

# **Guidelines for the clinical management of diphtheria**

## **Guideline Development Group**

**November 2023**

## Overview

For the development of the WHO *Guidelines for the clinical management of diphtheria* a formal Guideline Development Group (GDG) comprising individuals with broad expertise spanning multiple specialties and all WHO regions was convened.

The technical unit collected and managed declarations of interests (DOIs). In addition to the distribution of DOI forms, during meetings the WHO Secretariat described the DOI process and an opportunity was given to GDG members to declare any interests not provided in written form.

WHO would like to acknowledge all the experts that contributed to the GDG and thank them for their commitment and support to achieve the evidence-based recommendations for care of patients with diphtheria.

### **Umma Idris Abdullahi**



Umma Idris Abdullahi is a paediatrician in northwest Nigeria, a region currently experiencing a major diphtheria outbreak. She has over 15 years' experience practising clinical paediatrics, with a focus on infectious diseases, teaching and mentoring medical students, interns and residents. Umma has published in prestigious journals and presented at many paediatric scientific meetings and conferences. She has been actively involved in the clinical response to the diphtheria outbreak.

### **Hamed Hassan Adetola**



Hamed Hassan Adetola is a clinical consultant paediatrician currently working with the Sierra Leone Ministry of Health as the National Coordinator of the Post Basic Certificate in Neonatal Nursing programme. He is also a consultant paediatrician (infectious diseases and emergency units) in the Department of Paediatrics, Ola During Children's Hospital, University of Sierra Leone, Freetown – the only tertiary hospital in the country. He has worked with the London School of Hygiene and Tropical Medicine/College of Medicine and Allied Health and as a paediatrician in the infectious disease unit at the EBOVAC-Salone Project, Kambia, Sierra Leone. He has a Postgraduate Diploma in Paediatric Emergency Medicine from the University of Edinburgh and is a Fellow of the Faculty of Paediatrics (paediatric infectious diseases) from the National Postgraduate Medical College of Nigeria and a Fellow of the West African College of Physicians (paediatric emergency and cardiology). He was the winner of the Olubunmi Robbin-Coker Prize for the best dissertation in the Faculty of Paediatrics, West Africa College of Physicians. He lectures over 800 students and health care workers.

## Andrew Argent



Andrew Argent was Professor and Head of the Department of Paediatrics and Child Health at the Red Cross War Memorial Children's Hospital (RCWMCH) and the University of Cape Town, South Africa, until he retired in October 2020. He has worked in paediatric critical care in Cape Town for over 30 years and was Director of the Paediatric Intensive care unit at the RCWMCH from 1999 to 2019. He has been a past president of both the Critical Care Society of Southern Africa, and the World Federation of Pediatric Intensive & Critical Care Societies. His doctoral studies related to the mechanics of breathing of children with acute severe croup. This provided experience and training particularly in respiratory mechanics and in the processes of assessing clinical severity scores. He has been involved in a number of studies addressing respiratory care in critically ill children, ventilation, pneumonia (including ventilator-associated pneumonia) and viral pathogens in pneumonia and has contributed editorials on these subjects. More recently he has been involved in systematic review processes to assess transfusion requirements of critically ill children and optimization of management of severe sepsis in children. He is currently involved in updating sepsis definitions for children across the world. Over the years he has written about the challenges related to resource allocation for critically ill children and adults and some of the ethical challenges in critical care. He has also contributed to the literature regarding paediatric cardiac intensive care. Currently he is a deputy chair for the Society of Critical Care Medicine initiative on paediatric sepsis definitions and is involved in a number of international collaborations.

## Lucille Blumberg



Professor Lucille Blumberg is currently a consultant at Right to Care (RTC) where her focus is on creating a One Health programme especially for rabies and responding to health emergencies in South Africa and the region. Until September 2021, she was Deputy Director at the National Institute for Communicable Diseases, the National Health Laboratory Service, and founding Head of the Division of Public Health Surveillance and Response. She is a medical consultant to the Division for Outbreak Preparedness and Response (includes Travel Medicine Unit) and to the Centre for Emerging, Zoonotic and Parasitic Diseases, where her major focus is on malaria, rabies, viral haemorrhagic fevers, pandemics, epidemics, One Health and zoonotic diseases and travel-related infections. She has worked on a number of outbreaks including rabies, avian influenza, cholera, typhoid, and the Lujo virus. She is a medical graduate of the University of the Witwatersrand, an Associate Professor in the Department of Medical Microbiology at the University of Stellenbosch, and lecturer in the Faculty of Veterinary Medicine at the University of Pretoria. She has specialist qualifications in clinical microbiology, travel medicine and infectious diseases. She is Chairperson of WHO Strategic Advisory Group for Infectious Hazards (STAG-IH), a member of the WHO Global Neglected Tropical Diseases Partners and of the Task Force for WHO R&D Blue Print for Crimean Congo Haemorrhagic Fever. She is also Editor-in-Chief of the journal *IJID One Health*.

**Victoria Chu**



Victoria Chu is a paediatric infectious disease physician and clinical epidemiologist at the University of California, San Francisco. She previously worked at the California Department of Public Health and served as an epidemic intelligence service officer at the Centers for Disease Control and Prevention. She has experience with public health surveillance, case and contact investigation and management of vaccine-preventable diseases and emerging infections. Her current research interest centres around transmission epidemiology of healthcare-associated infections and acquisition and transmission of antimicrobial resistance genes.

## Androulla Efstratiou



Professor Androulla Efstratiou is Director of the WHO Global Collaborating Centre for Reference and Research on Diphtheria and Streptococcal Infections and Consultant Public Health Microbiologist at the United Kingdom Health Security Agency. She is a Visiting Professor to the Faculty of Medicine, Department of Infectious Diseases, Imperial College, London; Adjunct Professor to the University of Cyprus Medical School and the European University Medical School Cyprus. Other key appointments include consultancy and advisory roles for WHO, the European Commission and international public health institutes and universities on infectious diseases, notably bacterial vaccine-preventable diseases. Her key specialist areas are in the field of diphtheria, streptococcal infections and global public health.



**Daniela Garone**



Daniela Garone is a medical doctor from Argentina, specialized in infectious diseases, internal medicine and clinical and pharmacological research. Daniela has more than 25 years' working in the clinical field and 13 years' experience managing medical programmes in resource-limited settings working with international organizations including Médecins sans Frontières (MSF) (Brazil, India, Malawi, Mozambique, South Africa, South Sudan, Venezuela and Zimbabwe). She has more than 20 years' experience working in clinical, pharmacological and operational research in low- and middle-income countries. Daniela is a serving HIV-TB expert member of the Technical Review Panel at the Global Fund, expert member of the Technical Advisory Panel of the Pandemic Fund, and of the expert panel at ELHRA and HORIZON-EU. She is also a reviewer of the JAIDS-AIDS, BMC-Lancet-TB union and others. She is International Medical Coordinator of MSF, representing MSF in the ICG (vaccine stockpile) for Ebola, meningitis, cholera and yellow fever, at the GFTCC SCOM, GOARN steering committee, Humanitarian Buffer, IA2030, as well as different working groups for disease elimination.

## Niranjan Kissoon



Niranjan Kissoon is President of the Global Sepsis Alliance, Co-Chair Pediatric Surviving Sepsis Campaign, Vice-President of the Canadian Sepsis Foundation, and Advisory Board Member of Sepsis Alliance USA and the African Sepsis Alliance. He is the Chair of World Sepsis Day, the International Pediatric Sepsis Initiative, and the Pediatric Surviving Sepsis Campaign Guidelines Committee. He is the holder of the UBC & BC Children's Hospital Professor in Critical Care – Global Child Health Department of Pediatrics and Emergency Medicine at the University of British Columbia, Vancouver, Canada. Niranjan is the recipient of the 2020 Vidyasagar and Nagamani Dharmapuri Award for his sustained exemplary and pioneering achievements in the care of critically ill and injured infants and children and the Society of Critical Care Master in Critical Care (their highest award) and the American Academy of Pediatrics Distinguished Career Award.

**Hans-Jörg Lang**



Hans-Jörg Lang completed his medical studies in Freiburg, Germany, and received training in paediatric intensive care medicine in the United Kingdom. For several years, he dedicated his efforts to working with development and humanitarian organizations in sub-Saharan Africa and briefly in Afghanistan, including MSF, ALIMA, GIZ/CIM, and DED. In this capacity, he actively contributed to training programmes and research projects, with a specific focus on essential paediatric emergency and critical care. Hans-Jörg has been actively involved in responding to Ebola virus (EBOV) outbreaks in the Democratic Republic of the Congo (2019/2020), Guinea (2021), the Sudan EBOV outbreak in Uganda (2022), and the Marburg virus outbreak in Equatorial Guinea (2023). In recent years, he has been engaged in various initiatives supported by WHO, including Ebola training and guideline development programmes, the WHO/WFP-Initiate project, which involves design of rapidly deployable treatment modules for high-consequence infectious diseases, and a WHO-led oxygen access scale-up project. He also takes an interest in climate-responsive health facility configuration and the use of renewable energy to ensure reliable electricity provision, ultimately improving access to essential paediatric care in low-resource contexts, particularly for populations exposed to humanitarian challenges.

**Madonna Matar**



Dr Madonna Matar graduated from the Lebanese Faculty of Medical Sciences, School of Medicine in Beirut and completed a Fellowship in Infectious Diseases at MD Anderson Cancer Center at the University of Texas, Houston Medical School, USA in 2002. Since, Dr Matar worked as a clinician at Notre Dame des Secours University Hospital in Byblos, Lebanon. She was appointed as Head of Infectious Diseases Division and Infection Control in her institution since 2006 and led the Antimicrobial Stewardship program successfully during the last few years. With a Master of Public Health from the American University of Beirut, Lebanon in 2014, Dr Matar has the opportunities to work with the Ministry of Health in Lebanon on multiple occasions and lately was appointed as a member of both the National Covid-19 Vaccine and the Cholera committees during the pandemic and outbreak. Dr Matar was also a consultant to the WHO on different projects involving Infection Control and writing clinical guidelines within the Middle East region focusing mainly on Antimicrobial Resistance and Stewardship. Dr Matar served as the President of the Lebanese Society of Infectious Diseases for the last 4 years until November 2023. She is appointed as an associate professor at the Faculty of Medicine, Holy Spirit University of Kaslik, Lebanon and is highly devoted to teaching, research and publications. Madonna Matar is the Head of Infectious Diseases, Notre Dame de Secours University Hospital, Jbeil (Lebanon). She has led the Antimicrobial Stewardship Programme and been Head of the COVID-19 Unit at Notre Dame des Secours University Hospital, and President of the Lebanese Society of Infectious Diseases and Clinical Microbiology since 2019. She holds a medical degree from the Faculty of Medical Sciences, Beirut, and a master's in Public health from the American University of Beirut.

## Ziad Memish



Ziad Memish is currently a senior consultant in infectious diseases and Director of the Research & Innovation Center at King Saud Medical City, Ministry of Health. He is Professor at the College of Medicine, Alfaisal University, Riyadh, Saudi Arabia, and Adjunct Professor in the Hubert Department of Global Health, Rollins School of Public Health, Emory University, Georgia, USA. Ziad obtained his medical degree from the University of Ottawa, Canada in 1987 and is board-certified by the American Board of Internal Medicine, the American Board of Infectious Diseases as well as a Fellow of the Royal College of Physicians (Canada, Edinburgh and London) and of the American College of Physicians. He is widely recognized as a pioneer in mass gathering medicine and infection control and established the WHO Collaborating Centre for Mass Gathering Medicine in the Ministry of Health and WHO Collaborating Centre for Infection Prevention and Control and Antimicrobial Resistance in the Saudi Ministry of National Guard (Health Affairs). On a national level he is the Chair of the National Scientific Technical Advisory Group for COVID-19 and the Chair of the Technical Advisory Group on COVID-19 vaccines under the Royal Court. He is Editor-in-Chief of two medical journals and has published more than 850 papers and book chapters.

## Srinivas Murthy



Srinivas Murthy is Associate Professor at the University of British Columbia in Vancouver, Canada. He is a paediatric infectious diseases and paediatric critical care physician and clinical epidemiologist. He has served as an advisor to WHO, Public Health Agency of Canada and other public health agencies around the world since 2014. He holds research grant support from the Canadian Institutes of Health Research, the Wellcome Trust and the Bill & Melinda Gates Foundation, and his academic and clinical focus is on severe and emerging respiratory infections. Srinivas participated in the WHO *Clinical management of COVID-19: living guideline*, serving as Clinical Chair.

**Regina Oladokun**



Regina Oladokun is Professor of Paediatric Infectious Diseases at the Department of Paediatrics, College of Medicine, University of Ibadan and University College Hospital, Ibadan, Nigeria. She coordinates the Paediatric HIV programme of the University College Hospital, Ibadan. She is the foundation Chair of the Antimicrobial Stewardship Committee of the University College Hospital, Ibadan; Vice-Chair of the Child TB Steering Committee of the Nigerian National TB Programme; and a member of the Paediatric HIV Stakeholders' Committee. She is the President of Nigerian Society for Paediatric Infectious Diseases and also chairs the Paediatric Infectious Diseases sub-specialty training programme of the West African College of Physicians and the National Postgraduate Medical College of Nigeria. She is a member of the World Society for Pediatric Infectious Diseases (WSPID) Education Committee 2022–2024 and Member of the Board of WSPID 2023–2025. She is a co-investigator in several projects pertaining to her research interests; TB, HIV, vaccine-preventable diseases and antimicrobial stewardship.

**Jacobus Preller**



Jacobus Preller is a consultant physician intensivist at Cambridge University Hospitals NHS Foundation Trust, Cambridge, United Kingdom and an affiliated assistant professor at the University of Cambridge. He qualified at the University of Pretoria in South Africa and worked in clinical posts in Azerbaijan, the Falkland Islands, Republic of Georgia, South Africa and the United Kingdom. A longstanding interest in global health led to participation in development, training and capacity building initiatives as well as other associated missions with WHO and other organizations in several countries in central Asia, the Middle East and Africa. He had the privilege to join the Case Management Team of the WHO Health Emergencies Programme in Geneva during the COVID-19 pandemic. During that time, as staff member, he participated in the process of drafting several WHO guidelines. He acted as principle investigator for several research studies and maintains varied research interests.



**Gentle Shrestha**



Gentle S Shrestha is an intensivist working as an associate professor at Department of Critical Care Medicine in Tribhuvan University Teaching Hospital, Kathmandu, Nepal. He is associated with and involved in multiple national and international societies. He is involved in multiple committees and groups that work for the advancement of critical care. He had contributed to WHO supported projects. He has over 180 peer-reviewed publications in national and international journals. His fields of interest are neurocritical care, point-of-care ultrasound and sepsis, and a focus on resource-limited settings.

**Shalini Sri Ranganathan**



Professor Shalini Sri Ranganathan is Senior Professor in Pharmacology at the Faculty of Medicine, University of Colombo and a board-certified specialist in paediatrics. She is a Fellow of National Academy of Science of Sri Lanka. She received the President's Award for Scientific Publication for several years and the Faculty Award for Excellence in Teaching and Student Mentoring in 2019, 2020 and 2021. She has authored over 70 publications and 100 scientific communications. She has served as an expert many times in the WHO Expert Group on Selection and Use of Essential Medicines. She is a member of several editorial boards in Sri Lanka.

**Salma Ali Suwaid**



Salma Ali Suwaid received her MBBS from Bayero University Kano, Nigeria, in 2003. She has been a Fellow European Society of Paediatric Endocrinology since 2013 and a Fellow of the West African College of Physicians since 2017. She has a Postgraduate Diploma in Paediatric Nutrition awarded by Boston University. She is currently Head of Department of Paediatrics at Murtala Muhammad Specialist Hospital, Kano State, and the state Case Manager for diphtheria outbreaks. She is a contributor to the national guidelines for diphtheria management in Nigeria and a team member for validation of Integrated Disease Surveillance and Response programmes in secondary and tertiary facilities in the country. She is presently a visiting consultant to Aminu Kano Teaching Hospital and participates as an examiner for the Medical and Dental Council of Nigeria for foreign-trained students. She is also Chair of the state adverse events following immunization committee. She participates in various local and international research projects as well as mentoring and teaching sessions for medical students and residents.

**Dat Vu Quoc**



Vu Quoc Dat is a lecturer at the Department of Infectious Diseases, Hanoi Medical University, Viet Nam and Vice-Head of the Department of Tropical Diseases, Hanoi Medical University Hospital. He completed the Career Development Fellowship with the WHO Special Programme for Research and Training in Tropical Diseases and undertook his PhD training at the Oxford University Clinical Research Unit in Viet Nam. He has expertise in clinical management of severe or life-threatening infections, zoonotic diseases, and emerging and re-emerging infectious diseases in resource-constrained settings. His research interests focus on interventions to emerging health issues related to infectious diseases, particularly in critical care settings, and on the capacity of health care systems in response to sepsis and severe acute respiratory infection. He served as a member of the national technical working groups for the development of national guidelines for the management of infectious diseases and is a member of WHO Strategic and Technical Advisory Group for Neglected Tropical Diseases (STAG-NTD).

## Sridhar Venkatapuram



Sridhar Venkatapuram is an academic-practitioner of global health ethics and justice. He is Associate Professor at King's College London, and Director of Global Health Education and Training at the King's Global Health Institute. He brings together the natural and social sciences related to health with philosophy, particularly political philosophy, to address issues related health rights, equity and good governance for health at local, national and global levels. He has worked with Human Rights Watch, Doctors of the World, the Population Council, Open Societies Institute, Wellcome Trust, Health Foundation, UK Parliament Office of Science & Technology and WHO. His PhD – an argument for every human being's moral right to health – was the basis of his first book, *Health justice: an argument from the capability approach* (Polity Press). He is co-editor of *Vulnerable: the law, policy and ethics of COVID-19* (University of Ottawa Press). Sridhar participated in the WHO *Clinical management of COVID-19: living guideline* (January 2021, infectious period), the WHO *Therapeutics and COVID-19: living guideline* (lopinavir, ivermectin, casirivimab and imdevimab, IL-6 RB, JAK inhibitors, sotrovimab, molnupiravir, fluvoxamine, colchicine, nirmatrelvir, remdesivir, VV116) and *Drugs to prevent COVID-19: living guideline*.

### Nicholas John White



Professor Sir Nicholas John White FRS is Professor of Tropical Medicine at the Faculty of Tropical Medicine, Mahidol University, Thailand, and at Oxford University, United Kingdom. He is also a Consultant Physician in acute general medicine at the John Radcliffe Hospital, Oxford. Professor White is a Wellcome Trust Principal Research Fellow who chairs the Wellcome Trust Tropical Medicine Research Programmes in South-East Asia. He has conducted research across a broad range of infectious diseases. His main research focus is the pathophysiology and treatment of malaria. He has authored over 1250 scientific publications and over 50 book chapters. His “h” index is currently 153 (Scopus) and 205 (Google). He has received the Prince Mahidol Prize for Medicine, the Canada Gairdner Foundation Global Health Prize, and the Royal Society of Tropical Medicine and Hygiene Manson medal. He co-chaired the WHO Antimalarial Treatment Guidelines Committee for 12 years and currently chairs the Scientific Advisory Committee of the Drugs for Neglected Diseases initiative and the Coalition for Equitable Research in Low-Resource Settings.

## Annex: Conflicts of interest

Name	Declared conflict
Umma Idris Adbullahi	No conflict declared.
Hamed Adetola Hassan	No conflict declared.
Andrew Argent	No conflict declared.
Lucille Blumberg	No conflict declared.
Victoria Chu	No conflict declared.
Vu Quoc Dat	No conflict declared.
Androulla Efstratiou	No conflict declared.
Daniela Garone	No conflict declared.
Niranjan Kissoon	No conflict declared.
Hans Jorg Lang	No conflict declared.
Madonna Matar	No conflict declared.
Ziad Memish	No conflict declared.
Srinivas Murthy	No conflict declared.
Regina Oladokun	No conflict declared.
Jacobus Preller	Employed by WHO in the Clinical management team from September 2020 to September 2021. Decision: no action needed.
Shalini Sri Ranganathan	No conflict declared.
Gentle Shreshta	No conflict declared.
Salma Suwaid	No conflict declared.
Sridhar Venkatapuram	No conflict declared.
Nicholas White	No conflict declared.