The Mycetoma Research Center,
University of Khartoum
WHO Collaborating Center
on Mycetoma & Skin NTDs

2024 Annual Report

Aspire, Collaborate, & Keep Growing

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The Director Message

As we reflect on the year 2024, we acknowledge the extraordinary challenges we faced in the wake of the ongoing war in Sudan. Despite the uncertainty and adversity, we have remained committed to our mission of promoting the ongoing discovery and development of scientific knowledge and clinical skills to improve the care of Mycetoma patients. Our work this year has been shaped by the realities of adapting to the evolving situation with care and urgency while continuing to support researchers and healthcare providers in managing mycetoma patients. It has also been guided by the unwavering belief that, together, our team has been able to overcome these difficulties.

Despite these challenges, the 2024 Annual Report marks a year of transformative progress and global collaboration in the fight against mycetoma and other skin-related neglected tropical diseases (NTDs). With profound pride and a deepened sense of purpose, we celebrate the milestones achieved by our team, whose relentless dedication has advanced both scientific innovation and patient-centered care. Over the past year, our scientific research has yielded critical insights into the epidemiology and molecular mechanisms of mycetoma, enabling the development of more accurate diagnostic tools and targeted therapies. Good scientific work in genomic studies and biomarker identification has brought us closer to bridging the diagnostic delays that have long hindered effective treatment, particularly in resource-limited settings.

As a World Health Organization (WHO) Collaborating Center, our mission transcends geographical boundaries. This year, we strengthened partnerships with global health bodies, academic institutions, and grassroots organisations, fostering a unified approach to combating these overlooked diseases. Through initiatives like the Global Mycetoma Working Group, as well as research centres and institutes, we have expanded training programmes for healthcare workers in endemic regions, disseminated accessible educational materials, and supported the rollout of telemedicine platforms to reach remote communities. Our advocacy efforts have also amplified policy dialogues, ensuring mycetoma remains a priority on the global health agenda.

Central to our progress is the resilience and trust of the patients we serve. Their courage fuels our determination to eliminate the physical and social burdens of mycetoma. Simultaneously, community-led awareness campaigns have reduced stigma and empowered individuals to seek care earlier, a critical step in preventing lifelong disability.

Looking ahead, we remain steadfast in our commitment to innovation and equity. With new clinical trials underway and artificial intelligence-driven diagnostics in development, we aim to revolutionise care delivery while advocating for sustainable funding mechanisms to ensure no patient is left behind. Together with our partners and communities, we are shaping a future where mycetoma and skin NTDs are no longer neglected but consigned to the past.

This report is a testament to collective action, and we invite you to join us in this vital journey.

Prof Ahmed Hassan Fahal,

MBBS, FRCS, FRCSI, FRCS(Gal), MD, MD,
FRCPath, FRCP(London)

The MRC Message

The Mycetoma Research Centre (MRC), founded in 1991 at the University of Khartoum, has established itself as a pioneering institution dedicated to the global fight against mycetoma, a neglected tropical disease (NTD) that causes severe suffering in impoverished populations, primarily in sub-Saharan Africa, South Asia, and Latin and South America. Over more than three decades, the MRC has evolved into a comprehensive, multidisciplinary hub that integrates advanced scientific research, compassionate patient care, capacity building, and active advocacy to address the complex challenges posed by this often misunderstood disease.

At its core, the MRC has made significant contributions to understanding mycetoma by conducting pioneering scientific research that spans from basic sciences to applied innovations. Its investigations into the causative agents, particularly the fungal pathogen Madurella mycetomatis and various bacterial actinomycetes, have provided critical insights into disease transmission, genetic susceptibility, and environmental reservoirs. Collaborations with renowned institutions have facilitated whole-genome sequencing of the pathogens, paving the way for targeted therapies. Additionally, the development of affordable diagnostic tools, such as PCR kits and application-based histopathological imaging algorithms, has revolutionised early detection, particularly in remote and resource-limited settings, where delays often lead to irreversible disabilities.

The MRC's clinical work is equally transformative. Its state-of-the-art referral clinics located in Kassala, Wad Onsa Satellite Centre, and Khartoum serve thousands of patients annually, offering multidisciplinary care that includes diagnosis, medical treatment, surgery, nursing, rehabilitation, and personalised treatment plans aimed at limb preservation. The integration of telemedicine has expanded the reach of these services, enabling real-time consultations with healthcare providers in rural areas of Sudan and beyond, thereby significantly improving access to specialist care and enhancing patient outcomes.

Recognising that sustainable progress depends on local expertise, the MRC has prioritised capacity building and education. Through workshops, webinars, and training programmes, it has trained a generation of healthcare professionals equipped to diagnose and manage mycetoma more effectively. The establishment of the African Mycetoma Working Group has fostered south-south collaboration, empowering regional

> **no disease is incurable when met with innovation, empathy, and collective resolve**

institutions to lead research, surveillance, and control efforts. The MRC also mentors young scientists through master›s and PhD programmes and partnerships with universities worldwide, ensuring the development of future leaders in NTD research and advocacy.

On the global stage, the MRC has played a vital role in shaping policies to combat mycetoma and other neglected tropical diseases (NTDs) of the skin. Since becoming a WHO Collaborating Centre in 2015, it has contributed to the inclusion of mycetoma in the WHO/NTDs list and the WHO's 2022–2030 Roadmap for Neglected Tropical Diseases, advocating for its recognition as a significant public health issue. Its advocacy has resulted in tangible policy changes, such as Sudan's integration of mycetoma treatment into its national health insurance scheme and the establishment of cross-border surveillance networks to monitor disease trends and inform targeted interventions.

The MRC's impact extends deeply into communities through culturally sensitive awareness campaigns delivered via radio, television, mobile health units, and school health programmes. These efforts have educated large populations on the importance of prevention, recognising early symptoms, and the need for timely treatment. Partnerships with local leaders and patient advocacy groups have helped reduce the stigma associated with the disease, encouraging individuals affected by it to seek care promptly. The centre's comprehensive patient registry, one of the largest globally, provides valuable data for tailoring interventions and amplifies patient voices in setting research priorities.

Looking toward the future, the MRC is committed to innovation and scientific advancement. It is pioneering the use of artificial intelligence to develop predictive models for mycetoma diagnosis and treatment outcomes, which could significantly reduce disease burden. Research into novel antimicrobials and immunotherapies aims to shorten treatment durations from years to months, alleviating the physical, emotional, and financial toll on patients are in progress. The centre is also exploring the environmental and ecological factors influencing disease distribution, such as climate change and land use patterns, to develop proactive strategies for prevention, embodying a true "One Health" approach.

Throughout its journey, the MRC has remained steadfast in its dedication to health equity. Its efforts exemplify how bridging the gaps between scientific discovery and real-world application, as well as fostering collaboration between local communities and global partners, can dramatically improve outcomes for marginalised populations. The centre's work underscores a fundamental truth: no disease is incurable when met with innovation, empathy, and collective resolve.

As the MRC approaches its fourth decade, it continues to strive for a future where mycetoma is no longer a neglected disease but a condition that can be effectively prevented, treated, and ultimately eradicated. Its ongoing commitment is not just to scientific progress but to moral responsibility, ensuring that even the most marginalised communities have access to health, hope, and a future free from suffering. The Mycetoma Research Centre exemplifies how dedicated research, compassionate care, and global advocacy can transform lives and bring about lasting change in the fight against neglected tropical diseases.

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2024 at a Glance

Research Excellence

Published over 20 peer-reviewed articles covering diagnostics, treatment protocols, epidemiology, and molecular biology, advancing the scientific understanding of mycetoma.

Clinical Impact

Handled numerous new cases, implementing innovative multidisciplinary treatment approaches that have markedly improved patient outcomes and quality of life.

Capacity Building

Conducted more than 15 specialised training workshops and webinars, reaching a broad network of scientists and healthcare professionals across Sudan and internationally.

Community Outreach

Carried out extensive awareness campaigns, resulting in increased early detection of cases and a reduction in disease progression within affected communities.

Global Recognition

Strengthened collaborations with the WHO and leading international research centers, contributing to policy development and advancing scientific research efforts.

Advances in Research & Innovation

This year marked a groundbreaking milestone in the field of mycetoma research with the anticipated publication of the results from the first-ever clinical trial dedicated to this neglected tropical disease. Conducted amidst challenging circumstances, including the global COVID-19 pandemic and ongoing political instabilities within the country, the trial exemplified resilience and unwavering commitment from researchers and healthcare professionals alike. Despite these obstacles, the successful execution of the study underscores the dedication to advancing treatment options for mycetoma. The trial's promising results offer renewed hope to patients suffering from mycetoma. Notably, the new drug developed through this research is designed to be patient-friendly, with a simplified regimen of once-weekly administration. This approach not only improves patient compliance but also reduces the burden of continuous hospital visits, making treatment more accessible, especially in resource-limited settings. Overall, these findings represent a significant leap forward in the fight against mycetoma, paving the way for improved clinical management and inspiring further research to eradicate this neglected disease. The successful trial and its subsequent publication stand as a testament to perseverance in scientific inquiry, even under adverse conditions, and herald a new era of hope and better health outcomes for affected communities.

Also, in 2024, the MRC published the first-ever machine learning-based computational model study designed to identify the causative agents of mycetoma by analysing histopathological images of mycetoma grains. Using a dataset of 890 grain images from 168 patients in Sudan, the model achieved an accuracy of approximately 92%, comparable to expert diagnosis. The approach demonstrated robustness to minor segmentation errors and variations in image acquisition, with texture homogeneity being the most significant feature for classification. The findings suggest that this semi-automated method could be highly beneficial for rural settings with limited access to specialised pathologists, offering a reliable tool to assist in diagnosis and guide appropriate treatment strategies.

2024 - Publications

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MRC - Post-graduate Students

The Centre actively supports post-graduate students pursuing master›s and doctoral degrees, providing them with mentorship, research opportunities, and access to cutting-edge facilities. Furthermore, researchers and scientists at the MRC are involved in innovative studies ranging from epidemiology to drug development, contributing valuable insights to the global understanding of mycetoma.

Post-gradate Students in 2024:

The following students obtained their PhD degrees

Dr Hyam Omer Ali obtained her degree in collaboration with the University of Orleans, France.
Title: Evaluation of a computational model for mycetoma-causative agent identification.

Dr Lamis Yahia obtained her PhD in partnership with University Tours, France.
Title: Emerging therapeutics: The imidazo[1,2-b]pyridazine scaffold as a novel drug candidate for eumycetoma, a neglected tropical disease.

Dr Emmanuel Edwar, in collaboration with Erasmus Medical Center, University of Rotterdam, The Netherlands.
Title: New molecular diagnostics for mycetoma
- Dr Rayan Ali obtained her degree in collaboration with the University of Sussex, UK.
Title: Genetic background of mycetoma patients.

PhD in Progress
Dr Eiman Siddig Ahmed, in collaboration with the NIHR Global Health Research Unit on Neglected Tropical Diseases at Brighton and Sussex Medical School, UK, supported by the National Institute of Health Research, UK. Title: Wound management; the socio-economic impacts.

Mrs Rihab Ahmed Hassan in collaboration with the Erasmus Medical Centre, Rotterdam University, The Netherlands. Title: In-vitro susceptibility pattern of different antimicrobial classes against actinomycetoma and eumycetoma

Masters Students:

Ms. Nema Ahmed Alfaki, MSc in Infection Biology studies, Swiss Tropical and Public Health Institute, Basel, Switzerland.
Mrs Lubna Sulyman EL Nour, MSc in Tropical Medicine and Global Health, University of Nagasaki, Japan.
Dr Samira Mohammed, MSc Hospital Pharmacy, National University, Sudan.

Capacity Building, Education & Training

The Mycetoma Research Centre (MRC) is recognised not only for its pioneering research and innovative treatments but also for its dedicated medical and healthcare staff, post-graduate students, researchers, and scientists who form the backbone of its success. The Centre places a strong emphasis on staff capacity building, education, and training to ensure sustainable progress in the fight against mycetoma and other neglected tropical diseases.

The multidisciplinary team at the MRC, including clinicians, laboratory technologists, researchers and support staff, are continuously engaged in professional development activities. They participate in specialised training programmes, stay updated with the latest clinical protocols, and collaborate on research initiatives to enhance patient care and treatment outcomes.

Conferences & Presentations

To foster expertise and ensure the widespread dissemination of knowledge, the MRC organises and participates in a variety of conferences and meetings to meet the diverse needs of researchers, healthcare professionals, and students.

Médecins Sans Frontières Scientific Days, London, UK, May, 2024

The Mycetoma Research Center took part in the annual "Conference Without Borders," organised by Médecins Sans Frontières in London, one of the most esteemed academic conferences hosted by MSF. During the event, Professor Ahmed Fahal, Director of the MRC, presented findings from a study titled «Once-weekly repurposed fosravuconazole versus daily itraconazole, combined with surgery, in patients with eumycetoma in Sudan,» which was a randomised, double-blind, phase 2 proof-of-concept trial aimed at evaluating the superior efficacy of the two treatment regimens.

Africa Health ExCon 2024, Cairo, Egypt, June, 2024

Professor Ahmed Fahal participated in Africa Health ExCon 2024, held in Cairo, Egypt, from June 3rd to 6th, 2024, which is Africa's largest conference and medical exhibition. During the event, he delivered a presentation titled «Mycetoma: The Challenges and Prospects,» highlighting the obstacles faced in addressing this disease and showcasing how the Mycetoma Research Centre has creatively overcome these challenges. He emphasised the urgent need for increased attention, research, and innovative solutions for mycetoma and other neglected tropical diseases, calling for a greater focus on these often-overlooked health issues.

Luxor Derma 2024, Cairo, Egypt, August 29th- 30th 2024

Professor Ahmed Fahal delivered a presentation on mycetoma, highlighting the Mycetoma Research Centre's extensive experience in tackling this disease. He discussed the challenges encountered, as well as the innovative strategies and significant progress made by the Centre in combating mycetoma and enhancing the quality of life for affected patients. Additionally, he emphasised the Centre's vital efforts in addressing the disease on national, regional, and global levels, showcasing its commitment to advancing research, treatment, and awareness worldwide.

The WHO-African Region Webinar
Mycetoma in Africa: Current Status and Perspectives, May 2024.

The WHO African Region organised a webinar on Mycetoma in Africa, bringing together experts to discuss its current status, challenges, and future perspectives. The session highlighted the disease's burden, diagnostic advances, and treatment options, emphasising the need for increased research and awareness.
Participants stressed the importance of integrating mycetoma management into broader neglected tropical disease (NTD) programmes. This approach can enhance surveillance, resource utilisation, and healthcare delivery, ultimately benefiting the affected communities. The webinar also emphasised the importance of community engagement, training healthcare workers, and strengthening health systems to ensure sustainable control efforts. Overall, the event promoted collaboration and advocacy to reduce the disease burden and improve the quality of life for those affected across Africa.

The Science Summit: the United Nations General Assembly 79, September 2024

The Science Summit featured a significant event titled «Managing Challenges and Building Resilience.» The MRC actively participated in this webinar, which aimed to address the broader impacts of current global and regional crises on science, technology, and innovation, particularly in conflict-affected regions like Sudan.

The MRC highlighted how ongoing conflict and instability in Sudan have disrupted scientific research, healthcare delivery, and innovative efforts, including those related to neglected tropical diseases such as mycetoma. The discussion emphasised the importance of resilience in scientific institutions and the need for sustainable strategies to maintain progress despite challenging circumstances.

The webinar provided a platform for objective dialogue among international experts, policymakers, and stakeholders, leading to practical recommendations. These included strengthening local research capacities, fostering international collaborations, ensuring continued funding, and integrating science and innovation into national recovery plans. The MRC's example illustrated both the challenges faced and the resilience demonstrated by scientific institutions working under difficult conditions.

The Arab Doctors Union Conference

The Mycetoma Research Centre actively participated in the 2024 Annual Arab Doctors Union Conference, held in Amman, Jordan, showcasing its ongoing efforts and dedication to combating neglected tropical diseases. During the conference, Prof. Fahal delivered a compelling presentation on the profound impact of the ongoing conflict in Sudan on the global fight against mycetoma and other skin-related neglected tropical diseases. He highlighted how the conflict has exacerbated the challenges faced in disease surveillance, diagnosis, treatment, and research, disrupting healthcare services and limiting access to necessary medical interventions for affected populations. The presentation highlighted the challenges of maintaining progress amid instability, including resource shortages, community displacement, and damaged healthcare infrastructure. Despite these setbacks, Prof. Fahal emphasised the importance of innovative strategies, international collaboration, and sustained advocacy to overcome these obstacles. He called for a coordinated global response that prioritises vulnerable populations, strengthens healthcare systems, and promotes research to develop affordable diagnostics and treatments. The conference provided a vital platform to raise awareness about these issues and foster partnerships aimed at ensuring continued progress in the fight against mycetoma and other skin neglected tropical diseases, even in the face of ongoing geopolitical challenges.

Science Summit Conference, Open Science

In September 2024, the Mycetoma Research Centre contributed to the Science Summit Conference, held in conjunction with the United Nations General Assembly 79, through an engaging open science webinar. This high-profile event provided a global platform to promote the principles of open science, transparency, collaboration, and accessibility in addressing pressing scientific research challenges. During the session, Dr Lamis El Khair and Prof Fahal delivered insightful presentations that highlighted the MRC's pioneering efforts in open science activities. Their contributions demonstrated how the MRC exemplifies the transformative potential of open science to enhance research efficiency, promote equitable access to knowledge, and ultimately improve health outcomes for affected populations worldwide. This participation underscored the center's commitment to advancing science through collaboration and openness, aligning with the broader goals of sustainable development and global health equity.

Ain Shams University and the Japan International Cooperation Agency (JICA) training workshop

In partnership with Ain Shams University, the Mycetoma Research Centre (MRC) participated in the Infection Prevention and Control of Neglected Tropical Diseases (NTDs) in the Era of COVID-19 training workshop, held from 3 to 28 November 2024. The workshop was organized by Ain Shams University in collaboration with the Japan International Cooperation Agency (JICA) and the Egyptian Agency of Partnership for Development (EAPD).

The MRC contributed to the workshop through three presentations:

1. Mycetoma: Challenges and Opportunities — delivered by Professor Ahmed Fahal, introducing participants to mycetoma, outlining the challenges in its management, and highlighting opportunities for advancing research and control efforts.
2. The Mycetoma Research Centre: Experience and Achievements — focusing on the MRC's strategies for managing mycetoma, overcoming challenges, raising awareness, and strengthening advocacy for the disease.
3. Funding Opportunities and How to Raise Funds for Neglected Tropical Diseases (NTDs) — drawing on the MRC's experience in resource mobilization, Professor Fahal shared practical strategies for securing funding, the key requirements for successful grant applications, and an overview of major global funding bodies that support NTD research and control.

Dr. Samira M. E. Hussein, Research Assistant at the MRC, participated as an attendee and contributed to representing the Centre at the event

MRC at UNESCO

The Mycetoma Research Centre (MRC) continues to stand out as a pioneering institution in scientific research in Sudan. Despite the challenges imposed by the ongoing conflict, MRC remained deeply engaged in regional and international efforts to advance higher education and scientific research, working closely with UNESCO and other partners in 2024.

Contribution to the Sudan Transitional Education Plan (TEP) 2025–2027

In June 2024, MRC participated in the Sudan Transitional Education Plan (TEP) 2025–2027 Higher Education Consultation Workshop, organized by UNESCO. The workshop took place in Cairo from 26–27 June 2024 and provided a vital platform for dialogue on strategies to address the severe challenges facing higher education and scientific research in Sudan as a result of the war. MRC representatives actively contributed to discussions on rebuilding the sector and aligning research priorities with national recovery efforts.

Brainstorming on Utilizing AI and IT in Scientific Research and Higher Education

In August 2024, MRC also took part in the UNESCO Khartoum Office’s workshop on Brainstorming on Utilizing AI and IT in Scientific Research and Higher Education. The aim was to identify priority activities for supporting the integration of AI and IT into these fields and to unite the Sudanese AI and IT community around opportunities for collaboration and innovation.

During this workshop, Professor Ahmed Fahal presented on Integrating Higher Education within the Local Education Group (LEG) Scope of the TEP 2025–2027, emphasizing the critical role of scientific research. Alongside Dr. Samira Hussein, MRC engaged in productive discussions that generated recommendations on maximizing the use of AI and IT tools. The workshop concluded with agreed priorities and system needs for applying these technologies in scientific research and higher education in Sudan.

MRC Training Workshops

Regularly scheduled lectures and hands-on workshops were organised to provide comprehensive training that enhances a wide range of skills essential for effective healthcare delivery and scientific research. These educational sessions focused on enhancing clinical skills, laboratory techniques, and research methodologies, ensuring that participants remained up-to-date with the latest advancements in their fields. Designed to serve medical professionals, students, and community health workers, these workshops aim to build local capacity by equipping participants with practical knowledge and hands-on experience that can be directly applied in patient management and community health initiatives. By fostering continuous learning and skill development, these programmes contribute to strengthening healthcare systems, promoting best practices, and ultimately improving patient outcomes and public health standards within the local and broader community.

The training workshops included the following:

- Good research, what is it?
- Research Funding Opportunities
- Harnessing Technology to Achieve High-Quality Publications
- Research Management
- Presentation Skills I
- Presentation Skills II
- Research Methodology Overview
- Research Study Design
- Winning Proposal Writing
- Group discussion: Research Ideas
- Literature Search
- Clinical trials at a glance
- Clinical trials: Sharing experience from the Mycetoma Research Centre
- Curriculum Vitae Writing
- Moodle: Learning Management System
- The R -R-platform
- Bioinformatics tools in mycetoma scientific research

Scientific Research Support and Funding in Port Sudan, Sudan

Professor Fahal delivered a presentation on «Scientific Research Support and Funding» in Port Sudan, under the patronage of Dr Amira Abbas, Director General of the Police Administration of Health Services at the Police Hospital, in collaboration with the National University. The event brought together professors and physicians from the National Ribat University, the National University, and the Police Hospital. During his presentation, he highlighted the critical role of scientific research in enhancing healthcare services and offered guidance on securing funding from various organisations. The session fostered an engaging and interactive discussion, ultimately leading to the formation of a research group dedicated to addressing challenges in the field, with the goal of advancing scientific research efforts.

Presentation Skills Training Workshop, National University-Sudan, Cairo, Egypt

On November 20, Professor Fahal led a training workshop on Presentation Skills at the National University-Sudan in Cairo. The workshop consisted of a series of sessions designed to improve presentation techniques. In this engaging and interactive format, he covered the basics of delivering effective presentations, highlighting key principles and methods. He also discussed different types of presentations and how to prepare for each one. The sessions created a collaborative atmosphere, encouraging participants to share their experiences and insights on memorable presentations, both good and bad. Attendees were also invited to explore strategies for engaging and maintaining the audience's attention. The workshop attracted a diverse group comprising faculty deans, academics, researchers, and students, all of whom were interested in enhancing their presentation skills.

Harnessing Technology to Achieve High-Quality Publications, National University, Cairo, Egypt

On October 31, Professor Fahal delivered a presentation titled «Harnessing Technology to Achieve High-Quality Publications» at the National University - Sudan in Cairo. In his talk, he examined various technologies and artificial intelligence platforms that can be utilised to produce high-quality publications, emphasising their proper and effective use. The interactive session was attended by a diverse audience, including faculty deans, academics, and university students from both medical and non-medical disciplines.

Scientific Research Opportunities Training Workshop

On October 24, Professor Ahmed Fahal delivered an engaging presentation on Research Funding Prospects at the National University in Sudan, held in Cairo. The event drew a diverse audience, comprising individuals from both medical and non-medical fields, including professors, university administrators, academic staff, researchers, and undergraduate students. During his presentation, Professor Fahal provided valuable insights into the fundamentals of research and highlighted various funding opportunities available to researchers. The session encouraged active participation, with lively discussions where attendees shared their views and asked questions, all of which Professor Fahal addressed carefully and comprehensively.

Mycetoma Research Club

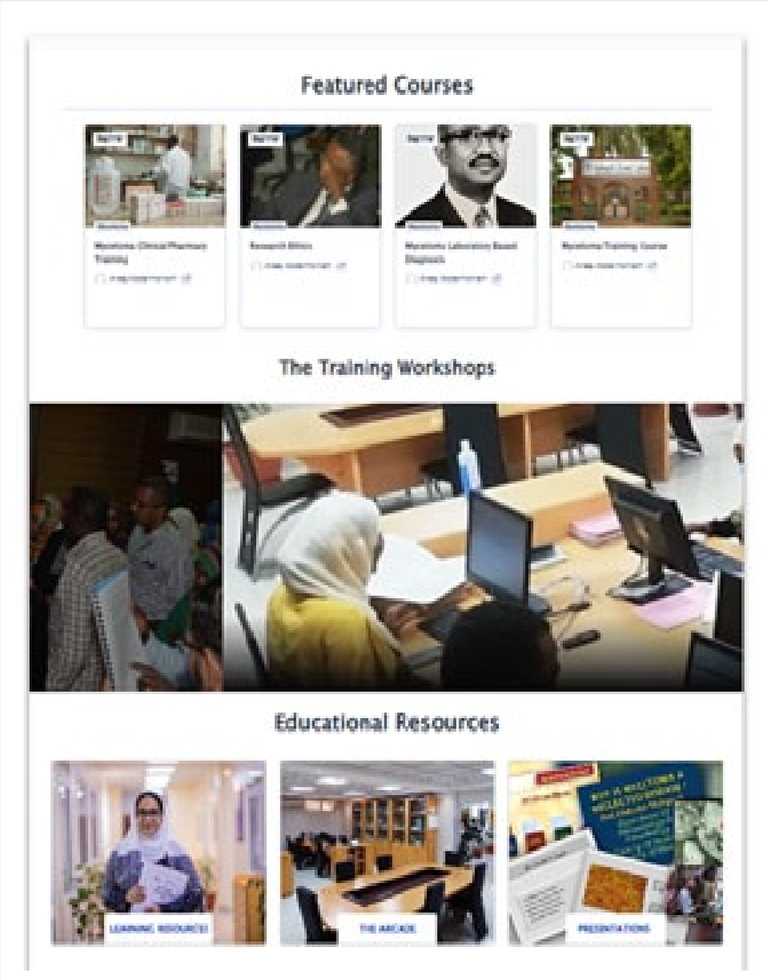
The Mycetoma Research Club is a biweekly online meeting designed to promote collaboration, knowledge exchange, and mentorship among students, junior researchers, supervisors, senior researchers, and medical doctors specialising in mycetoma.

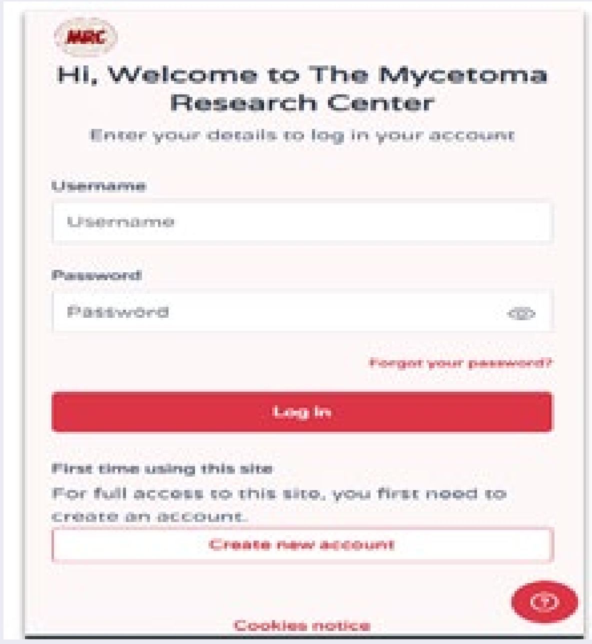
It aims to unite a diverse group of researchers and clinicians, which will significantly advance mycetoma research and improve patient and community management. Its main objectives include creating a platform for presenting and discussing ongoing research projects, new findings, and innovative ideas, providing mentorship, guidance, and support to postgraduate students and junior researchers, cultivating a supportive and collaborative problem-solving environment for its members; and encouraging interdisciplinary approaches to address the complex challenges associated with mycetoma.

In 2024, the Mycetoma Research Club organised 16 meetings attended by many participants from various disciplines and regions worldwide. The meetings were held online via Zoom. Throughout these sessions, a wide range of topics was covered, including mycetoma management in countries such as Ethiopia and Senegal, funding opportunities, and open science initiatives. All meetings were recorded and uploaded to the Mycetoma Research Center's YouTube channel, where they are accessible in a dedicated playlist for the Mycetoma Research Club. The club has fostered collaborations among scientists, opening doors for future partnerships and research opportunities.

Date	Title	Presenter(s)
30/07	Introductory Session	Prof Ahmed Fahal Dr Abdalla Ahmed Dr Samira Hussein
06/08	Drug discovery in Eumycetoma Scholarship Opportunity Mycetoma Pathogenesis Project	Dr Lamis Elkheir Dr Samira Hussein Prof Ahmed Fahal
13/08	Mycetoma: Treatment Challenges in Ethiopia, Lessons Learned from Boru Meda Hospital Dermatology Referral Center News and Updates	Dr Wosen Kelema Dr Areej AbdelMonim
20/08	Introduction to Open Science Pat I DAAD PhD Application	Dr Lamis Elkheir Dr Mohammed Badawi
27/08	Microbiological Culturing Techniques RSTMH Grants	Ms Nema Alfaki Dr Samira Hussein
03/09	Epidemiology of Mycetoma and Molecular Identification of Causative Organisms in Senegal Mycetoma in Kenya: An Overview	Dr Khadim Dr Ruth Nyangacha
10/09	Introduction to Open Science Pat II	Dr Lamis Elkheir
17/09	Diagnostic Approach for Mycetoma in Senegal Mycetoma Young Researchers Association (MYRA)	Carole Minlekib Dr Samira Hussein
24/09	Limitations of the Current Publishing System	Dr Lamis Elkheir
01/10	Histopathology of Mycetoma	Prof Lamyaa Elhassan
08/10	Global Mycetoma Working Group	Dr Dallas Smith
22/10	Bioinformatics: Biological Databases and Resources	Dr Alaa Almleeh
05/11	Advancing Mycetoma Diagnosis: AI in Histopathology	Dr Hyam Ali
19/11	History of Mycetoma	Professor Roderick Hay
03/12	European Cooperation in Science and Technology (COST)	Dr. Mahmoud Abuhussein
17/12	Development of the Mycetoma Activity and Severity Clinical Scale (MASS): A new clinical scoring for mycetoma	Dr. David Chandler

Mycetoma Online Training Modules





The MRC established several Online Training Modules. These are comprehensive educational programmes organised and developed by a team of experts specialising in various aspects of mycetoma healthcare, scientific research, diagnosis, treatment, and community engagement initiatives.

These modules are delivered through a robust Moodle learning management system, providing a user-friendly platform for learners to access high-quality content. The modules include practical, hands-on training sessions that cover the latest topics in scientific research, clinical practice, public health strategies, and community-based interventions. Designed to enhance capacity in emerging fields, these training modules foster collaborative learning environments by incorporating mentorship schemes that connect experienced professionals with learners. They offer flexible access, allowing participants to learn at their own pace and convenience, which is especially valuable for busy healthcare professionals, students, and researchers.

Through these initiatives, the Mycetoma Research Centre aims to enhance skills, foster innovation, and facilitate the effective translation of the latest scientific discoveries into practical applications. The ultimate goal is to improve health outcomes by equipping healthcare providers, researchers, and community workers with the necessary knowledge and tools to combat mycetoma more effectively across different communities worldwide.

The MRC Research Groups

The MRC Research Groups are composed of several specialised teams that work together in a coordinated and collaborative manner to comprehensively address the various aspects of mycetoma. Each team is dedicated to particular areas of expertise, such as drug discovery, epidemiology, bioinformatics, and artificial intelligence, allowing for focused research efforts that target specific challenges associated with the disease. These groups actively engage in interdisciplinary collaboration, sharing insights, data, and resources to develop more effective diagnostic methods, treatments, and public health strategies.
By bringing together researchers from diverse backgrounds, including microbiology, clinical medicine, genomics, data science, social sciences and public health, the groups foster a dynamic environment of knowledge exchange and innovation. This collaborative approach not only accelerates scientific discovery but also ensures that different perspectives and expertise are integrated into comprehensive solutions, ultimately strengthening the overall effort to understand, prevent, and treat mycetoma more effectively.

Drug Discovery Research Group

This group is dedicated to identifying and developing new treatments for mycetoma. It focuses on screening both natural and synthetic compounds to evaluate their anti-mycetoma activity. The group conducts in vitro studies, which are performed in controlled laboratory environments outside living organisms, as well as in vivo studies within living models to assess the efficacy and safety of potential therapeutics. Collaborating with pharmaceutical companies and research institutions, they leverage external expertise and resources to accelerate the development of effective and safe treatments. Their overarching goal is to create innovative therapies that can significantly improve patient outcomes.

Artificial Intelligence Research Group

Harnessing the power of machine learning, artificial intelligence and other AI tools, this group aims to enhance healthcare outcomes through advanced data analysis. They develop machine learning models that aid in early disease diagnosis by analysing imaging and clinical data, helping to identify patterns and biomarkers indicative of specific conditions for prompt intervention. The group also builds predictive models to forecast disease outbreaks and progression, facilitating timely responses. By automating the analysis of large datasets, they can rapidly extract valuable insights and trends. Additionally, this group supports telemedicine and remote diagnostic initiatives, making healthcare more accessible to populations in remote or underserved areas.

Epidemiology Research Group

Focused on understanding the distribution and determinants of health and disease within populations, this group collects and analyses epidemiological data to identify trends and risk factors. Through mapping disease prevalence and investigating factors contributing to disease spread, they develop effective public health strategies. The group conducts community surveys and field studies to gather firsthand data, providing valuable insights into community health status. Their findings inform policy decisions and intervention programmes aimed at improving public health outcomes and controlling disease transmission.

Bioinformatics Research Group

This group plays a vital role in analysing and interpreting genomic data related to mycetoma. They are involved in collecting and sequencing genomic material from mycetoma patients and the causative agents of the disease. Collaborating with sequencing laboratories they ensure the generation of high-quality data. Their analyses focus on identifying genes, mutations, and resistance markers critical for understanding disease mechanisms. They annotate genomes to uncover factors related to pathogenicity and virulence, compare genomic sequences across different strains to understand genetic diversity and epidemiological patterns and develop phylogenetic trees to trace the evolution and spread of causative agents. The group also maintains a genomic database that facilitates data sharing and collaborative research among local and international scientists, fostering a global effort to combat mycetoma.

Community Engagement & Public Health Outreach

In 2024, despite the ongoing conflict and challenging circumstances within the country, the MRC successfully carried out a series of community engagement initiatives aimed at improving health outcomes and fostering community resilience. These efforts were focused on several key regions, including Kassala and Wad Halfa in Kassala State, as well as Wad Onsa in the Eastern Sennar locality of Sennar State.

The activities undertaken during these initiatives encompassed a broad spectrum of health interventions and community support programmes. Notably, the MRC organised comprehensive medical campaigns dedicated to the diagnosis and treatment of mycetoma. These campaigns provided free medical consultations, diagnostic services, and treatment options, ensuring that vulnerable communities received essential care.

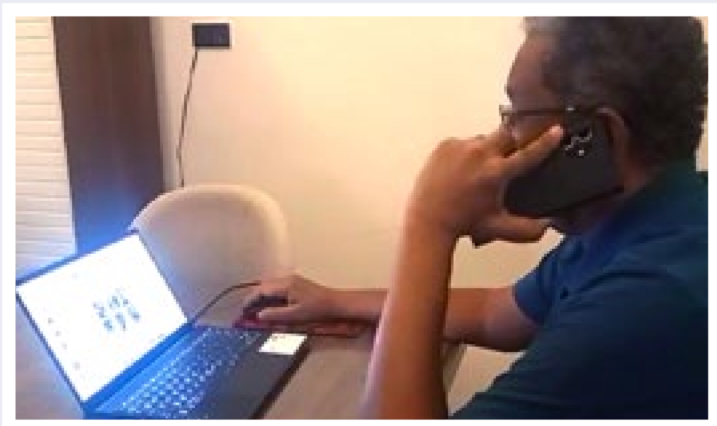
In addition to direct medical interventions, the initiatives emphasised health education to raise awareness about hygiene practices and early disease detection. Community members were engaged through educational sessions, distribution of informational materials, and interactive discussions aimed at empowering them with knowledge to manage their health proactively.

Furthermore, the MRC prioritised capacity building by training and educating local medical and health personnel. Workshops and training sessions were conducted to equip healthcare workers with the latest knowledge, diagnostic techniques, and treatment protocols for mycetoma and other prevalent health issues. This focus on capacity building aimed to strengthen local health systems and ensure sustainable health improvements beyond the immediate campaigns.

Mycetoma Diagnosis and Treatment Campaign at Kassala City, July 20, 2024

This collaborative campaign, organised by the Kassala State Ministry of Health, the Federal Ministry of Health, and the Mycetoma Research Centre at the University of Khartoum, aimed to diagnose and treat patients with mycetoma. Staffed by specialised experts, the campaign included thorough examinations and diagnostic tests, such as blood and tissue analysis, X-rays, and ultrasounds, to accurately assess the extent of the disease. Confirmed cases received appropriate medications, antifungal, antibacterial, or surgical interventions for advanced cases. Patients were also educated on wound care and hygiene, with follow-up plans established. The campaign provided free healthcare, significantly benefiting the local community by increasing awareness and facilitating early diagnosis and treatment of this debilitating disease.

Mycetoma Health and Medical Campaign, New Halfa Locality, August 23, 2024



A medical and treatment day was organised in New Halfa locality through a collaborative effort involving the Kassala State Ministry of Health, the Federal Ministry of Health represented by the Mycetoma Control Project, the New Halfa Health Authority, and the Medical Supply Fund of Kassala State. The campaign focused on identifying new cases of mycetoma, providing management for confirmed cases, and ensuring comprehensive diagnosis and care. A variety of diagnostic tests were conducted to identify the causative organisms and confirm the diagnoses. X-rays were used to evaluate the extent of bone involvement, while ultrasounds helped assess soft tissue involvement, offering a detailed understanding of each patient's condition. Appropriate treatment was administered based on individual diagnoses. The event was led by experienced consultants and healthcare professionals specialising in mycetoma management and advocacy.

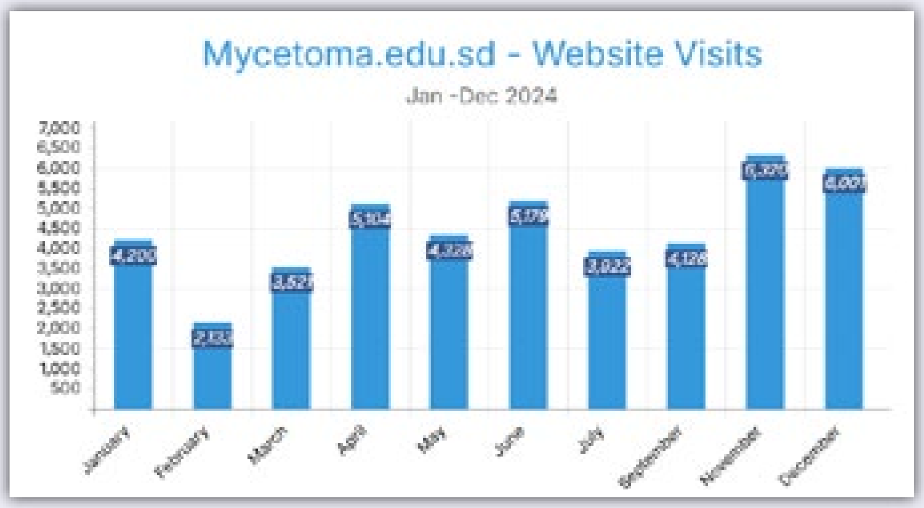
Wad Onsa Satellite Center Medical Campaign

This comprehensive medical, health, and social campaign was organised through a collaborative effort involving multiple stakeholders, including the Sennar Ministry of Health, the local Zaka Fund, the National Medical Insurance Fund, and the Wad Onsa community. The primary objective was to provide accessible healthcare services, raise awareness about mycetoma, and improve the overall health and well-being of the local population. Throughout the campaign, more than 109 individuals suspected of having mycetoma were carefully examined by trained healthcare professionals. These patients received thorough medical assessments, and those confirmed to have the disease were provided with appropriate management and treatment options.

In addition to medical care, a specialised team of mycetoma experts conducted health education initiatives aimed at increasing community awareness about the disease's causes, prevention strategies, and the importance of early diagnosis and treatment. These educational sessions included interactive discussions, distribution of informational materials, and demonstrations on wound care and hygiene practices. The campaign also emphasised the social aspects of health, offering guidance on accessing further medical support and addressing the stigma associated with the disease.

All these efforts were provided free of charge, ensuring that financial barriers did not prevent community members from receiving essential health services. The initiative not only addressed immediate healthcare needs but also fostered community engagement, improved understanding of mycetoma, and promoted a preventative approach to health management within the Wad Onsa locality. Overall, the campaign aimed to leave a lasting positive impact on the community by strengthening health awareness and enhancing access to quality medical care.

Mycetoma Advocacy



The MRC, in partnership with the National Mycetoma Control Programme, the Federal Ministry of Health, and the respective Ministries of Health in Kassala and Sennar states, undertook a series of comprehensive advocacy and awareness initiatives focused on mycetoma. These efforts aimed to raise public understanding of the disease, promote early diagnosis and encourage community engagement in prevention and treatment. To reach a wider audience, the campaign included the production of multiple media programmes, such as television and radio episodes, as well as interviews featuring medical experts, community leaders, and health officials. These broadcasts provided vital information about mycetoma causes, symptoms, and the importance of seeking timely medical care, helping to dispel misconceptions and stigma associated with the disease.

In addition to mass media outreach, the initiative involved distributing printed educational materials, including leaflets and booklets, that contained easy-to-understand information on disease prevention, hygiene practices, and available treatment options. These materials were strategically distributed in clinics, community centers, and local markets to ensure accessibility.

Furthermore, community discussion groups were organised across various localities, providing a platform for open dialogue between health professionals and community members. These sessions aimed to foster awareness, answer questions, and encourage community participation in efforts to prevent mycetoma. The combined approach of media engagement, printed materials, and community discussions significantly enhanced public knowledge and mobilised communities to take proactive steps against mycetoma.

Overall, these advocacy and awareness activities played a crucial role in strengthening community engagement, improving health literacy, and supporting the national effort to control and eventually eradicate mycetoma in the region.

Global Collaborations
& Strategic Partnerships

Despite the challenges posed by the ongoing conflict within the country, the MRC demonstrated resilience and continued to foster strong collaborations with a wide range of stakeholders. These included numerous international and local partners, non-governmental organisations (NGOs), and several embassies operating in Sudan. Through these partnerships, the MRC was able to sustain and expand its health initiatives, research activities, and community outreach programmes, ensuring that its efforts in combating mycetoma and improving health services remained effective despite the difficult circumstances.

In addition to its collaborations, the MRC actively engaged in a variety of scientific research projects aimed at advancing the understanding, diagnosis, and treatment of mycetoma. These projects encompass critical aspects, including epidemiology, which aims to understand disease patterns and risk factors; diagnostic innovations to improve early detection; and treatment strategies to enhance patient outcomes. The research efforts are complemented by advocacy initiatives designed to raise awareness, promote early diagnosis, and mobilise resources for combating the disease more effectively.

Furthermore, the MRC is a founding member and an active participant in the Mycetoma Global Working Group, a prestigious international consortium dedicated to addressing the global burden of mycetoma. The MRC regularly presents updates on its activities, research findings, and community programmes to this group, contributing valuable insights from Sudan's frontline experience. The group comprises leading mycetoma and global health experts from 35 countries worldwide, all committed to improving the quality of care, advancing research, and fostering collaboration across borders.

Through its sustained efforts in research, international collaboration, and advocacy, the MRC continues to play a critical role in the global fight against mycetoma, striving to improve patient care and contribute to the global body of knowledge despite the complex challenges posed by the ongoing conflict.

International Collaboration

1. The World Health Organization
2. Institute of Reliable Embedded Systems and Communication Electronics (ivESK), Offenburg University, Germany
3. Erasmus University Medical Center
4. Institute of Tropical Medicine, Nagasaki University, Japan
5. Institute of Transformative Bio-Molecules, Nagoya University, Japan
6. Medical Mycology Research Center, Chiba University, Japan
7. Graduate School of Human Development and Environment, Kobe University, Japan
8. UFR Sciences de la Santé, Université Gaston Berger, Saint Louis, Senegal,
9. Centre for Bacterial Cell Biology, Newcastle University, Newcastle-upon-Tyne, UK
10. The Mycotic Diseases Branch at Centers for Disease Control and Prevention (CDC), USA
11. Neglected Diseases Initiative (DNDi), Geneva and Nairobi
12. Eisa Ltd., Japan Company.
13. Association of Aids and Relief, Japan
14. Faculty of Mathematical Sciences, University of Tours, France
15. Faculty of Pharmacy, University of Tours, France
16. MedicImage, UK
17. Bosasso University, Puntland, Somalia
18. Africa Skin NTD LABNET
19. Hannover University of Applied Sciences and Arts, Germany
20. Qatar Charity, Qatar

National Collaboration

1. Comboni College of Science and Technology, Sudan
2. Faculty of Fine and Applied Art, Sudan University of Sciences and Technology, Sudan
3. The Social and Economic Bureau, Sudan
4. University of Sennar, Sudan
5. The National Institue for Communicable Diseases, Univerity of Gazeria
6. Federal Ministry of Health, Sennar State, Sudan
7. Ministry of Health, Sennar State, Sudan
8. Ministry of Health, The White Nile State, Sudan
9. Ministry of Health Kassala State, Sudan.

Mycetoma Young Researchers Association (MYRA)

The Mycetoma Young Researchers Association (MYRA) was officially established in 2022 with the primary goal of bringing together passionate young researchers, junior scientists, and field experts dedicated to advancing knowledge in the fields of mycetoma and neglected tropical diseases (NTDs). Recognising the significant knowledge gaps in various aspects of this neglected tropical disease, MYRA was founded to foster a collaborative environment where emerging researchers can engage in high-quality, innovative, and cutting-edge research projects. By doing so, MYRA aims to contribute to a deeper understanding of mycetoma's epidemiology, diagnosis, treatment, and prevention strategies, ultimately working towards improved patient outcomes.

Many members of MYRA are actively pursuing postgraduate studies, including master›s and doctoral degrees, with some having already successfully obtained their academic qualifications. The association's members are highly motivated and contribute to the scientific community through recent publications in reputable journals, sharing new findings and insights related to mycetoma. These publications help to fill existing gaps in scientific literature and promote further research and collaboration.

MYRA utilises various platforms and networks to effectively communicate its activities. These include the Mycetoma Research Club, which provides a forum for discussion and knowledge exchange; the Mycetoma Scientific Group, which facilitates collaborative research efforts; and various outreach initiatives, conferences, and seminars aimed at disseminating research findings and raising awareness about mycetoma. Through these channels, MYRA ensures that its work reaches a broad audience, including researchers, clinicians, policymakers, and affected communities.

The organisation has experienced rapid growth, with an increasing number of young researchers, students, and early-career scientists joining its ranks. This expanding membership reflects a growing interest among the youth and academic institutions in addressing mycetoma as a global health challenge. As the network continues to grow, MYRA is poised to play an increasingly vital role in shaping future research directions, advocating for neglected disease priorities, and fostering the next generation of mycetoma experts. Overall, MYRA's efforts are crucial in building capacity, fostering innovation, and ensuring sustained scientific progress in the fight against mycetoma.

Sustainable Development & Future Strategic Goals

The Mycetoma Research Center is dedicated to advancing the understanding, diagnosis, treatment, and prevention of mycetoma. As part of its commitment to sustainable development and long-term impact, the MRC has outlined strategic goals aimed at fostering innovation, expanding outreach, and strengthening collaborations.

Sustainable Development Initiatives
Capacity Building and Education:
The MRC emphasises training healthcare professionals, researchers, and community health workers to ensure local capacity for early detection, effective management, and patient support. Design educational programmes aim to raise awareness and reduce the stigma associated with mycetoma.

Research and Innovation:
Continuous investment in research is essential for developing innovative diagnostic tools, enhancing treatment options, and gaining a deeper understanding of disease epidemiology. The center promotes interdisciplinary collaborations to foster innovative solutions.

Community Engagement:
Empowering affected communities through awareness campaigns and preventive measures is crucial. The MRC works closely with local populations to implement sustainable, culturally appropriate interventions.

Environmental and Socio-economic Sustainability:
Recognising social determinants of health, the MRC advocates for integrated approaches that address environmental factors contributing to disease prevalence, such as poverty, poor sanitation, and inadequate access to healthcare.

Future Strategic Goals
Expansion of Research Infrastructure:
Developing advanced laboratories and data management systems to support high-quality research and facilitate international collaborations.

Global Partnerships and Outreach:
Strengthening partnerships with international health organisations, universities, and NGOs to promote knowledge exchange and joint initiatives.

Development of New Diagnostic and Therapeutic Tools:
Prioritising research toward affordable, rapid diagnostic methods and effective, accessible treatments to improve patient outcomes.

Policy Advocacy and Integration:
Influencing health policies to include mycetoma in national neglected tropical disease programmes and ensuring sustainable funding for ongoing research and healthcare delivery.

Monitoring and Evaluation:
Implementing robust monitoring systems to assess the impact of interventions, track disease trends, and adapt strategies accordingly.

The Mycetoma Research Centre is committed to upholding sustainable development principles, aiming to alleviate the burden of mycetoma through innovative research, community engagement, and strategic partnerships. Its future goals reflect a comprehensive approach to addressing the social, environmental, and health challenges posed by this neglected disease, ensuring lasting benefits for affected populations and global health.

The MRC Members› Reflections

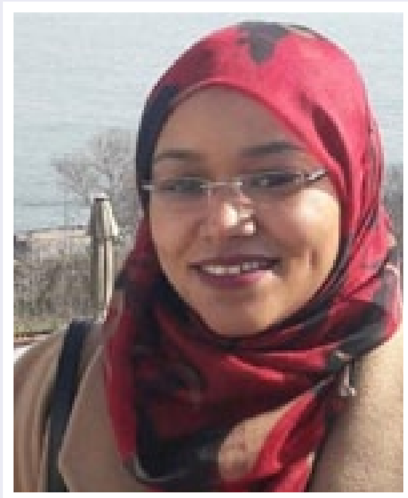
Dr Samira Mohamed

Achievements Despite Adversity

Despite facing ongoing challenges and obstacles, I was successfully selected to join the Local Network Leads (LNL) training programme organised by the African Reproducibility Network (AREN), which I attended from April to October 2024. The conflict in Sudan prevented me from completing my master's studies at my original institution; however, I demonstrated resilience by continuing my academic pursuits at an alternative university.

My dedication and perseverance were recognised internationally: in November 2024, I was nominated for the Most Influential Women Award by the World Association for Sustainable Development (WASD) in the United Kingdom. In March 2025, I was honoured to receive the Most Influential Women – Outstanding Early Career Achievement Award.

Dr Lamis Yahia Mohamed Elkheir



In 2024, despite the challenges of conflict and displacement, I proudly completed my PhD in collaboration with the University of Tours. My research focused on the imidazo[1,2-b]pyridazine scaffold as a novel therapeutic candidate for eumycetoma. Currently, I am working to advance this compound through the drug discovery pipeline with the aim of developing more effective treatment options.

Despite the physical distance, I remained actively engaged in the MRC ongoing scientific initiatives. I contributed to several research projects and participated in multidisciplinary collaborations that exemplify the MRC's commitment to innovation in the face of adversity.

This year also marked a significant milestone in my advocacy for open science. I had the honour of representing the MRC at the UN General Assembly's Science Summit to highlight our open science initiatives. Additionally, I was elected Co-Chair of Working Group 2 under the Open Science Monitoring Initiative (OSMI), supported by UNESCO's Open Science team. This group focuses on mapping global open science indicators to promote transparency and equity in research. These roles have reinforced my dedication to advancing inclusive, collaborative science in support of the MRC's mission.

Dr Ali Awadallah

Dr Ali Awadallah, a distinguished senior researcher at the Mycetoma Research Center and the National University, has made a remarkable impact through his unwavering dedication to advancing mycetoma research. As the researcher with the highest publication rate at the center in 2024, his relentless pursuit of scientific excellence has significantly contributed to a deeper understanding of the disease and has elevated the center's reputation on the international stage.

Dr. Awadallah's prolific output reflects his commitment to innovative research, collaborative efforts, and the dissemination of knowledge that benefits affected communities worldwide. His achievements serve as an inspiring example of scholarly rigour, dedication, and the vital role of research in addressing neglected tropical diseases.

Acknowledgements & Appreciation

On behalf of the entire Mycetoma Research Centre team, we would like to express our deepest and most sincere gratitude to all our collaborators, partners, and supporters for their unwavering dedication, relentless hard work, and passionate commitment, especially during these challenging and unprecedented times. Your continued support has been instrumental in enabling us to persevere and advance our mission despite the difficulties faced by our country and the global community.

We extend special thanks and genuine acknowledgement to the dedicated members of the MRC. Their exceptional contributions, resilience, and unwavering commitment during these difficult periods have been nothing short of inspiring. Their efforts have not only sustained our ongoing projects but have also laid a strong foundation for future breakthroughs and innovations. Their perseverance and dedication exemplify the true spirit of scientific research and community service, and we are incredibly proud of their achievements.

As we look ahead, we are excited about the journey that lies before us. We remain committed to pushing boundaries, exploring new horizons, and making significant strides in the fight against mycetoma and other neglected diseases.

We eagerly anticipate continuing this collaborative journey with all of our colleagues and collaborators, working together to achieve even greater milestones, enhance patient outcomes, and make meaningful contributions to global health.

> **We remain committed to pushing boundaries, exploring new horizons, and making significant strides in the fight against mycetoma and other neglected diseases.**

MRC 2024

The Mycetoma Research Center,
University of Khartoum
WHO Collaborating Center
on Mycetoma & Skin NTDs

www.mycetoma.edu.sd