app's broader applicability, beyond CDG, was recognized as it could benefit individuals with various disabilities.

Dr. Peter Witters expressed interest in collaborating with the Young Scientist for the CDG network, recognizing the value of young investigators who stay at the forefront of scientific research. The network emphasized its commitment to building a sustainable knowledge-sharing platform for future CDG researchers.

The discussion also touched on the challenge of translating complex medical information into lay language, especially in regions with language barriers. There is a need for patient's families to meet other families at different stages of their CDG journey, acknowledging that some are primarily focused on immediate survival.

DAY 2 OF THE 6TH WORLD CONFERENCE ON CDG (22ND JULY)

RESEARCH DRUG DEVELOPMENT, THERAPIES, AND CLINICAL TRIALS

Overview of nutritional replacement therapies for CDG

Peter Witters, Centre for Metabolic Diseases, UZ Leuven, Belgium

Nutritional replacement therapies address specific deficiencies or abnormalities in glycosylation pathways that result from CDG. Despite the presence of sugar, vitamins, or trace elements in the food that we daily eat, the supplementation of those nutritional replacement therapies has to be thoroughly tested for safety and efficacy.

Dr. Peter Witters elucidated an array of nutritional treatments already accessible or currently being explored within the realm of clinical trials. These treatments encompass diverse CDG subtypes, namely:

- Mannose for MPI-CDG.
- Fucose for SLC35C1-, FUT8-, and GFUS-CDG.
- Galactose for PGM- and SLC35A2-CDG.
- Manganese combined with galactose for SLC39A8-, SLC35A2-, and TMEM165-CDG.
- Galactose, manganese, and uridine for SCL39A8-CDG.
- Uridine for CAD-CDG.

However, the landscape of CDG therapies is marked by substantial challenges, leading to the failure of clinical trials involving nutritional replacement approaches. These challenges encompass several aspects such as: limited number of participants, impacting generalizability; the complexity of assessing global improvement in comparison to control groups; potential changes in disease severity over time; uncertainties regarding biomarker reliability and measurement techniques; the timing of therapy initiation in relation to irreversible features, and the interplay with other pathway components.

Even though challenges exist, we are making promising progress in improving CDG treatments through dedicated research and innovation.

Update about clinical trial for dietary supplementation of Galactose in SLC35A2-CDG and PGM1-CDG and lessons transferable across all CDGs

Andrew C. Edmondson, FCDGC and Children's Hospital of Philadelphia (CHOP), USA

In this section, Dr. Andrew Edmondson summarized the latest information on clinical trials involving the therapeutic use of galactose for the treatment of SLC35A2-CDG and PGM1-CDG. Regarding the PGM1-CDG clinical trial, there were two major concerns: safety and efficacy. To ensure safety, the regulatory authorities did not allow the participation of children in the study (due to the possibility of hypoglycemia), and adult participants (aged 18 and over) underwent frequent laboratory monitoring. In relation to the evaluation of efficacy, the approach involved conducting a double-blind, placebo-controlled trial and employing the measurement of outcomes with clinical significance.

Following an initial open-label pilot study that demonstrated clinical and biochemical improvements, as well as favorable safety and tolerability profiles for SLC35A2-CDG, regulatory concerns shifted to safety considerations. Special attention was given to eye exams and the need for pregnancy testing and contraception among female participants. The evaluation of the study's efficacy centered on pharmacokinetics and assessing developmental and growth outcomes.

Finally, Dr. Andrew Edmondson shared some insights from the FDA CDER & NIH NCATS webinar. Different innovative approaches were introduced, including a global statistical test of multiple endpoints. This method seeks enhancements within predefined domains, accommodating participants with diverse manifestations. The option of virtual patient participation within the study's country was also suggested during the webinar, reflecting a modern and inclusive approach to knowledge sharing and collaboration in the field.

Efficacy of oral manganese and D-galactose therapy for a novel TMEM165-CDG patient

Zoé Durin, CNRS, UMR 8576-UGSF-Structural and Functional Glycobiology Unit, University of Lille, Lille, France

In this presentation, Zoé Durin showcased how a one-year-old baby girl with TMEM165-CDG improved her symptoms after therapeutic treatment with manganese.

In a close collaboration between the Functional Glycobiology Unit, University of Lille (France), and Necker Hospital (Paris, France), Zoé Durin and colleagues confirmed the diagnosis through different techniques of molecular biology using fibroblasts of the patient (skin cells). The conventional treatment for TMEM165-CDG patients typically involves the use of D-galactose. However, previous studies carried out by Zoé Durin and colleagues showed that D-galactose is only effective for N-glycosylation defects. On the other hand, manganese, which is a trace mineral, has exhibited a high degree of effectiveness in ameliorating a wide array of glycosylation defects (N- and O-glycosylation, glycosaminoglycans, and glycolipids). With this bearing in mind, Zoé Durin and the team conducted experiments to determine the optimal

concentration of manganese for treating the patient. Notably, the treatment yielded improvements in various symptoms, particularly those associated with the liver. However, the administration of manganese can pose a significant challenge due to its neurological toxicity. To overcome this issue, the patient is being monitored continuously for potential toxic effects.

CDG CARE, MANAGEMENT, DAILY LIFE, AND WELL-BEING

Voices of CDG Families and Advocates: Inspiring stories and insights – The CDG Passport

Fiona Waddell, The Netherlands

Fiona Waddell, a MPI-CDG patient advocate in The Netherlands, presented the “CDG Passport” project and how it can be useful in daily life. The main goal of the “CDG Passport” is to provide short, clear, and relevant information about the clinical features of a specific CDG, medical treatment, overall daily care and management, as well as insights into how to communicate with the patient. The key purpose is to share all the information with daycare centers, schools, clinicians, and even with families and friends, to help them to better understand what CDG is and how to manage the disease in daily life. In the near future, the passport will be available for download in several languages and for different subtypes of CDG, from the Metabolic Emergency Protocol (<https://www.emergencyprotocol.net/>).

Live interview: Empowering families - Preparing for medical appointments and amplifying their voices

During this inspiring interview, a panel of CDG experts shared strategies and practical tips to empower patients to be prepared for medical appointments. Clinicians emphasized the significance of understanding the patient and family's medical history, especially during the first appointment. Families were encouraged to gather crucial patient information and details, symptoms, ongoing treatments, and lab results. Clinicians also advised families to prepare questions and concerns about the patient's condition, treatment, care, management, and other relevant matters. A mother of a child with PMM2-CDG also noted that having a packed "hospital-to-go bag" is highly advantageous for frequently hospitalized patients. Being prepared makes it easier for parents to deal with the situation and reduces stress.

Furthermore, clinicians shared how important the appointments are to inform and educate patients and families, as well as advised to advocate for their needs and ensure their voices are heard. The majority of the time spent in medical appointments should be dedicated to educating and empowering patients and families about CDG, its symptoms, daily care, treatment options, and clinical trials. Families should receive information in lay language, supported by infographics

and figures for clarity. Additionally, some clinicians usually provide a Survey Development tool to track developmental milestones achieved throughout the patient journey. Also, a parent emphasized the significance of having a CDG specialist as part of the multidisciplinary clinical team.

The possibility of creating a medical notebook was also discussed. It can be a highly valuable source of information, especially for the first appointment, by gathering information related to the (many) specialists following the patient, medical treatments, and previous medications. However, keeping those records may be challenging for families, mainly when significant changes occur (e.g., in symptoms or medication). Ideally, it would be much more advantageous to centralize electronic medical registrations that could be shared by all healthcare institutions (as is already in the USA and some countries of Europe).

Rare Barometer: Making the Voice of People Living with Rare Diseases (PLwRDs) heard! EURORDIS-Rare Diseases Europe Global Survey Initiative for Evidence-Based Advocacy

Rita Francisco, Survey Junior Manager EURORDIS, France.

In this talk, Dr. Rita Francisco informed the audience about the following main topics:

- What is the Rare Barometer Programme and its primary purpose;
- What is the Newborn Screening Survey, and how patients and families can participate in it;
- What information and how patients/families, associations, and other entities can access and use the results.

The Rare Barometer Programme is a EURORDIS survey initiative that aims to gather the perspectives of patients and caregivers/families on various cross-cutting subjects related to Rare Diseases to integrate those insights into policy-making and decision-making procedures. The surveys are translated into several languages and the results can be shared with patients, families, patient representatives, associations, and governmental entities.

The Newborn screening - an online survey translated into 24 languages - targeted individuals affected by a rare disease and their family members. The main goals of the survey are:

- To understand rare disease patients' views on newborn screening;
- Identify acceptable criteria for newborn screening in treatable diseases;
- Comprehend how the opinion of people living with rare diseases on newborn screening relates to their characteristics (age, gender, country, family situation, etc.).

Also, Dr. Rita Francisco explained how to access the survey, register, and participate. Families were encouraged to actively share the survey on social media to reach out to as many people as possible.

The survey findings, presented as reports and/or fact sheets, can be accessed by patients, families, institutions, patient representatives, and/or other entities. Additionally, the results can be customized for EURORDIS members. The main goal is to communicate the results and spread the word worldwide.

In conclusion, the Rare Barometer can help to overcome some of the challenges faced by patients and their families living with a rare disease. It serves as a valuable tool in addressing the limited awareness and understanding of rare diseases by collecting patients' perspectives, informing policy and decision-making, advocating and raising awareness, helping to define tailored solutions, and empowering patients.

Think Tank 2: Strengthening CDG knowledge, education, and fostering collaboration for enhanced care

The need for centralized information poses several challenges for patients, their families, healthcare professionals, and researchers. Accessing accurate CDG data, such as treatment alternatives, care procedures, clinical trials, and research findings, becomes challenging without a centralized repository with reliable data. This can result in delayed diagnoses, ineffective treatments, and limited access to the latest advancements in CDG research. By fostering collaboration and knowledge-sharing, the think tank's objective was to bring together experts, families, and individuals affected by CDG to brainstorm innovative solutions and strategies to overcome the challenge of decentralized information.

The audience suggested creating a web-based hub to gather reliable and scientifically accurate information on CDG, including treatment options, care, management, medical history, and clinical trials, presented in scientific and lay language. It was also suggested to create a multidisciplinary team to collect and share the data globally in an easily accessible manner. Furthermore, it was proposed to connect this information with National Healthcare Systems by centralizing the data in a "Passport" or "Card," providing essential information for clinicians in emergencies or when encountering CDG patients for the first time. A significant challenge that arose from the idea to create the hub was the costs associated with developing and managing this international project. One potential solution might be commercializing the information to the pharmaceutical industry in exchange for a fee (functioning like a sponsor).

Live interview: Emotional journeys - Navigating diagnosis and sibling experiences in CDG

During this touching interview, siblings of patients living with PMM2-CDG or SSR4-CDG shared their experiences of growing up with a brother or sister affected by this rare condition. The discussion embraced the challenges of a late diagnosis, limited information, and the comfort of

joining a CDG community and patient organizations. Additionally, they talk about the daily struggles of care and management and the concerns related to the uncertainty of the future.

For the healthy siblings and their families, it was a tremendous relief when the brother/sister was finally diagnosed. Knowing the name of the disease had a psychological and emotional positive impact and dramatically reduced anxiety. The diagnosis allowed the family to search for more specific information, find a community to share experiences, and encounter social and professional support. The siblings encouraged parents who are still searching for a definitive diagnosis to persevere and continue their fight. The process can be demanding, but the diagnosis will improve medical care, management, and overall quality of life.

The siblings interviewed also recommended that parents should explain to the healthy kid(s)/siblings what CDG is and include them in the process. Furthermore, they encouraged siblings to participate in common activities (e.g., playing games, listening to music, or engaging in sensory experiences) to foster bonds between them. Still, the uncertainty of the future for adults living with CDG remains a significant concern that weighs on their families.

Think Tank 3: Prioritizing behavior issues and mental health in CDG: addressing needs for CDG families

Ksenia Lebedeva, CDG & Allies and Claudia de Freitas, Researcher at Institute of Public Health, University of Porto, Portugal.

The session followed the previous day's workshop regarding CDG behavioral issues (described on page 17). Ksenia Lebedeva explained the concept of design thinking and took participants through a practical exercise using the design thinking process to solve behavioral issues related to CDG during the previous workshop.

In this session, Ksenia Lebedeva presented several successful applications of design thinking in addressing various health-related challenges, demonstrating the efficacy of the design thinking process. The strength of design thinking lies in its three essential principles: human-centered, experimental, and collaborative.

Participants in the prior workshop were presented with various challenges and invited to reframe the problem statements, to formulate clear and actionable problem statements. Building upon these redefined problem statements, the primary objective of the think tank was to identify solutions for addressing these challenges.

Claudia de Freitas invited participants to consider the problem statements during the ideation session and brainstorm potential solutions. A cross-functional team, comprising representatives from all relevant stakeholders, was assembled to categorize the generated ideas into four groups based on priority. These were the ideas that came up:

1. "Less Effort, Most Impact" Ideas:

- Creating a speech card or passport, allowing individuals to communicate their specific needs for better understanding.
- Developing an app capable of translating and enhancing speech clarity for users.
- Using sign language as an alternative communication method, which may prove more effective for certain CDG children.

2. "Incredible Ideas":

- Organizing a day at school where verbal communication is restricted, encouraging students to use alternative modalities, and fostering empathy and patience among peers.
- Promoting the accessibility of augmentative technology and communication devices to aid CDG patients in communication.

3. "Obvious Ideas":

- Ensuring an inclusive environment and seeking input from individuals with different communication styles or time needs, especially in educational settings.
- Raising awareness within society about diverse communication methods, including schools' use of communication cards.
- Equipping caregivers and educators with skills to assist children with CDG in being understood, such as using gestures and simplified language.

4. All Other Ideas:

- Initiating further research to understand behavioral characteristics and markers related to CDG with communication challenges.
- Providing education and training to experts in the field of communication for CDG.
- Promoting awareness by distributing CDG-themed t-shirts to raise understanding and empathy within communities.

All ideas generated have been gathered for future usage in the prototyping phase, which will be led by Ksenia Lebedeva.

Pitch: How to form an international team to advance understanding of the role of glycans in biology and impact CDG research: The GlycoTwinning

Paula Videira, UCIBIO, FCT-NOVA, APCDG and CDG & Allies-PPAIN

Glycans play a key role in basic molecular mechanisms; therefore, they can be used as targets for developing innovative immunotherapies to treat patients with glycosylation disorders. The main goal of the pitch was to share how the GLYCOTwinning Project has been used to enhance the comprehension of glycans biology, molecular pathways, and interactions with other molecules and potentially establish additional diagnostic tools and treatments for CDG.

The GLYCOTwinning Network is composed of a multidisciplinary team with expertise in different fields of glycoscience. The network is developing the GLYCOToolbox, which is an integrated technology that aims to characterize glycan-protein interactions. Identifying glycans and ligands is essential to elucidate the structures of glycan-protein complexes and understand glycan function in a cellular context. With this information, researchers can develop more reliable *in vitro* disease models (i.e., patient-derived platforms), biomarkers and specific treatments. Thus, the GLYCOTwinning project is an opportunity to attract and empower scientists, enhance researchers' capabilities and creativity, reinforce research management, expand dissemination efforts, boost reputation, and foster stronger collaborations.

Pitch: Unveiling Valter's Journey: An inspirational life story

Anja Højte, VALE designs, Denmark.

Valter's mother shared her intuitive awareness of his baby's uniqueness since he was born. At the age of two and a half years old, Valter received a diagnosis of PIGV-CDG. His parents didn't see the diagnosis as a critical concern, as their focus shifted toward managing his symptoms. Valter's distinct requirements, recurring epilepsy episodes, and limited responsiveness led his parents to create a home environment that suited him best. The parents were determined to provide Valter with the highest quality of life and soon discovered a significant lack of clothing options catering to specific children with disabilities. This was when the concept of VALE began taking shape. VALE, which bears the company's name and Valter's nickname, has been in operation for five years. The journey has been laborious and time-consuming but worth it.

Pitch: VALE Designs, a brand of sustainable and fashionable adaptive clothing aiming to ensure equal opportunities for all

Hugo Perdigão and Tina Sørensen, VALE Designs, Denmark

Vale® is a Scandinavian Adaptive Clothing company specializing in high-quality, comfortable, and stylish clothing for people with reduced mobility. Furthermore, Vale® offers pragmatic solutions that simplify dressing routines, reducing physical strain and enhancing overall productivity and safety for caregivers. The clothes do not contain any harmful substances or chemicals and are produced in a socially and environmentally responsible way. Notable attributes and intricate details are incorporated into this unique clothing line, which includes:

- A special fastening system;
- Hidden zippers on arms and legs;
- Special probe holes (to receive nutrition fluids and medicines);
- Open back top;
- No physical labels inside;
- Sensorial friendly materials.

For shopping or to learn more about this remarkable company, please visit the official website:

<https://vale-designs.com/>

Pitch: I was the first CDG patient in the world who had a liver transplant and I wrote the book *Survivor* about it!

Fiona Waddell, The Netherlands

Having been diagnosed with MPI-CDG, Fiona Waddell became the first CDG patient worldwide to undergo a successful liver transplant. She authored the book "Overlever" (*Survivor*, in English Language), narrating her journey's emotional and physical challenges.

After the surgery, Fiona Waddell was hospitalized for many months due to several complications. Despite some frustrations initially, her resilience and acceptance of the situation gave her peace, strength, and confidence to continue living happily and enjoying the small things of life. Nowadays, regardless of having to take some immunosuppressors, fortunately, the surgery considerably improved her quality of life and well-being. Fiona Waddell proved herself and others to be a force of nature, showcasing perseverance as she coped with the disease and overcame the setbacks on her journey.

Pitch: The App that makes medical information accessible and understandable for all
Larisa Aragón Castro, CEO and co-founder, SumMed, Switzerland, and Stefani Derzi, Chief Scientific Officer, SumMed, Switzerland.

The general population often struggles to understand medical jargon due to low levels of health literacy. Patients' and caregivers' limited comprehension can translate into a lack of empowerment, hindering the ability to make well-informed health decisions. To overcome this problem, the SumMed company designed and developed a user-friendly interface. The main goal of the App is to make medical information clear, trustworthy, and accessible to all by offering the following benefits:

- Summarize medical content from diverse sources clearly and understandably (e.g., offers the possibility to upload documents, like lab results);
- Decode complex terminology;
- Offer multilingual translation (90 languages);

- Provide related trusted information;
- Boost confidence in health choices for patients and caregivers.

Concluding, the SumMed App enhances users' understanding of medical information and empowers them to make better healthcare decisions.

DAY 3 OF THE 6TH WORLD CONFERENCE ON CDG (23RD July)

RESEARCH DRUG DEVELOPMENT, THERAPIES, AND CLINICAL TRIALS

Overview of non-nutritional replacement therapies (Part 1)

Eva Morava, FCDGC and Mayo Clinic (USA)

In this presentation, Dr. Eva Morava showcased how non-nutritional replacement therapies can help to treat the symptoms of people living with CDG. The non-dietary treatments discussed during the talk were:

- Acetazolamide (off-label use);
- Chaperones;
- Small molecules;
- Drug repurposing;
- Activated sugar therapy;
- Antisense oligonucleotides therapy;
- Preclinical gene therapy;

Dr. Eva Morava briefly shared with the audience how these options function in ameliorating some symptoms of CDG. Additionally, she explained the biochemistry pathway of each compound inside the cells and provided valuable insights about ongoing and future clinical trials.

The main conclusions underscored were:

- Different methods are being studied for treating various CDG;
- Drug development can be costly and time-consuming; therefore using already approved drugs for other conditions (drug repositioning) may be a good alternative for rare diseases;
- Acetazolamide and Epalrestat are two of the non-nutritional replacement therapies that are being developed and showing promising results for treating PMM2-CDG;
- Chaperones, alone or combined with proteostasis regulators, can help stabilize and activate enzymes for unstable mutations in PMM2-CDG.

- More testing and development are needed to find treatments for CDG in the future.

The Power of Social Innovation for Rare Diseases

Tineke Kleinhout-Vliek, Postdoctoral researcher Social Pharmaceutical Innovation / Copernicus Institute of Sustainable Development, Utrecht University, The Netherlands.

The application of the “classical” innovation system faces inherent limitations. Gathering data is complex and can be expensive, resulting in unmet healthcare needs that often accompany rare diseases. Dr. Tineke Kleinhout-Vliek, a social scientist, aimed to shed light on the concept of Social Innovation and its potential implications within the context of rare diseases. Social innovations are alternative ways of increasing access to medicines, addressing medical needs, and decreasing inequality. In a trans-Atlantic partnership, Dr. Tineke Kleinhout-Vliek and colleagues studied 15 different cases of social innovations in rare diseases. Their investigation revealed significant challenges stemming from 1. costly, 2. unavailable, 3. underdeveloped, or 4. absent medical treatments. Different social innovations were proposed to overcome these challenges:

1. Implementation of start and stop criteria for medical treatments and risk-sharing agreements between pharmaceutical companies and policymakers.
2. Leveraging pharmacist compounding techniques to create customized medications for individual patients that are only available for a limited time.
3. Pioneering programs that allow patients who do not meet the specific eligibility criteria to participate in clinical trials.
4. Fostering partnerships and collaborations between academic institutions and pharmaceutical companies, as well as including patients and the general public as partners in different healthcare and medical research areas.

These innovative solutions can blur the boundaries by increasing access to medicines, improving the critical role of clinicians in collaborations, and open possibilities for patient input (including agenda setting).

GLM-101 in PMM2-CDG, results from phase 1 and phase 2 trials

Tristen Moors, Vice President, Clinical Operations at Glycomine, Inc., USA.

In this informative talk, Tristen Moors from Glycomine shared novel insights related to the clinical study encompassing the therapeutic use of GLM-101 for PMM2-CDG. GLM-101, is an injectable new therapeutic drug composed by mannose-1-phosphate (M1P) surrounded by a layer of lipids (liposomes). The main goal is to deliver mannose-1-phosphate (M1P) inside the cells, aiming to produce guanosine diphosphate (GDP)-mannose for mannosylation of glycans. Employing liposomes as carriers facilitates the penetration of the M1P

through the plasma membrane, aiming to deliver the compound into the cell efficiently. In the 1st phase of the clinical trial, GLM101 was shown to be safe, well tolerated, and with moderate infusion reactions in adult healthy volunteers. Phase 2 is being carried out in adults with PMM2-CDG using different concentrations (10, 20, and 30 mg/kg) for 12 or 24 weeks. The main goal for the future is to perform clinical trials with adolescents using the same concentrations.

In conclusion, although the clinical trials are still in progress, Tristen Moors emphasized the promising potential of GLM-101 for PMM2-CDG patients, hinting at hopeful outcomes in the future.

Drug repurposing in CDG: Update, challenges and opportunities

Ethan Perlstein, Perlara (USA).

Drug repurposing involves finding new therapeutic uses for existing drugs. In rare diseases like CDG, where developing new drugs from scratch can be challenging and time-consuming, repurposing offers a quicker and potentially more effective way to identify treatments, utilizing drugs already approved or in development for other conditions.

One way to accelerate drug repurposing testing is using simple patient avatars (i.e., disease models). Researchers can assess drug efficacy by genetically modifying these models (e.g., yeast, flies, worms, fish, or fibroblasts), bypassing the need for more time-consuming and expensive mouse/rat models.

Ethan Perlstein also shared details about how Perlara is progressing in developing a CDG yeast model for drug screening tests. Currently, researchers have successfully introduced various CDG mutations to generate specific yeast models representing distinct CDG subtypes. Unceasing efforts are in progress to broaden the diversity of these models, intending to increase their number over time.

Acetazolamide CDG: Update and lessons for all CDGs

Christina Lam, FCDGC, Seattle Children's Hospital (USA).

An earlier clinical study conducted by Dr. Mercedes Serrano and colleagues in Barcelona, Spain, showed that Acetazolamide was safe and effective in enhancing motor cerebellar syndrome in individuals with PMM2-CDG. While the outcomes appeared promising, this study raised some concerns. Among the issues identified were the absence of a placebo control group, lack of blinding, and challenges in precisely adjusting the dosage. To address these challenges, the solution involved conducting a new clinical trial: a double-blind, placebo-controlled, randomized study of Acetazolamide versus Placebo in individuals with PMM2-CDG (>4 years old). The trial was stratified based on age and severity and included a safety extension phase. One of the main

objectives was to recruit 26 participants for a 6-month clinical trial, followed by an extended period of 2 years for open-label use. The study's primary objective was to evaluate the efficacy of acetazolamide in improving ataxia in individuals with PMM2-CDG.

However, before starting a clinical trial, an Investigational New Drug (IND) must be submitted to the FDA. The IND is a crucial milestone in the process of bringing a new medication or treatment to market. It represents a formal request to the FDA for permission to initiate clinical trials with the new drug. The goal of the IND application is to demonstrate the drug's safety and efficacy through a series of well-defined phases, ultimately leading to the FDA's final acceptance for market approval. The process is laborious, time-consuming and requires much paperwork with more than one hundred pages.

The IND was granted in January 2023. This activity helps the rare diseases community by:

- Giving clinical trial experience to the CDG community,
- Bringing hope, if Acetazolamide is really helpful and worth the trouble of taking medication every day,
- If found to be helpful, it may be able to expand studies into other types of N-linked CDG subtypes.

The key take-home messages of this process were:

1. Early involvement with the FDA is crucial due to the lengthy duration of processes.
2. Patient engagement holds significant importance.
3. Trial duration must be both realistic and feasible.

Epalrestat repurposing in PMM2-CDG: Update and lessons for all CDG

Eva Morava, FCDGC and Mayo Clinic (USA)

The utilization of patient avatars for repurposing and screening drugs has proven to be an efficient and accelerated approach. Epalrestat, initially developed for diabetes to counter high blood sugar and sugar alcohol (sorbitol), was tested in a patient avatar of PMM2-CDG. The models showed improved glycosylation activity. Moreover, tests conducted on PMM2-CDG patients revealed that 80% had elevated sorbitol levels (which are toxic for the nervous system), prompting the consideration of a clinical trial using Epalrestat.

The main goals of using Epalrestat in PMM2-CDG individuals are:

1. Improve phosphomannomutase 2 (PMM2) activity for better glycosylation;
2. Improve lab abnormalities in blood;
3. Decrease sugar alcohols in urine;
4. Improve clinical symptoms.

The results of administering Epalrestat to a single patient (Maggie) demonstrated significant improvement in glycosylation. Encouraged by these promising results, a Phase 3 randomized, double-blind, two-period study is currently underway to assess the safety and efficacy of Epalrestat in children with PMM2-CDG. The primary outcome measures are International Cooperative Ataxia Rating Scale (ICARS), motor function, antithrombin three deficiency, and sorbitol in the urine. If the drug demonstrates its efficacy, other patients will have the opportunity to use this medication during the open-label period.

If Epalrestat demonstrates both safety and efficacy, it has the potential to be used in other CDG subtypes.

CDG CARE, MANAGEMENT, DAILY LIFE, AND WELL BEING

The role of the advanced clinical practitioner in the care and management of Congenital Disorders of Glycosylation (CDG)

Mel McSweeney, Great Ormond Street Hospital (GOSH), London, UK.

Dr. Mel McSweeney, an experienced Advanced Nurse Practitioner, presented valuable insights during her talk, shedding light on the pivotal role of Advanced Clinical Practitioners (ACPs) in the care and management of individuals with CDG.

Dr. Mel McSweeney delved into the job of ACPs, who have expert clinical knowledge and skills. ACPs are free to make their own decisions on patient assessment, diagnosis, and treatment. They are also critical in reducing treatment delays and providing interim care, especially in a healthcare system constrained by waiting lists. ACPs operate as a hybrid between nursing, allied health professionals, and medicine to effectively meet patients' diverse needs.

The talk explored the multidisciplinary approach to patient care, emphasizing the patient at the center. Besides ACPs, the healthcare team includes clinicians, general practitioners, pharmacists, and dietitians.

The four pillars of ACP practice are clinical practice, facilitating learning, leadership, and evidence-based research and development. The proportion of each pillar's emphasis may vary depending on the practitioner's role and experience.

She described how ACPs are uniquely positioned to take on complex decision-making, clinical judgment, and problem-solving.

Education was another pivotal aspect of ACP roles, involving staying informed, mentoring junior staff, and disseminating knowledge. Finally, Dr. Mel McSweeney mentioned the critical role of ACPs in research and data collection, as they identify potential patients for clinical trials,

collaborate with pharmaceutical companies, and contribute to developing evidence-based practices.

In summary, have a multifaceted role in CDG patient care, encompassing clinical expertise, education, leadership, and research. Their invaluable contributions ensure high-quality, patient-centered care within a multidisciplinary healthcare system.

The recipe to build excellence from scratch: Overcoming challenges in establishing a center of excellence for CDG

Christin Johnsen, MD, University Medical Center Göttingen, Clinic for Pediatrics and Adolescent Medicine (Germany)

During the talk, Dr. Christin Johnsen shared with the audience what are the main “ingredients” to successfully create a clinic specialized in CDG and the main challenges to maintain excellence in treating and caring for patients.

The ongoing challenges underscored were:

- The complexity of the disease (more than 170 subtypes);
- The amount of time needed to be spent with the patient as they are unique in the world;
- The lack of available treatment options (and the hopes and expectations of families);
- Complicated regulatory processes.

To overcome these challenges, “passion for CDG” is one of the key elements to succeed and help patients and families facing their difficult journey. Other fundamental ingredients are:

- Expertise: acquired by attending conferences and meetings, asking other CDG specialists, joining CDG collaborations, and patient groups (e.g., Facebook)
- Great team: composed of nurses, multidisciplinary specialists (including outside of CDG) and importantly, to have a metabolic dietitian;
- Flexibility: because patients have unique needs and it is imperative to hear them and be patient.

She also highlighted the advantages of the clinician being prepared for the appointment in advance (by gathering information about the patient, preparing education materials, finding out about potential therapies), writing the final patient report as soon as possible, and sharing it with patients and families.

Dr. Christin Johnsen finalized the presentation by emphasizing the importance of creating CDG clinics in all countries to avoid the burden of the costs and time spent traveling between countries and provide the best treatments and care for all CDG patients.

Live interview: Transcending borders: Best practices from CDG Centers of Excellence for global impact.

During this live interview, the clinicians shared with the audience the key elements necessary for managing a center of excellence focused on treating patients with CDG. They also explained how they collaborate globally despite limited funding.

In their view, dedication, connection to the CDG network, passion, and expertise constitute some of the essential core elements for success in this field and for becoming a proficient professional. To foster worldwide collaboration, experts emphasized the importance of uniting national groups and coordinating activities to establish an international society and develop a centralized repository of information to benefit the CDG community. Funding these endeavors involves critical steps such as partnering with the pharmaceutical industry and actively seeking research funding.

Live interview: Funding the Future: Accelerating Research and Drug Development for CDG through successful project examples and funding strategies.

During this session, the experts provided guidance on securing funding for research projects and clinical trials to enhance drug development for CDG. The key ideas and potential strategies are summarized as follows:

- The CDG multidisciplinary teams should have complementary skills and work together with national referral centers. Additionally, joining larger consortia (e.g., related to neurological disorders) can open the door for larger projects and increase the funds.
- Reach out to the pharmaceutical industry for collaboration to secure funding as they become more interested in rare diseases.
- Collaborate with physicians, clinics, and other companies from different fields and explore solutions that bring mutual benefits.
- Establish incremental milestones and seek funding gradually while progressing toward the final product. For instance, one could seek funding to demonstrate the drug's efficacy in animal models, and upon successful achievement, request funds for a clinical trial involving the study of the safety of the drug in healthy volunteers, and so forth. The main goal is to decrease the risk of the project and open the possibility of collaborating with different investors.
- Integrate the patients and families in the research project as they are deeply motivated and eager to contribute as much as possible. By involving them, it becomes possible to identify shortcomings and manage their expectations, leading to a more comprehensive understanding of the process.

- CDG families and advocate groups should use the benefits of social media platforms to increase awareness and secure funding.

CONCLUSION AND FUTURE DIRECTIONS

The 6th World Conference on CDG marked a significant milestone in collaborative efforts to address the complex challenges posed by CDG. Building on the insights gained and collaborative spirit nurtured during this conference, several conclusions and future directions emerged:

- Integrating emerging technologies, such as the development of innovative research techniques (e.g., patients' avatars), should be prioritized in CDG research and drug development, offering new avenues for faster drug screening, personalized therapies and the creation of more effective clinical trials.
- Exploring drug repurposing is a promising avenue for CDG research and treatment. This approach involves investigating existing drugs for potential applications in CDG, leveraging known safety profiles and mechanisms. The application of repurposed drugs expedites therapeutic options, saving time and resources. Efforts to identify and validate promising candidates for repurposing should be intensified, potentially accelerating treatment availability and improving the lives of CDG patients.
- Enhancing global connectivity and collaboration is essential, with a focus on strengthening networks among CDG researchers, clinicians, and patient communities across borders to accelerate clear and accurate knowledge sharing.
- Advocating for policy reforms and increased funding for CDG research at national and international levels is crucial to fuel advancements and ensure equitable access to innovative treatments and interventions.
- Using the potential of patient-driven initiatives and community engagement by empowering individuals and families affected by CDG to actively participate in research, share experiences, and influence the direction of future studies, is critical.







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“If you want to go fast, go alone. If you want to go far, go together.”



African Proverb

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