

Emerging respiratory tract infections



Emerging and re-emerging respiratory tract infectious diseases¹ and the growing problem of antimicrobial resistance² continue to challenge diagnostic, treatment, prevention, and control strategies. Respiratory tract infections with epidemic and pandemic potential have plagued people since the dawn of human history.³ Comprehensive assessments of the global burden of disease show that respiratory tract infections are some of the commonest causes of morbidity and mortality worldwide, imposing a huge burden on health services.^{4,5} The past century has seen several epidemics of new viral respiratory tract infections, most of which emerged from interactions between people and animals.^{1,3}

Several newly discovered viruses with epidemic potential have threatened global health security.^{1,6,7} These include severe acute respiratory syndrome-coronavirus (SARS-CoV), avian influenza viruses H5N1, H7N9, and H10N8, variant influenza A H3N2 virus, swine-origin influenza A H1N1, human adenovirus-14, and the Middle East respiratory syndrome-coronavirus (MERS-CoV). The pathogenesis and mode of transmission of MERS-CoV and influenza A H7N9 are still poorly understood, which hampers implementation of intervention and preventive measures. Furthermore, the emergence and spread of antimicrobial-resistant bacterial, viral, and fungal pathogens, for which treatment options are diminishing, are of major global concern. These intricate and complex relations between microbes, human and animal hosts, and environmental factors influence risk, exposure, pathogenicity, infectiousness, and transmissibility. Furthermore, microorganisms do not respect international boundaries, and ease of global travel and airborne spread make them a persistent threat to global health security.⁸

This emerging respiratory tract infections Series in *The Lancet Infectious Diseases* includes five articles on infectious diseases with epidemic and pandemic potential. The first article⁹ reviews surveillance systems in place for early detection of emerging and re-emerging respiratory viruses. The second¹⁰ reviews the pandemic potential of these emerging viruses. The focus of pandemic preparedness should include upstream prevention through better collaboration between human and animal health sciences to improve identification of potential pathogens before they become serious human

threats and to prevent their emergence where possible. The third article¹¹ gives an overview of the epidemiology of new viruses, their geographical distribution, and mode of transmission from zoonotic or environmental sources and between human beings.

Rapid and accurate identification of pathogens is crucial to achieve optimum treatment, public health surveillance, and control outcomes. Other important challenges to the improvement of management outcomes of respiratory tract infections are development of tests for prediction and monitoring of treatment response; rapid identification of drug resistant pathogens; more widespread surveillance of infections, locally and internationally; and those viruses with pandemic potential that require a global response. The fourth article¹² reviews the present portfolio of diagnostic tests and technological advances that are enabling progress to be made in development of near point-of-care rapid diagnostic tests for viral and bacterial respiratory tract infections, including drug-resistant tuberculosis. The emergence and spread of antimicrobial-resistant infections for which diminishing treatment options are available is of major global concern. The fifth article¹³ focuses on development and use of new antimicrobial agents and immune-based and host-directed therapies for a range of conventional and emerging viral respiratory tract infections.

Although advances in molecular biology allow for genomic studies to rapidly identify new pathogens and predict their evolution and spread in human populations, improved understanding of dynamics of these microbes in animals could prevent outbreaks in people. Because of space constraints, we do not cover the following important aspects of respiratory tract infections in this series: pathogenesis, infectivity, pathogenicity, immunity, kinetics, and transmissibility of new viruses; preventive strategies including vaccines (existing and those under development), infection control measures and the relation between environmental ventilation, imbalanced ward airflow, design of hospital wards, and spread of viral respiratory infections in the hospital and the community; the growing problem of antibiotic resistant bacterial respiratory tract infections in the community, in hospitals, and in immunocompromised patients; and surveillance data and bioinformatics to model and predict the pandemic potential of viral respiratory tract infections.

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The threat to global health security from emerging and re-emerging respiratory tract infections will be ever present because of the genetic adaptability of microbes, and their ability to resist clinical interventions and public health measures aimed at their elimination. Although much has been learned from previous outbreaks, present surveillance systems have their inherent weaknesses, and recent experiences with MERS-CoV¹⁴ show that pandemic preparedness still faces major political and scientific challenges.¹⁵ An important priority for control of infectious disease is to ensure that scientific and technological advances in molecular diagnostics and bioinformatics are well integrated into public health. More effective and wider partnerships based on equity and best ethical practice, across governments, health care, academia, industry, and with the public, are essential to effectively galvanise economic, political and scientific measures required to develop core capacities, including legislation, national focal points, and pandemic planning to reduce risk of global spread and reduce the burden of respiratory tract infectious diseases. An urgent need exists to establish trusting and effective meaningful collaborations between countries to tackle new emerging microbial threats. This will facilitate early and rapid detection of potential pandemic infectious diseases through public health actions within the framework of the International Health Regulations.¹⁶

*Alimuddin Zumla, David S Hui, Jaffar A Al-Tawfiq, Phillipe Gautret, Brian McCloskey, Ziad A Memish
 Division of Infection and Immunity, Royal Free Hospital Campus, University College London, and NIHR Biomedical Research Centre, University College London Hospital, London NW3 2PF, UK (AIZ); Division of Respiratory Medicine and Stanley Ho Center for Emerging Infectious Diseases, The Chinese University of Hong Kong, Prince of Wales Hospital, New Territories, Hong Kong (DH); John Hopkins Aramco healthcare, Dhahran, Saudi Arabia, and Indiana University School of Medicine, Indiana, USA (JAA-T); Assistance Publique Hôpitaux de Marseille, CHU Nord, Pôle Infectieux, Institut

Hospitalo-Universitaire Méditerranée Infection & Aix Marseille Université, Unité de Recherche en Maladies Infectieuses et Tropicales Emergentes (URMITE), Marseille, France (PG); Global Health and WHO Collaborating Centre on Mass Gatherings, Public Health England, London, UK (BM); Global Center for Mass Gatherings Medicine, Ministry of Health, Riyadh, Kingdom of Saudi Arabia (ZAM, BM, AIZ); and Ministry of Health and Al-Faisal University, Riyadh, Saudi Arabia (ZAM)
 a.zumla@ucl.ac.uk

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