

Name Dilip Nathwani	GMC/GDC Registration Number 2926281 (GMC); DOB: 17/03/1961
Specialty: Infectious Diseases Details	ID Consultant 01 Jan 1993- 2018
Name of Appointment Director of AHSP	AHSP director- 2014 to current
NHS Employer NHS Tayside	Main Place of Work Ninewells Hospital
Honorary Professor of Infection, University of Dundee ; dilip.nathwani@nhs.net ; dnathwani@dundee.ac.uk	Professional Qualifications MBChB 1984 with commendation, University of Aberdeen; DTMH (1992); FRCP (Edinburgh) 1995; FRCP (London) 2004

SCOPE AND LEVEL OF PROFESSIONAL CONTRIBUTION TO THE NHS

Evidence of Leadership: 1] Between 2008-2017 I led the Scottish Antimicrobial Prescribing Group (SAPG), a SGHD project to lead antimicrobial stewardship for Scotland. The impact of this work has led to significant reduction in primary and secondary care prescriptions of antibiotic associated with *C.difficile* infection [CDI] and stabilisation and reduction in antibiotic resistance. This work is recognised as a global exemplar of healthcare intervention in this area. 2] Since 2014 I have led as co-director/director the creation of the first Academic Health Sciences Partnership [AHSP] in Scotland. This collaboration between NHS Tayside, the University of Dundee and commercial partners is the driver for healthcare innovation in the region with the aims of improving health and wealth. The AHSP as one key example has created a unique collaboration between Life sciences, the centre for human identification and anatomy, medical technologies including industrial partners, health and skills to create a "Biomedical Cluster" that will drive economic growth in the region. Funding has been awarded for £25m and we are presently developing the outline business case and operational plan for a Bio/Med tech innovation hub in Dundee. The possibility of using the AHSP model for driving innovation across Scotland is being considered by the SGHD and has been subject of a recent ethnographic evaluation. 3] In 2015 received from Her Majesty Queen Elizabeth the Order of the British Empire [OBE] for services to the treatment of infectious diseases and was elected President of the British Society for Antimicrobial Chemotherapy [BSAC] recognizing my national and international contribution in the field of clinical infection management, antimicrobial stewardship and antimicrobial resistance [AMR]. As a recognition of my work in antimicrobial stewardship I was also invited by the RCPE to give the Jim Petrie Memorial Lecture in Aberdeen in 2019.

AUDIT, CLINICAL GOVERNANCE, PROMOTION OF EVIDENCE BASED MEDICINE

1]. Between 2014- 2017 Chaired the Scottish Informatics Infection Intelligence Platform. This is unique platform to infection and built on the success of the diabetes platform. Key functions of the platform have been embedded within the work of the Scottish Antimicrobial Prescribing Group and is seen as a good model of how informatics can not only inform policy but how it can provide a robust evaluation of the impact of community, hospital or national healthcare interventions on a range of outcomes including the ability to measure unintended consequences. 2] At a local level in Tayside I led the creation of a more diverse approach to reducing "high end" broad spectrum antibiotic use by promoting "older" alternative agents to tazocin and meropenem- this proved to be successful in achieving the desired outcomes of reducing use of the above agents and has led to its promotion within national Scottish policy [Kennedy H et al. JAC 2015]. Scotland as a result of wider adoption of this practice has some of the lowest rates of hospital use of meropenem. 3] In 2016 I was invited by the European Wound Management Association to lead the first cross disciplinary European working group to identify the key evidence base requirements in relation to wound care and prudent use of antibiotics.

ADMINISTRATIVE, MANAGEMENT AND ADVISORY ACTIVITIES

LOCAL

1] 2001-2015 Lead Clinician and Chair of the Anti-microbial Management Team. I successfully led the regions action against improving the quality of antimicrobial prescribing. 2] On behalf of NHST i led for the first 3 years the successful implementation of the national sepsis program ; 3]. DME & Acting Chair of NHS Tayside ACT group. I was the first appointed DME in Scotland. As DME and member of this group i have positively influenced the delivery of UG and subsequently PG teaching delivery within NHS Tayside. This has been identified as an area of good practice by the GMC. 4] As chair the AHSP executive group i have driven the creation of a collaborative framework to drive innovation and support the NHST transformationa program as well as the new regional planning process.

NATIONAL

During my tenure as chair of SAPG I created with Kevin Rooney the case for developing and funding [from HAI funding] the Scottish Patient Safety Sepsis program which has been very successful. As recent Specialty Advisor for infectious Diseases to the SGHD[member of SMASAC] I have helped the ID specialty gain prominence where it did not have in the past, particularly in the areas of antimicrobial stewardship, healthcare acquired infection and ambulatory IV therapy. 2015-2018 President of the British Society for Antimicrobial Chemotherapy[BSAC] recognising my national and international leadership in the field of clinical infection management, education & antimicrobial stewardship.

INTERNATIONAL

My involvement and leadership in the field of antimicrobial stewardship, sepsis and MRSA/CID management has been recognised in Scotland, UK and internationally. In 2011 I was appointed by the European Society of Microbiology and Infectious Diseases as Chair of one of their key study groups- European Study Group for Antibiotic Policies (ESGAP). In 2017 -2018 i have led and participated in the World health Organisation [WHO] expert groups on creating a competency framework for healthcare professional training in AMR and more recently developing antimicrobial stewardship education and implementation tool kits for lower and middle income countries. In 2017 i was invited to give the plenary guest lecture on "global antimicrobial stewardship" by the European Society for Clinical Microbiology and Infectious diseases [ESCMID] at their annual conference in Vienna attended by 11000 delegates, the largest infection conference in the world. My lecture was the most attended lecture in the conference- 1800 delegates. Between 2016-2018 i have led on behalf of the UK government the UK-Russian roundtable discussions on AMR - these are supported by the UK foreign and commonwealth office [FCO] science and innovation networks. The FCO has supported three other projects which i have led in India, South Africa and Brazil. In 2017 i was invited by the influential EU Pan-European network to contribute a seminal piece about the challenges of AMR within the European healthcare context. More recently I have participated and in some part led the WHO healthcare professional competency framework for training in AMR and development of the Antimicrobial stewardship tool kit for lower and middle income countries. I am also involved in developing training material for WHO in this area as well as providing site visits & training. My international work in AMR was recognized by the Dutch National AMR Group for the 2019 SWAB award of International leading contribution to AMS.

RESEARCH, INNOVATION AND COMMERCIAL

1] As a busy NHS clinician I continue to have a high research and publication profile- As of 2018 265 peer reviewed publications with 53 in the last 5 years. Their impact is outlined below. 2] In the last five years we have attracted 5 senior international colleagues to learn and observe our stewardship program and were a premier ESCMID observer ship centre. 3] Evaluations of all my presentations at local, national or international meetings have demonstrated high/very high satisfaction from attendee's or participants. 4] The importance of implementation science in changing clinical and public behaviour in the context of healthcare is fundamental to achieving better outcomes. The concept of better training, better systems of care leading to better outcomes for all is well accepted. As co-lead [with Professor Mary Renfrew] I showed clinical leadership in securing the funding for the development and formation of the first Scottish Improvement science collaborative [SISCO]. At the heart of this work was creating a research and Knowledge Transfer community that supported quality improvement methodology. 5] Throughout my career I have been interested in evaluating clinical and economic value of new antimicrobial and novel services to deliver infection care. As part of this I have keen insight into working with commercial & research partners and how these can impact on the NHS and also other healthcare systems at a global level. This insight is now supported by engaging and learning about the broader health and care innovation ecosystem.

PUBLICATIONS and SIGNIFICANCE OF RESEARCH

Number of PEER REVIEWED articles: whole career: 265 last five years: 53

Illustrated examples of research impact: 1] Audit: Six years of a national antimicrobial stewardship programme in Scotland: where are we now: Colligan C et al. ARIC 2015; 2] New research/impact: Impact of antimicrobial stewardship interventions on *C.difficile* infection and clinical outcomes: segmented regression analysis. Patton A et al JAC 2018; 73(20:517-526; 3] research and policy: Reduction in post-operative acute kidney injury following change in antibiotic prophylaxis policy for orthopaedic surgery: an observational study. Walker H et al. JAC 2016; 71(9): 2598-605. ; 4] cost- effectiveness: Pan-

European early switch/early discharge opportunities exist for hospitalized patients with MRSA complicated skin and soft tissue infections. Nathwani D et al. CMI 2014; 20(10):993-1000;

5] informatics/healthcare : Building a national infection intelligence platform to improve antimicrobial stewardship and drive better patient outcomes: the Scottish experience. Bennie M et al. JAC 2017; 6] Changes in resistance among coliform bacteraemia associated with a primary care antimicrobial stewardship intervention: A population-based interrupted time series study. Hernandez- Santiago V et al. Plos One 2019, in press. Unique high impact study showing impact of a regional stewardship programme on a key outcome- resistance in bacteraemic patients admitted to hospital.

72(10): 2938-2942; 7] Changing Practice through Education : Development and impact of a massive open on line course (MOOC) for antimicrobial stewardship. Perez et al JAC 2018; 73(4): 1091-1097; 8] Global audit & impact: An international cross-sectional survey of antimicrobial stewardship programmes in hospitals. Howard P et al. JAC 2015; 70(4):1245-55.

SCIENTIFIC REVIEW

Peer review of Journals: In the past 5 years I regularly review for a range of high quality infection journals continue to provide peer review of national research grants. More recently i but have channeled more of my energies into global educational solutions outlined below.

TEACHING AND TRAINING

UNDERGRADUATE

In March 2005-2008 I was appointed NHS Director of Undergraduate Teaching. This was the first such role of its kind in Scotland and i have been influential locally in providing NHS leadership, accountability and innovation in this area. The success of this post had encouraged other boards to make similar appointments. Importantly the work I have developed in Tayside around quality assurance and performance management has clearly informed the 2008 national ACT working group recommendations in this area. Despite this I continue to be involved in everyday clinical teaching/ assessment (2007-2008 Faculty of Medical Educators Student award for "Inspirational Teacher"; 2012-2013 FAME award for continuing and long term excellence in teaching) in Dundee. I was also Honorary President of Dundee University Medical Society. I have since 2013 continued to teach undergraduates and have undertaken a range of survey's to understand the educational needs of medical students in relation to AMR. This has been helpful in current on going WHO work to develop a curriculum and competency framework for AMR learning.

POSTGRADUATE AND PROFESSIONAL

Royal Colleges: Secretary, Intercollegiate Medical SHO Posts Inspection Committee Medicine (IMSPEC) until 2002; SAC: Secretary (1998-2002) Specialist Advisory Committee for Training in Infectious Diseases and Tropical Medicine (SAC, JCHMT); Programme Director and Educational Supervisor for SpR training in Infectious Diseases until 2010; Local Training: Educational Supervisor for Foundation Doctors, Member, Post-Graduate Regional Education and Training Committee; 1995-2003 Lead Clinician (RCPE) for PACES in Dundee. In March 2008 was appointed to NHS Director of Medical Education which has a strategic role related to ensuring educational provision and governance for undergraduate and post-graduate education in NHS Tayside. I have been instrumental in securing the first NHS Directorate of Medical Education at a board level that has integrated high quality Undergraduate and Postgraduate medical education delivery. I completed this role in 2014-15 to take on the new role of co-director/director of the AHSP. Since then my contribution to local PG training has been limited but i have been extensively involved in providing global educational solutions in the area of AMR. This is illustrated below.

EDUCATIONAL PUBLICATIONS

Number of books: whole career 1, chapter in text books 10

Co-author of Illustrated Cases in Acute Clinical Medicine, Churchill Livingstone, Edinburgh 1994. Chapters: Whole career: 10, last 5 years 4; In 2015 I created and led a tripartite collaboration between University of Dundee, British Society for Antimicrobial Chemotherapy [BSAC] and FutureLearn to create the world's first open access free at the point of access massive open on line course [MOOC] in antimicrobial stewardship. This has now been through 4 foreign language translations and has been accessed by > 60000 participants from 163 countries. This has been complimented in 2018 by the development of a unique freely accessible global interactive global e-book on stewardship for all healthcare professionals. Since its launch in 3/18 it has had > 30,000 formal downloads and was recognised by WHO as a key global educational solution in AMR. In both ventures clinical, academic and commercial partners across Scotland and globally have been involved. The above example illustrates my recent focus on building knowledge sharing and transfer capacity by harnessing resources from a range of stakeholders- commercial, non-governmental bodies, charities so as to build capacity for developing, delivering and measuring the impact of these educational resources. The most recent example of educational innovation is leading [as Editor in Chief] the development of a unique open access on line education learning repository and research platform for AMR and antimicrobial stewardship- JAC-AMR [<https://academic.oup.com/jacamr/issue/1/1>]. This is a collaboration between BSAC and Oxford University Press.

IMPROVEMENTS IN SERVICE AND ACHIEVEMENT OF SERVICE GOALS

Service Goals: The last 4 years i have continued to contribute to the ID service and organizational goals. Since 2014 i have focused more on the AHSP and AMR. Despite this i continue to provide mentoring and senior leadership to the ID department which has 3/ 4 consultant colleagues appointed in the last 3 years. As AHSP-co-director I also attend senior NHST leadership meetings to provide support for clinical strategy and transformation so as to allow us to reach our goals. For example, the AHSP has created a quality improvement and informatics cluster, bringing together NHS/care clinicians with academics and the commercial sector so as to support the achieve of key service goals through innovation.

OVERALL PERSONAL APPRAISAL

Between 1993 and 2014 I have led the NHST ID service into effectively meeting the modern challenges of infection. My contributions to healthcare in Tayside and to the medical school and broader academic life have been recognised through receipt of a range of accolades previously described. I have continued to further develop my academic contribution exemplified by > 265 publications and importantly many of them, have demonstrated that a significant amount of my work has influenced policy, improved education and improved care and outcomes. My national and international profile continues to grow significantly as evidenced by Chair of the European Stewardship organisation [ESGAP], Presidency of the British Society for Antimicrobial Chemotherapy [BSAC], recent membership of the expert WHO consultations and work on behalf of the UK FCO'S. As Chair of the Scottish Antimicrobial Prescribing Group between 2008-17 I led the group to positively impact on clinical infection outcomes and improved safety but have also put Scotland " on the map" as a centre of international excellence in this area. I have shown leadership in bringing together the broad and sometimes diverse infection community with other key players to understand and support improved care. The collaboration to build the unique Scottish Infection Intelligence platform is a good example of this. In addition I jointly secured funding for the first Scottish improvement science collaborative [SISSC]. My recent work in relation to global education in AMR, including the MOOC, E-BOOK and JAC-AMR and driving health and care innovation in Scotland to improve health and wealth is beginning to reach fruition.

SUMMARY

Over the last three decades I have acquired diverse and vast experience in providing NHS based acute infection and internal medicine care combined with development of modern outpatient and ambulatory care services. In addition I have developed my academic capabilities in the field of infection management evaluation and research that has resulted in significant clinical impact as well as influencing local, national and global practice & policy. My focus on outcomes as well as health economics has led to increasing interest in value based healthcare. More recently, I have also acquired new experience and skills sets in delivering "all types of " healthcare innovation that aims to improve health outcomes and economic growth. Here I have acquired a range of valuable skills in seeking and developing commercialization opportunities.

Education has always been a passion for me exhibited by a desire to "deliver open access innovative education as a global level".

My main area of focus remains AMR and antimicrobial stewardship where I bring insight into clinical and economic value of new care pathways for infection management, how new antimicrobials as well how such technologies [e.g diagnostics] will/could work within a complex NHS and global care system, their value and how they may be appraised by health technology assessment groups - these insights stem from more than 30 years working in the NHS and collaborating with other health systems, including those in lower and middle income countries. Training healthcare professionals and others on how best to use these pathway, new antibiotics & technologies underlies all this- providing busy people with a range of education and training solutions, such as on line courses, is a key focus.