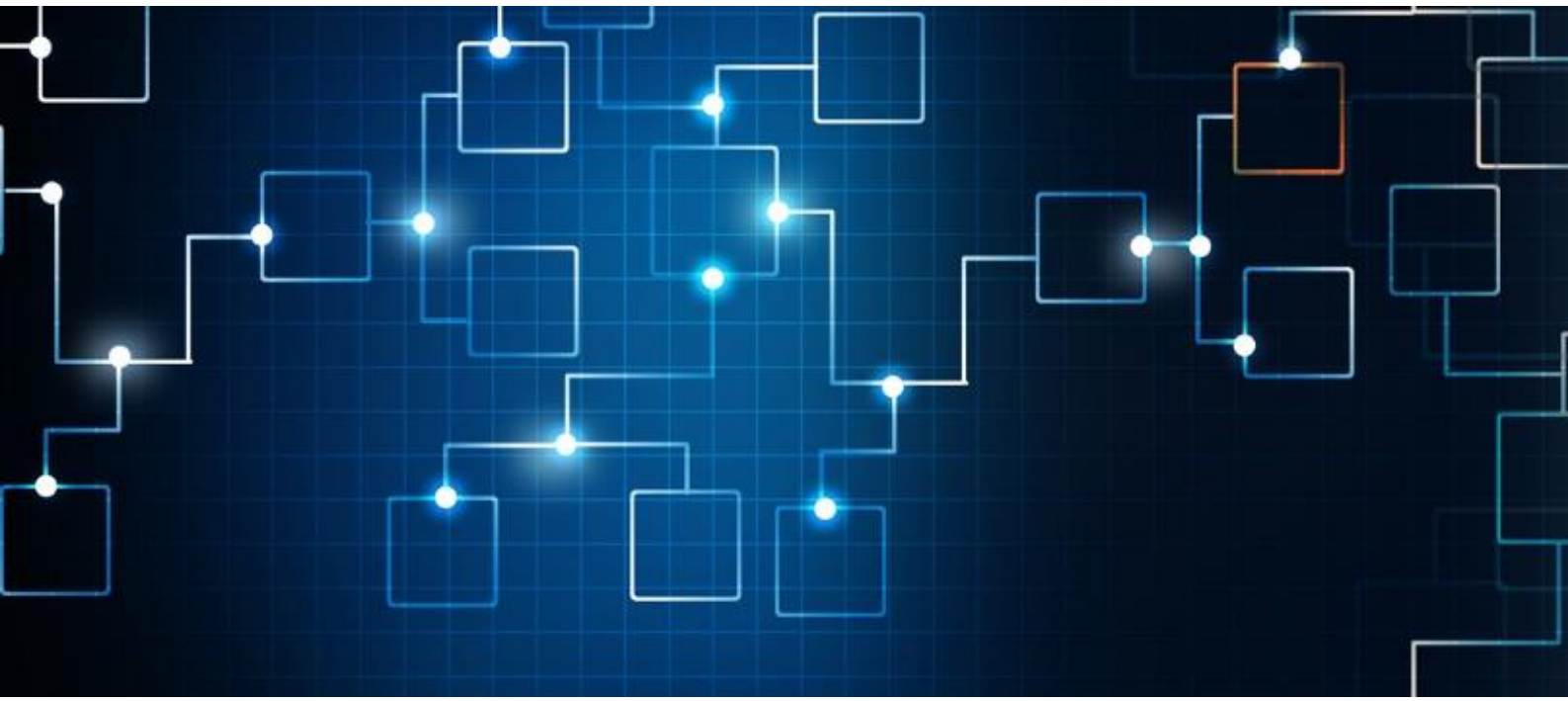

Fourth JPIAMR Call Workshop:

Maximising existing and future research efforts and resource alignment to combat AMR

8-9 March 2018
Frankfurt am Main

UPPSALA UNIVERSITET

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Vetenskapsrådet

Workshop Overview

The workshop on the funded working groups/networks from the JPIAMR fourth call "Maximizing existing and future research efforts and resource alignment to combat AMR" was hosted by Goethe University, Uppsala University (MRC) and JPIAMR, and funded by the Swedish Research Council (SRC). The conference brought together 40 participants, representing 11 of the 13 funded projects, and representatives from the JPIAMR funding agencies, management board and secretariat.

The aims of the workshop were to:

- Share ideas on AMR policy recommendations and research strategies by bringing the PIs in the different projects together to present their work
- Increase awareness of existing networks and identify possibilities for future research collaboration and funding schemes
- Exchange experiences, approaches and lessons learnt. What has worked and what has not?
- Future alignment and potential coordination of programmes

This report gives a short description of the presented projects, the challenges and lessons learnt.

Major Conclusions

- Network funding mechanism facilitated the formation of successful networks in all strategic JPIAMR areas.
- JPIAMR Network funding allowed Networks to carry out a broad range of activities with different outcomes, including white papers/position papers, conferences/workshops, systematic reviews, Standard Operating Procedures, online courses, guidance documents and journal articles, amongst others.
- Funded Networks would benefit from participating in an earlier joint meeting.

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Presentations:

Plenary Talk 1: On the development of different AMR policy recommendations and research strategies

A personal view

Presenter: Antoine Andremont, University Paris-Diderot Medical School and INSERM, France

"Research strategies are often more driven by social and economic pressures than pure science"

There have been two main research movements in AMR:

1. Industry: development of better antibiotics (natural, synthetic, semi-synthetic)
2. Academia: to decipher resistance mechanisms when new resistance phenotypes were observed in patients

During the 80s and the 90s marked by the eruption of HIV infections and of many diseases linked to the aging of the population, there were no new antibiotics developed and industrial research stopped brutally. The best young scientists chose to work on other topics. Only a limited number of small hubs in the EU still focused on AMR despite the fact that big funding agencies were not so interested in funding AMR. During this time, at the turn of the millennium, there was limited breakthrough research on AMR in contrast with a massive increase in antibiotic usage since generic antibiotics arrived on the market. In 2005-2010 there was a brutal wakeup call with recognition of the importance of the issue of antimicrobial resistance. In the following years two types of reports have been issued:

1. Reports from academia stressing natural evolution of resistance as a Darwinian phenomenon. These reports underlined the food chain and the environment in the emergence of resistance and drove the emergence of the "One Health" concept.
2. Economic forum of Davos, stressing the risk of the economic impact of AMR (2013).

After 2010 there was a number of significant reports and action plans published (WHO Global Action Plan, The OIE and FAO plans for AMR control, The World Bank report on the economic impact of AMR & The O'Neil report). These reports all stressed the level of risk for all, the lack of immediate solutions and the need for research.

In 2014, the Dutch government organised a global ministerial conference on AMR. At this conference Daphne Decker, a model and actress, shared her year-long fight against an *E. coli* superbug infection, giving the AMR issue a "face" and the recognition that this type of infection could affect anyone.

The JPIAMR was formed in 2011 and probably has the best developed Strategic Research Agenda (SRA) in the field, introducing the pillars of therapeutics, diagnostics, surveillance, transmission, environment & interventions, with no official prioritization of the topics. The content of the SRA and the JPIAMR calls are strongly influenced by the JPIAMR member country policies. JPIAMR has funded projects in most areas, but the areas of diagnostics and surveillance are not yet highly funded by JPIAMR.

Although the One Health approach is recommended in all high level documents, funding in the areas of AMR has largely been focused on the development of new antibiotics, despite the fact that the WHO Global Action plan only suggests developing new medicines in one of the five priorities.

In 2017 the WHO published the Global priority list of antibiotic-resistant bacteria to guide research, discovery and development of new antibiotics. This has had a profound influence on research policies and funding. Several other initiatives also focus on the development of new drugs.

- GARDP: Global antibiotic research and development partnership
- CARB-X: promote the development of new antibiotics.
- Novo holdings: fund for medical and life science research in Denmark. Focused on WHO priority pathogens at the very early stage of development
- DRIVE AB: driving reinvestment in R&D for antibiotics and advocating their responsible use

There are also private-public initiatives and non-profit organisations that are focusing on diagnostics

- IMI (Innovative Medicines Initiative): with its recent call on diagnostics "The value of diagnostics to combat antimicrobial resistance by optimising antibiotic use" – focused on Lower Respiratory Tract infections
- FIND: a not for profit organisation recognised by the Swiss government as an international organisation has a plan for tackling AMR
- Unitaid: working group to study how to fight AMR through access to innovative treatments and diagnostics

There is a clear need for coordination of efforts in AMR research. There are two major movements that have been put in place for that:

- At the technical level: creation of the JPIAMR Virtual Research Institute (VRI) to coordinate research
- At the political level: Global Hub that will be launched in 2018 to create high level awareness between the states and will be dynamic dashboard of all efforts

In conclusion, the efforts to address AMR are impressive and it is essential that One Health remains central in these efforts. Currently there is a huge effort addressing the development of new drugs, and to a lesser extent the development of diagnostics. Other innovative efforts such as alternatives to antibiotics, reduction of use, use of big data, protection of the environment, inclusion of social sciences and vigilance to emerging new fields also need to be recognised.

Plenary Talk 2: The JPIAMR Virtual Research Institute

Presenter: Edith Brochu, CIHR Institute of Infection and Immunity, Canada

The JPIAMR VRI will build a virtual corridor to facilitate new, multi-dimensional partnerships and collaborations. The JPIAMR VRI has been discussed at many meetings in the last 6 months and was the focus of a workshop, organised by the German Aerospace Centre and the Canadian Institute for Health Research, in Berlin November 2017. The recommendations for this workshop were to:

- Act now and build the VRI by engaging the different pillars of the SRA
- Build a clear mission and vision
- Identify a unique niche
- Provide a strong IT infrastructure
- Hold a series of regional planning workshops
- Evaluate similar organisations that are successful and model the JPIAMR VRI on these
- Build networking functions

The JPIAMR VRI vision: the global research community is engaged to reduce the burden of AMR through a one health approach.

The VRI mission: The JPIAMR-VRI is a virtual platform to connect research networks and research performing institutes/centres to implement Antimicrobial Resistance One Health collaborative research on the JPIAMR Strategic Research Agenda priority topics by increasing knowledge, diversity, collaborations and capability.

The JPIAMR-VRI will engage global One Health research. The global platform will support knowledge exchange aimed to link AMR research and reduce duplication of effort.

A network call will be launched in the May 2018 to involve the scientific AMR community in the development of the JPIAMR-VRI. The funded networks will focus on brining the JPIAMR-VRI to life!

The European Commission Action Plan, launched in June 2017, includes a specific action committed to supporting the establishment of a JPIAMR-VRI to improve further global research collaboration.

Discussion comments

- *How will researchers benefit from the JPIAMR-VRI and how will it stop us making the errors we made in the past?*
  We have a variety of outcomes within the VRI. Mapping will be one thing that will be built in to the information database, so the research that is being conducted will be evident and this will avoid duplication of effort. Information will be available and accessible more rapidly. There will be increased collaborations and partnerships, increased knowledge and data sharing, linkages created across and between research fields, access to exchange programmes, workshops, educational and training programmes, stocktaking of existing networks/centres/projects.

- *How will we link JPIAMR being semi-global to the JPIAMR-VRI that is global?*
  The JPIAMR member countries will be initially engaged and the JPIAMR-VRI will eventually be made more global. JPIAMR will reach out to others who would benefit from being involved in the JPIAMR-VRI. Different stakeholders will be engaged. JPIAMR recognises that the JPIAMR-VRI is a vehicle for the JPIAMR to extend their global reach.

- *Will you focus on networks that are already existing?*
  The JPIAMR-VRI will start with the networks that are closest to the JPIAMR Strategic Research Agenda, and engage the others with time. That vision is to be inclusive.

- *Within any given country there is already fragmentation, regarding the One Health approach. How will the VRI help with fragmentation where all stakeholders are trying to protect their own interests?*
  The engagement is in development but we appreciate that every country has fragmentation but the small successes will be to bring these fragmented groups to the VRI. We will initially begin by attracting the low hanging fruit.

- *Some structural centres got private funding with the agreement that they publish information as soon as it was obtained. These centres could still publish information. The VRI could have this type of idea. Is there an idea to involve industry?*
  Yes, at some point industry should be involved, but the extent is unknown and at what time is also unclear.

- *What is in it for an academic researcher? How will affect me, my career etc in an academic context?*
  We intend to focus initially on the younger generation, who may have great ideas but do not have the connections etc. We want to work with researchers to determine what their needs are, and build the VRI based on research need.

Tackling AMR via innovative natural products

Presenter: Rolf Müller, Helmholtz-Institut für Pharmazeutische Forschung Saarland, Germany

The Helmholtz-Institute für Pharmazeutische Forschung Saarland (HIPS) as part of the Helmholtz Centre for Infection Research focuses on:

1. Bacterial and viral pathogens
2. Immune response and interventions
3. Anti-infectives

There is a developmental crisis for novel antibiotics and this has a major clinical impact. Current antibiotics belong only to few classes, and the number of targets are limited. We need new antibiotics with innovative targets and ideas. The objectives of the anti-infectives groups at HIPS/HZI are to find new compounds, new targets, and optimise pharmaceutical properties.

More than 80% of the anti-bacterials on the market are natural products. HZI/HIPS focusses on the WHO priority list and on the medical need, and identified compounds from myxobacteria, actinobacteria and fungi with promising anti-infective properties. In addition, they have developed a database for dereplication of all compounds so they can identify new compounds and have a library of natural products.

Myxobacterial genomes are a promising source of novel natural products that are antibacterial or antifungal. Most compounds are toxic but some show potency as antibacterials without significant toxicity. By growing myxobacteria under different conditions (eg liquid culture vs agar) they can cause changes in the compounds produced by these organisms.

Within Germany there is a virtual centre for infection research (DZIF), founded in 2015 with government funding, which engages 35 different research instructions with the aim to bridge the "translational gap" in anti-infective discovery. Some compounds that they have discovered with potential therapeutic properties include:

- Cystobactamids: novel lead compounds against ESKAPE pathogens. They are a novel antibiotic class and have a broad-spectrum activity against Gram negatives. Significant effects shown in mouse models.
- Amidochelocardins: resistance-breaking broad spectrum antibiotics that have been shown to have effects in UTI mouse models.
- Novel antibiotics and anti-parasitic agents against Filariasis: elephantiasis and onchocerciasis. One of these compounds (corallopyronin) has increased action compared to tetracyclines but development is difficult due to the lack of interest in this health topic.
- Griselimycins: potential anti-TB drugs that have activity against DnaN. A plasma stable variant without cross resistance with known antibiotics has been developed in collaboration with Sanofi.

Medicinal chemistry and natural products have a role to play in AMR research. Academic research needs to be linked with the development by industry and PPP as mentioned above by Prof. Andremont. However, academic institutions typically cannot bridge the gap into the requirements of the PPPs. To achieve bridging this gap JPIAMR should play a role as VRI to coordinate efforts in academic institutions and help with advice regarding drug development.

Working group presentations:

Flies (Diptera: Muscidae) and the spread of antimicrobial resistant bacteria

Coordinator: Frieder Schaumburg, University Hospital Münster, Germany

JPIAMR area: Surveillance, Environment, Transmission

Working Group Partners:

- Dr. Abraham Alabi, Centre de Recherches Médicales de Lambaréné, Albert Schweitzer Hospital, Lambaréné, Gabon.
- Prof. Dr. Ross Fitzgerald, Roslin Institute, Royal School of Veterinary Studies, University of Edinburgh, UK.
- Prof. Dr. Martin Grobusch, Academic Medical Center, University of Amsterdam, the Netherlands.
- Prof. Dr. Stefan Kühne, Federal Research Centre for Cultivated Plants, Institute for Strategies and Technology Assessment, Germany.
- Prof. Dr. Luca Guardabassi, Department of Veterinary Disease Biology, Faculty of Health and Medical Sciences, University of Copenhagen, Denmark and School of Veterinary Medicine, Ross University, St. Kitts.

Summary

Factors facilitating the emergence of antimicrobial resistant microorganisms are antibiotic misuse and transmission in healthcare facilities and the community. However, recent studies highlight the importance of alternative transmission routes, such as zoonotic spread or potential dissemination through environmental sources (water, food items).

Vector-borne transmission of antimicrobial resistance (AMR) has been neglected in the past. Transposition of bacteria by 'filth flies' is a long-known concept and whilst plausible, there is very little evidence for a public health-relevant dimension of AMR and flies.

Flies and the spread of AMR might be a challenge both in industrialised (e.g. livestock, production, global warming) and developing countries (e.g. insufficient sanitary systems, immediate contact between humans and livestock). Since the emergence of drug resistance is a global challenge, it needs cross-border approaches. Our working group was formed to conceptualise the role of flies in the transmission of antimicrobial resistant bacteria and to identify knowledge gaps for future research agendas.

The output is a systematic literature review and the main findings are that 'filth flies' can be colonised with antimicrobial-resistant bacteria of clinical relevance. Due to the faecal-oral route of transmission, the enteric bacteria pose the highest risk. This includes extended spectrum beta-lactamase-, carbapenemase-producing and colistin-resistant (mcr-1 positive) bacteria. Resistant bacteria in flies often share the same genotypes with bacteria from humans and animals when their habitat overlap. 'Filth flies' can 'bio-enhance' the transmission of AMR as bacteria multiply in the digestive tract, mouthparts and regurgitation spots.

In our report, we also define a future research agenda to address open questions. The most important research need is a quantitative risk assessment model that should be refined and fed with additional data (e.g. vectorial capacity, colonisation dose). This requires targeted ecological, epidemiological and *in vivo* experimental studies.

Behavioural approaches to optimise antibiotic stewardship in hospitals

Coordinator: Craig R Ramsay, Health Services Research Unit, University of Aberdeen, UK.

JPIAMR area: Interventions

Working Group Partners:

- Prof Peter Davey, University of Dundee, United Kingdom
- Dr Esmita Charani, Imperial College London, United Kingdom
- Prof Jeremy Grimshaw, Ottawa Health Research Institute, Canada
- Prof Andrew Morris, University of Toronto, Canada
- Associate Prof Ingrid Smith, Haukeland University Hospital and University of Bergen, Norway
- Dr Brita Skodvin, University of Bergen and Haukeland University Hospital, Norway
- Prof Winfried Kern, Albert-Ludwigs University, Germany
- Prof Jill Francis, City University London, United Kingdom
- Dr Charis Marwick, University of Dundee and NHS Tayside, United Kingdom
- Dr Ralph Möhler, Cochrane Germany and University of Freiberg, Germany
- Prof Jan Clarkson, University of Dundee, United Kingdom
- Dr Eilidh Duncan, University of Aberdeen, United Kingdom
- Dr Katie Gillies, University of Aberdeen, United Kingdom
- Dr Fabiana Lorencatto, University College London, United Kingdom
- Jo McEwen, NHS Tayside, United Kingdom
- Stephen McIntyre, City University, United Kingdom
- Susan Rogers van Katwyk, University of Ottawa, Canada
- Dr Magda Rzewuska, University of Aberdeen, United Kingdom
- Dr Kathryn Suh, Ottawa Hospital, Canada

Summary

Antibiotic stewardship is a key strategy to prevent antibiotic resistance and reduce healthcare associated infections. There is robust evidence to show that a variety of stewardship interventions are effective in reducing unnecessary treatment safely, without increase in mortality. However, stewardship efforts require health professionals to change their behaviour and it is uncertain the extent to which the substantial theoretical and empirical framework in behavioural sciences about how to change behaviour has been applied to stewardship programmes. This working group brings together world experts in antibiotic stewardship with experts in implementation science and behaviour change to address:

1. What behaviour change approaches can be recommended now to optimise hospital stewardship programmes?
2. How can hospital stewardship programmes be designed to optimise implementation across countries?
3. What is the research agenda to optimise efficient implementation of hospital antibiotic stewardship programmes worldwide?

Our group recently completed the most comprehensive systematic review to date of 221 intervention studies to improve hospital antibiotic prescribing. The working group has carried out further analysis on the data from this systematic review in order to provide guidance on what behaviour change approaches are effective strategies for optimising stewardship in hospitals. We have completed a further systematic review on the international barriers and facilitators to antibiotic stewardship in

hospitals to provide details on the likely challenges that can be encountered when setting up and implementing these programmes. The working group has also completed a structured consensus process to identify and agree research priorities for efforts to optimise behavioural approaches to the implementation of antibiotic stewardship in hospitals worldwide.

The research priorities were

- Conduct robust evaluations of stewardship programmes
- Establish the role of patients in antibiotic stewardship in hospitals
- Identify the barriers and facilitators to implementing antibiotic stewardship programmes and good clinical practice
- Specify the actors and actions required by clinical teams and stewardship programmes
- Establish the activities in current stewardship programmes
- Evaluate the role and impact of government and policy context
- Identify a defined balanced set of outcomes and measures to evaluate the effects of interventions
- Establish the evidence base for appropriateness
- Establish how to define and design stewardship programmes
- Conduct a synthesis of available evidence to support planning for future research and planning for stewardship programmes

We intend to further disseminate these outputs widely including peer-reviewed journal articles, white papers and by incorporating the working group findings into a Massive Online Open Course (MOOC) for health professionals engaged in stewardship efforts.

VetCAST – Veterinary Committee on Antimicrobial Susceptibility Testing

Coordinator: D.J. Mevius, Wageningen Bioveterinary Research, Lelystad, The Netherlands.

JPIAMR area: Diagnostics, Therapeutics, Surveillance

Working Group Partners:

VetCAST Steering Committee:

- Dr. Kees Veldman, microbiologist, Central Veterinary Institute part of Wageningen UR, the Netherlands. MIC-data manager of VetCAST, expert in antimicrobial resistance and antimicrobial susceptibility testing
- Dr. Peter Damborg, Veterinary microbiologist, secretary of VetCAST, Department of Veterinary Disease Biology, University of Copenhagen, Denmark
- Dr. Ludovic Pelligand, veterinary pharmacologist, PK/PD expert, Steering Committee member of VetCAST, PK-data manager, Department of Comparative Biomedical Sciences, Royal Veterinary College, London, United Kingdom
- Prof. Pierre Louis Toutain (emeritus), veterinary pharmacologist, Steering Committee member of VetCAST. Department Pharmacologie-Thérapeutique, l'Ecole Nationale Vétérinaire de Toulouse, France/Royal Veterinary College, London, United Kingdom
- Prof. Alain Bousquet-Melou, Department Pharmacologie-Thérapeutique, l'Ecole Nationale Vétérinaire de Toulouse, France

All 49 VetCAST members are:

- Alain Bousquet-Melou (France)
- Annet Heuvelink (Netherlands)
- Agnese Cannas (Italy)
- Alessia Franco (Italy)

- Andrea Fessler (Germany)
- Antonio Battisti (Italy)
- Antonia Vidili (Italy)
- Christina Greko (Sweden)
- Cindy Dierikx (Netherlands)
- Dik Mevius (Netherlands)
- Enzovet (Italy)
- Gudrun Overesch (Switzerland)
- Gunnar Kahlmeter (Sweden)
- Heike Kaspar (Germany)
- Illias Chantziaras (Belgium)
- J Mitchell (United Kingdom)
- Jean-Yves Madec (France)
- Juergen Wallmann (Germany)
- JW Mouton (Netherlands)
- Renata Karpiskova (Czech Republic)
- Kees Veldman (Netherlands)
- Lina Cavaco (Denmark)
- Lisbeth Rem Jessen (Denmark)
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- Marisa Haenni (France)
- Navotna (Czech Republic)
- Peter Damborg (Denmark)
- Peter Lees (United Kingdom)
- Pierre Louis Toutain (France)
- Pokludova (Czech Republic)
- Rafael Canton (Spain)
- Stefan Schwarz (Germany)
- Vincent Perreten (Switzerland)
- Zrinka Stritof (Croatia)
- Dorina Tomofte (United Kingdom
- Luca Guardabassi (Denmark)
- Lina Cavaco (Denmark)
- Valeria Bortolaia (Denmark)
- Geoffrey Foster (United Kingdom)
- Lorenzo Fraile (Spain)
- Simone Dore (Italy)
- Maritg Maaland (Norway)
- Petra Cagnardi (Italy)
- Ronette Gehring (Netherlands)
- Doresi (Italy)
- Andrew Mead (United Kingdom)
- Christian Giske (Sweden)

Veterinary clinicians:

- Lisbeth Rem Jessen, University Hospital for Companion Animals, University of Copenhagen, Denmark
- Christophe Hugnet, Clinique Vétérinaire des Lavandes, La Begude De Mazenc, France

Liaison with CLSI as observers:

Dr. Shabbir Simjee, Elanco Animal Health, Basingstoke, United Kingdom

Summary

The objectives of VetCAST were:

- To define science based clinical MIC-breakpoints (CBPs) in order to harmonise the results of antimicrobial susceptibility testing (AST) of veterinary pathogens in Europe.
- To provide a joint European forum for veterinary microbiologists, pharmacologists and clinicians working in research, public health and animal healthcare, including both public and private organisations to promote the importance of harmonized veterinary AST.

To comply with these objectives, position papers and SOPs on CBP definition, data-collection and maintenance were produced. Training courses were organised for professionals involved in veterinary antimicrobial therapy and AMR surveillance. VetCAST's activities and production were actively promoted though publically available sources and journals.

The starting date of VetCAST was March 27, 2017. On this date, we organized a kick-off meeting at Schiphol at which we discussed the plans and activities within VetCAST. There were 22 participants present from nine European countries (France, Denmark, Sweden, Italy, Germany, Czech-republic, United Kingdom, Croatia and the Netherlands).

The Steering Committee met on a regular basis through SKYPE. A closing meeting is organised at Schiphol airport on March 16, 2018 where 30 interested persons will be present.

Our network group had two major outcomes:

1. The publication of a position paper in an open access scientific journal of VetCAST for the definition of clinical breakpoints for drugs licensed for veterinary medicine. The reference to the paper is: Toutain PL, Bousquet-Mélou A, Damborg P, Ferran AA, Mevius D, Pelligand L, Veldman KT, Lees P. En Route towards European Clinical Breakpoints for Veterinary Antimicrobial Susceptibility Testing: A Position Paper Explaining the VetCAST Approach. Front Microbiol. 2017 Dec 15;8: 2344.
   This position paper was written in close collaboration with EUCAST. It is considered to be a major achievement and outcome of this network group, because it identifies to the scientific community how VetCAST aims work. The manuscript was accepted by EMA, with very few comments.
2. The second major outcome of VetCAST was the organisation of a one-week training course on PK-PD analysis and definition of clinical breakpoints in September in Toulouse, France. Lecturers were invited from European countries, the US and Australia including from EUCAST. The workshop was attended by 40+ participants and was repeated on a smaller scale in November 2017 in Uppsala, Sweden. Participants were predominantly from European countries, but also from China. Moreover, during the upcoming EAVPT congress in Wroclaw Poland in June 2018, again several sessions will be organised by VetCAST members on PK/PD analysis and Clinical Breakpoint definitions.

Additional achievements

- A webpage on the site of EUCAST, where all information on activities is posted (http://www.eucast.org/ast_of_veterinary_pathogens/)
- An SOP was developed for data collection from industrial partners, including a letter for private parties involved. The SOP is shared with industrial partners of interest and EMA and used for data collection.
- An application was submitted for a COST action on VetCAST. The intention was and is to ensure VetCAST's sustainability. The evaluation is foreseen for April 2018.
- A lobby was initiated by French partners to obtain support by DG-Sanco on the position of VetCAST as advisory body for EMA.
- PK/PD data collected for florfenicol in relation to the animal pathogens *Mannheimia haemolytica, Pasteurella multocida* and *Actinobacillus pleuropneumoniae.*
- During the closing meeting at Schiphol on March 16, the first species specific clinical breakpoints will be presented including it rationale document.

Consensus on Antimicrobial Stewardship Evaluation (CASE) working group

Coordinator: M.J.M. Bonten, University Medical Center Utrecht, Netherlands.

JPIAMR area: Intervention, Environment

Working Group Partners:

- M.J. Llewelyn, University of Sussex, United Kingdom
- S.A. Walker, University College London, United Kingdom
- J.I. Islam, University of Sussex, United Kingdom
- C.H. van Werkhoven, University Medical Centre Utrecht, the Netherlands

- M. van Smeden, University Medical Centre Utrecht, the Netherlands
- V.A. Schweitzer, University Medical Centre Utrecht, the Netherlands
- J. Bielicki, St George's University of London, United Kingdom
- P. Little, University of Southampton, United Kingdom
- J. Rodríguez-Baño, Hospital Universitario Virgen Macarena Seville, Spain
- B. Huttner, University of Geneva Hospitals and Medical Faculty, Switzerland
- E. Tacconelli, Universitätsklinikum Tübingen, Germany
- A. Savoldi, Universitätsklinikum Tübingen, Germany
- J.F. Timsit, Inserm Université Paris Diderot, France
- M. Wolkewitz, Freiburg Center for Data Analysis and Modelling, Germany

Summary

The aim of antimicrobial stewardship is to optimise antibiotic use by ensuring effective treatment of patients with infection while minimising the harms associated with antimicrobial use. The evidence regarding the efficacy and safety of various antimicrobial stewardship strategies is limited because a substantial majority of published studies is of insufficient methodological quality to provide interpretable conclusions. In the CASE working group we aimed to set out consensus-based recommendations on the design of research studies which aim to evaluate antimicrobial stewardship interventions.

First, we conducted a systematic literature search to get a complete overview of the methodological quality of published antimicrobial stewardship studies and to investigate in which areas of research the methodological quality was poorest. The systematic literature search was conducted as an integral part of the working group and the discussions during the working group consensus meetings were used to determine which factors were important for determining methodological quality and which stratifying factors should be investigated. The systematic literature search identified 12,722 studies of which 567 were included and data on methodological quality was extracted. The overall methodological quality of the included studies was low. Few studies used a randomised research design (15.2%) or included an external control group (27.0%). The majority of studies were before-after studies (50.3%), before-after studies with interrupted time-series analysis (15.2%), or cohort studies without control groups (7.6%). Many studies did not report clinical (55.6%) or microbiological (73.9%) outcomes. In the stratified analyses, we identified that the methodological quality was generally higher in primary care and in studies with financial support. There is no improvement of methodological quality over time, and there were no large differences between studies performed in paediatric versus adult patients, or in studies from different geographical regions.

As part of the consensus procedure we organised two consensus group meetings. In preparation for the first consensus group meeting we send a questionnaire to the working group members with questions about the desired scope and goals of the working group and the methods required to achieve them. In the first working group meeting the results of the questionnaires were discussed and consensus on the scope and goal was reached. In addition, we discussed which design elements are important and which factors influence design decisions. After the first working group, the insights from the discussion were used to draft the first version of the whitepaper. The whitepaper consists of (1) a systematic overview of the current methodological quality of antimicrobial stewardship studies, (2) a theoretical framework of different design elements, and (3) specific recommendations based on decisions that researchers make when designing an antimicrobial stewardship study. In the second working group meeting the first draft of the whitepaper was discussed and consensus on the recommendations to be included in the whitepaper was achieved. After the second working group meeting the external advisory panel was consulted and feedback on the whitepaper was received. The

working group will conclude by completing the whitepaper and submitting the whitepaper for scientific publication.

Appropriate use of antibiotics: the role of complementary alternative medicinal (CAM) treatment strategies

Coordinator: Erik W. Baars, Louis Bolk Institute/ University of Applied Sciences Leiden, The Netherlands.

JPIAMR area: Interventions

Working Group Partners:

- Klaus von Ammon, University of Bern, CAM center
- Thomas Breitkreuz, Filderklink, Hufelandgesellschaft
- Roman Huber, University of Freiburg, Head of CAM center
- David Martin, University of Tübingen
- Harald Matthes, University Charité, Berlin, Head of Havelhöhe Clinic, Berlin, Hufelandgesellschaft
- Jan Vagedes, Filder-Klinik, Head of ARCIM Institute
- Willem van Leeuwen, University of Applied Science Leiden
- Esther van der Werf (née Kok), University of Bristol
- Merlin Willcox, University of Southhampton
- Paschen von Flotow, Sustainable Business Institute (SBI)
- Philippe Hartemann, University of Lorraine
- Josef Hummelsberger, International Society for TCM
- Ton Nicolai, EUROCAM
- Tido von Schön-Angerer, IVAA
- Madan Thangevelu, University Cambridge (Ayurveda)
- Ursula Wolf, University of Bern, Head of CAM centre

Summary

Objectives

- To provide an overview of expert and scientific knowledge on CAM/IM treatment of (1) infectious diseases where antibiotics are not indicated; and (2) infectious diseases where the resistance problem is very large: e.g., bacterial urinary tract infections, enteritis and upper respiratory tract infections.
- To develop a first concept evidence and expertise-based decision-making tool for conventional doctors and CAM/IM practitioners for CAM treatment of these types of infectious diseases (see first objective).
- To provide a communication platform for all stakeholders involved.

Outcomes

The project will be finished July 1, 2018. Outcomes of the project are and will be:

- A narrative review “The contribution of Complementary & Alternative Medicine to reduce antibiotic use: a narrative review of health concepts, prevention and treatment strategies”, that provides the overall basis for studying the CAM contribution (submitted).
- A systematic review of systematic reviews “Can complementary and alternative medicine treatment strategies reduce antibiotic use or control symptoms of uncomplicated acute RTIs? A systematic review of systematic reviews of observational studies and clinical trials” (planned submission March 2018).
- Overview of results of an international survey among CAM expert doctors and therapists on best practices regarding treatment of uncomplicated cough, sore throat and fever as part of URTIs (to be finished first week of April 2018).
- A guidance document, that is integrating the results of both the survey and the systematic review, that provides the basis for the development of a decision making tool (DMT) for doctors and a Patient decision aid (PtDA).
- DMTs for doctors and PtDAs for patients with RTIs.
- A concept dissemination plan of DMTs and PtDAs.
- An institutional model of structural development of DMTs for doctors and PtDAs for patients on CAM treatment of infections.
- An international conference in which results and future perspectives will be presented and discussed with stakeholders (June 6, 2018).
- A website with all information, that serves as a communication platform for all stakeholders involved.

The Antimicrobial Resistance in Intensive Care (AMRIC) Network: A global surveillance network to monitor the role of the ICU environment in the emergence of AMR

Coordinator: John Marshall, International Forum for Acute Care Trialists, Canada

JPIAMR area: Surveillance, Transmission, Environment

Working Group Partners:

- Rob Fowler, Canada. Associate Professor of Medicine, University of Toronto; Senior scientist, Evaluative Clinical Sciences, Sunnybrook Research Institute; Associate director, Institute of Health Policy, Management and Evaluation, U of T; Consultant, World Health Organisation, Department of Pandemic and Epidemic Diseases, Geneva, Switzerland.
- Nick Daneman, Canada. Assistant Professor of Medicine, University of Toronto; Scientist, Evaluative Clinical Sciences, Sunnybrook Research Institute.
- Srinivas Murthy, Canada. Clinical Assistant Professor, Department of Pediatrics, University of British Columbia; Clinical Investigator, Child and Family Research Institute, University of British Columbia.
- Anthony Gordon, United Kingdom. Chair of Anaesthesia and Critical Care, Imperial College London; NIHR clinical trials fellow.
- Michael Bauer, Germany. Professor & Chair, Dept. of Anaesthesiology and Intensive Care Therapy Friedrich-Schiller-University, Jena; Chief-Executive Director Centre for Sepsis Control and Care, Jena University.
- Miguel Sánchez García, Spain. Associate Professor of Medicine, Universidad Complutense Madrid; Director Critical Care Department, Hospital Clínico San Carlos, Madrid, Spain, for the Spanish InFACT Network.

Summary

The AMRIC program seeks to create a global surveillance network of intensive care units (ICUs) to track patterns of antimicrobial resistance in the sickest patients, and to leverage geographic variability in rates to identify modifiable risk factors that can be targeted to reduce the prevalence and transmission of resistant organisms. As outlined in our application, this current proposal has 3 objectives:

1. To conduct a scoping review of approaches to AMR surveillance in the ICU setting, with a particular emphasis on the role of environmental reservoirs of resistant organisms.
2. To develop a sampling strategy to create a globally representative sample of ICUs and a data platform to support initial pilot studies.
3. To develop a sustainability plan and governance framework for future work.

Through two face-to-face meetings, an intensive scoping review, and regular video conferences, we have addressed these objectives as follows:

- Undertaken a scoping review, abstracting data from more than 1500 published papers addressing AMR in the hospital and ICU, with a particular emphasis on low and middle income countries. Data analysis is ongoing; we will synthesise data outlining countries involved in AMR surveillance, data collection approaches used, collaborations, funding models, and resistance patterns. Resistance data will be used to create a virtual surveillance network by mapping published resistance profiles as reported in the studies.
- Completed a systematic review of risk factors for *Acinetobacter* in the ICU, with a focus on environmental reservoirs.
- Established an Antimicrobial Resistance Working Group within the International Forum for Acute Care Trialists (InFACT) chaired by Drs. Ignacio Martin-Loeches (Ireland) and Fernando Bozza (Brazil).
- Begun recruiting InFACT member groups (36 from every continent) to identify capacity for participation in a surveillance network.
- Developed a preliminary surveillance protocol describing a tiered approach to data collection ranging from the most basic (Tier 1 – resistance profiles from the microbiology lab) to more intensive detailed serial patient monitoring -Tier 4).
- Created a draft outline for a collaborative manuscript on the role of the ICU in surveillance and control of antibiotic-resistant organisms.

BEAM Alliance

Coordinator: Florence Sejourne, Da Volterra, France.

JPIAMR area: Therapeutics, Intervention, Diagnostics

Working Group Partners:

- Albert Palomer (CEO), ABAC Therapeutics, Spain
- Holger Schmoll (CFO), Aicuris, Germany
- Philippe Bordeau (CEO), Alaxia, France
- Nicholas Benedict (CEO), Allecra, Germany/ France
- Marc Lemonnier (CEO), Antabio, France
- Rasmus Toft-Kehler (CEO), AntibioTx, Denmark

- René Russo (President & CEO), Arsanis Biosciences, Austria
- Grant Hawthorne (COO), Auspherix, United Kingdom
- Marc Gitzinger (CEO), Bioversys, Switzerland
- Dominique Le Beller (DG), Deinobiotics, France
- Bill Love (Founder and Chief Scientific Officer), Destiny Pharma, Ltd, United Kingdom
- David Williams (CEO), Discuva, United Kingdom
- Xavier Duportet (CEO), Eligo Bioscience, France
- Frances Crewdson (CSO), Helperby, United Kingdom
- Hervé Affagard (CEO), Maat Pharma, France
- Stéphane Huguet (CEO), Mutabilis, United Kingdom
- Martti Vaara (CEO), Northern Antibiotics Ltd, Finland
- Philippe Villain-Guillot (CEO), Nosopharm, France
- Dr. Deborah A. O'Neil (CSO), Novabiotics, United Kingdom
- Jerome Gabard (COO), Pherecydes, France
- Heather Fairhead (CEO), Phico Therapeutics, United Kingdom
- Helmut Kessmann (Head of Business Development Pharma), Polyphor Ltd, Switzerland
- Iain Ross (Executive Chairman), Redx Pharma, United Kingdom
- Alessandro Pini (Founder and President of the Executive Board), Setlance, Italy
- Maxime Fontanié (CEO), Vibiosphen, France
- Thierry Bernardi (CEO), BioFilm Pharma, France
- Steve Gelone (CSO), Nabriva Therapeutics, Austria
- Mike Westby (CEO), Centauri Therapeutics, United Kingdom
- Andrew Shearer (Innovations Liaison Manager), Neem Biotech, United Kingdom

Summary

The intent of the Working Group was to gather the leading SME C-level motivated executives (CEOs, CMOs, CBOs and CFOs with exceptional experiences both in antibiotics R&D, biotech entrepreneurship and pharmaceutical development and market access) from at least 20 EU companies to mobilise studies and express the aggregated SME position on the current issues, recommendations and actions for AMR, the long-term objective being to integrate into the global AMR agenda the insight accrued from the key opinion leaders innovating and struggling day after day to bring to market much needed new drugs and devices. This sapience shall be decisive in pushing forward conceptualisation of ideas towards market access of novel products that tackle the AMR crisis.

All expected outputs of the working group were achieved successfully, and the JPI-AMR support was decisive in supporting the network set-up.

1. The BEAM Alliance was structured into a formal association. With today 48 members from 13 EU countries, it demonstrates the need for a gathering of SMEs in the field. This working group is mostly focused on economical perspectives of innovative products combating AMR, where executives from SMEs are the key experts and this knowledge is integral for conceiving fruitful and efficient incentives
2. The BEAM Alliance updated the pipeline of products in development by SMEs in Europe and communicated it on its new website, directly to quantify the innovation supported by SMEs and communicate on the tremendous potential of the European SMEs as a whole to tackle AMR. An early audit suggested that the BEAM Alliance members are collectively developing more than 100 new products focused upon tackling AMR (https://beam-alliance.eu/ba_pipeline).

3. The BEAM Alliance organised three 1-day plenary meetings between BEAM Alliance members to discuss and validate a common position on all the recommendations and economic incentives: in London on January 16, at ECCMID in April 15, and in Basel on October 2017.
4. We have organised over 15 face-to-face meetings between representatives of the Working Group and key stakeholders such as DRIVE AB consortium partners and experts, European bodies implicated in drug development regulation (EMA, EUCAST), the European Commission DG SANTE and DG RTD, NGOs and organising parties of the AMR Call to Action (WHO, IACG, Wellcome Trust). BEAM also supported national initiatives by providing content and participating to meetings in Switzerland, France or the Netherland. We also massively took part to the Novel Antimicrobials conference in Berlin on February 2017 and are co-organising the session of March 2018, building here an agenda dedicated to the specific issues of R&D development of novel strategies to combat AMR with all the SME ecosystem in particular public stakeholders like WHO, IACG, EMA, EUCAST, AccessToMedicine Foundation, GARDP, CARB-X, AMR Centre, etc….
5. BEAM Alliance has compiled and published a position paper on November 18, 2017. It summarises the practical problems and needs of SMEs which relates to both conducting R&D evaluation criteria at early and clinical stages, regulatory pathways…), and funding of business models that are from R&D and market perspectives both unpredictable. The aim of the Position Paper is to provide some guidelines to support policy makers in validating that the actions thy prepare ultimately reach the target to drive incentivisation for AMR therapies (https://beam-alliance.eu/page/news).

Bridging the gap between exposure to AMR in the environment and impact to human health

Coordinator: Ana Maria de Roda Husman, National Institute for Public Health and the Environment RIVM and Utrecht University UU IRAS, The Netherlands.

JPIAMR area: Environment, Surveillance, Transmission

Working Group Partners:

Network Partners

- Nicholas Ashbolt, School of Public Health, University of Alberta, Canada
- Paul Hunter Norwich Medical School, United Kingdom
- Antoine Andremont, University Paris-Diderot, France
- Jack Schijven, National Institute of Public and the Environment (RIVM) + Utrecht University Geosciences, the Netherlands
- Heike Schmitt, RIVM + Utrecht University IRAS, the Netherlands

Network Members

- Amy Kirby, CDC, United States of America
- Ed Topp, AGR.GC, Canada
- Rob Lake, ESR, New Zealand
- Scott Bradford, USDA, United States of America
- Will Gaze, University of Exeter, United Kingdom
- Juanita Haagsma, Erasmus MC, the Netherlands

Advisory Reference Group Members

- Mark Sobsey, University of North Carolina, United States of America
- Chuck Haas, Drexel University, United States of America
- Kate Medlicott, Awa Aidare-Kane and teams at WHO Headquarters

Summary

Exposure to antibiotic resistant bacteria in the environment (water, soil, air) will impact human health involving complex interactions between bacteria and humans. However, it has proven very difficult to quantify environmental exposure to AMR and possible health impacts, and therefore our network of experts and advisors, was established. We have explored and summarised available tools and study protocols to systematically quantify environmental exposures to antibiotic resistant bacteria. Detection methods and modelling approaches were outlined on how to link exposure data and epidemiological data to health impacts from antibiotic resistant bacteria.

Deliverables

1. A network of expert risk assessors, microbiologists, quantitative epidemiologists, public health advisors at influential organizations and knowledge institutes and universities was formed;
2. A workshop was organised to bring together experts, list existing knowledge, and identify knowledge gaps;
3. Study designs that were previously successful in environmental surveillance, quantitative exposure assessments from environmental emissions, as well as model development for carriage, excretion, colonisation, horizontal gene transfer and dose-response were described as well as suggested study designs for AMR;
4. Guidance will be provided to funding agencies and researchers on how to integrate exposure assessments and human health impact assessment into surveillance programs, funding schemes and research proposals/ projects.
5. A scientific paper entitled 'Assessing human exposure to antibiotic resistance in the environment and its health impacts: Knowns, unknowns and call to action' was drafted by the Network to be submitted to a peer-reviewed journal.

Network on quantification of veterinary Antimicrobial consumption at herd level and Analysis, CommunicaTion and benchmarkING to improve responsible use

Coordinator: Jeroen Dewulf, Ghent University, Belgium.

JPIAMR area: Intervention, Surveillance

Working Group Partners:

- Anne Hémonic, IFIP-Institut du porc, France
- Claire Chauvin, ANSES, France
- Roswitha Merle, University of Berlin, Germany
- Annemarie Käsbohrer, BfR, Germany and University of Veterinary Medicine, Vienna, Austria
- Mette Ely Fertner, National Veterinary Institute, Denmark (previously University of Copenhagen)

- Birgitte Borck Høg, National Food Institute, Denmark
- Vibe Dalhoff Andersen, National Food Institute, Denmark
- Wannes Vanderhaeghen, AMCRA, Belgium
- Cedric Muentener, University of Zurich, Switzerland
- Katharina Stärk, SAFOSO, Switzerland
- Dick Heederik, Utrecht University, The Netherlands
- Inge Van Geijlswijk, Utrecht University, The Netherlands
- Walter Obritzhauser, Independent reseacrher, Austria
- Klemens Fuchs, Austrian Agency for Health and Food Safety, Austria
- Kari Grave, Norwegian Veterinary Institute, Norway
- Federico Scali, IZSLER, Italy
- Alborali Giovanni Loris, IZSLER, Italy
- Carolee Carson, Public Health Agency, Canada
- Richard J. Reid-Smith, Public Health Agency, Canada
- David F. Léger, Public Health Agency, Canada
- Agnes Agunos, Public Health Agency, Canada
- Hannah Reeves, Veterinary Medicines Directorate, United Kingdom (replaced by Stacey Brown)
- Fraser Broadfoot, Veterinary Medicines Directorate, United Kingdom
- Kay Isabella Torriani, Federal Food Safety and Veterinary Office, Switzerland (replaced by Stephane Blatti-Cardinaux)

Summary

The background for the AACTING-project was the benefit of sharing and disseminating experience-based knowledge among and to various stakeholders (researchers, policy makers, project managers and technicians, farmers, veterinarians, food industry representatives, etc.) involved in the increasingly important topic of monitoring and reducing antimicrobial usage (AMU) in animals. Complementing other initiatives (especially the ESVAC-project of the European Medicines Agency), AACTING focused on farm-level AMU and more specifically, on systems for quantification, benchmarking and reporting of farm-level AMU in different countries and how these are applied for awareness raising and promoting stewardship.

The general aim was translated into four practical aims: 1) Performing a strength/weaknesses analysis of currently existing systems for farm-level AMU monitoring and subsequently drafting a review manuscript; 2) developing guidelines, based on the review, describing ('best') practices for collecting, analysing, benchmarking and reporting of farm-level AMU in the scope of awareness raising and stewardship; 3) develop a website gathering relevant and up-to-date information about existing monitoring systems and other relevant activities; 4) organise an International Conference on quantification of veterinary antimicrobial consumption.

Outcome/deliverable 1: The strength/weaknesses analysis of existing systems was finalised during the AACTING kick-off meeting organised 27-28 March 2017 in Vienna. The resulting overview of systems was used as a basis for a draft review manuscript discussed among the Working Group members in preparation and during the halfway meeting organised 18-19 September in Rome. A second draft manuscript is currently circulating in the Working Group and will be discussed during the AACTING closing meeting in Ghent, 27-28 February 2018. Subsequently, a final draft will be established and submitted for publication (journal to be decided). The overview of systems was published as an 'Annex' available as pdf on the AACTING website and served as basis for the online overview on the website (see below).

Outcome/deliverable 2: The guidelines were originally drafted as part of the review manuscript but during the Rome meeting it was decided to publish it as a separate document. It is planned to agree

on the guidelines during the Ghent closing meeting, after which it will be made available through the AACTING website and promoted through the Working Group members' network.

Outcome/deliverable 3: An AACTING website was set-up after a design was decided during the Vienna kick-off meeting. Careful consideration deemed the initial idea of making an online (discussion) forum unfeasible within the limited means of the project. The website (www.aacting.org) was put online on October 18th 2017. It contains four main pages (Project description, Overview of monitoring systems, International Conference and Guidelines) as well as pages providing general information on the quantification of AMU (still under construction) and links to some of the major global initiatives concerning AMU and antimicrobial resistance. The central aspect is the overview of monitoring systems, for which a searchable database was created allowing looking per country or per animal species for farm-level AMU monitoring systems. It currently contains information on 16 countries and 29 AMU data-collection systems. As such, it is the first comprehensive compilation of all the available AMU data-collection systems in animal production globally.

Outcome/deliverable 4: The First International Conference on Quantification, Benchmarking and Stewardship of Veterinary Antimicrobial Usage was held on the 27-28 February in Ghent, adjacent to the AACTING closing meeting. Up to 141 participants registered, which was way above our initial expectations. In addition to four plenary talks, eight oral presentations were selected from over 40 submitted abstracts. The remainder presented posters. For all details, please visit http://www.aacting.org/international-conference/.

To make the AACTING project activities sustainable, the Working Group members have pledged to continue the work of the AACTING-consortium in the coming years to complete the few ongoing activities from the project, as well as to start new initiatives to establish a comprehensive, global network of professionals for exchanging best practice, experiences and knowledge.

AMR Rapid Diagnostic Tests – AMR-RDT

Coordinator: Till T. Bachmann, University of Edinburgh, UK.

JPIAMR area: Diagnostics

Working Group Partners:

- Alex van Belkum, BioMérieux, France
- Alasdair MacGowan, North Bristol NHS Trust, United Kingdom
- Aman Russom, KTH Royal Institute of Technology, Sweden
- Andrew Shepherd, Omega Diagnostics, United Kingdom
- Ann Van den Bruel, NIHR Diagnostic Evidence Cooperative, United Kingdom
- Annika Eriksson, HemoCue AB, Sweden
- Barbara Fallowfield, British *In Vitro* Diagnostics Association, left United Kingdom
- Cassandra Kelly-Cirino, Foundation for Innovative New Diagnostics, Switzerland
- Carla Deakin, NICE, United Kingdom
- Eiichi Tamiya, Osaka University, Japan
- Francis Moussy, World Health Organization, Observer, Switzerland
- Franck Molina, European Diagnostics Cluster Alliance, France
- Frank Apostel, R-Biopharm, Germany
- Frank Bier, Fraunhofer IZI, Germany

- Gerd Luedke, Curetis GmbH, Germany
- Guido Werner, Robert Koch Institute, Germany
- Gunnar S. Simonsen, University of Tromsø, Norway
- Gyorgy Abel, Lahey Hospital, Harvard University, United States of America
- Herman Goossens, Antwerp University, Belgium
- Jacob Moran-Gilad, Ben-Gurion University & Ministry of Health, Israel
- James Fraser, Chipcare, Canada
- Jean-François de Lavison, Ahimsa Fund, France
- John P. Hays, Erasmus University Medical Center, the Netherlands
- John Rex, F2G, Ltd. (ex. Astra Zeneca), United States of America
- Jordi Vila, University of Barcelona, Spain
- Karsten Becker, University Hospital Münster, DGHM, Germany
- Kate Templeton, NHS Lothian, United Kingdom
- Kirsten Miller-Duys, Hyrax Biosciences, South Africa
- Konstantinos Mitsakakis, Hahn-Schickard, University of Freiburg, Germany
- Manica Balasegeram, GARDP/DNDI, Switzerland
- Mark Woolhouse, University of Edinburgh, United Kingdom
- Neil Butler, Spectromics, United Kingdom
- Neil Woodford, Public Health England, United Kingdom
- Paul Savelkoul, Maastricht University, the Netherlands
- Petra Gastmeier, Charite Belin, Infect Control 2020, Germany
- Philippe Lagace-Wiens, University of Manitoba (left), Canada
- Ramanan Laxminarayan, Center for Disease Dynamics, Economics & Policy; United States of America/India
- Rosanna Peeling, London School of Hygiene &Tropical Medicine, United Kingdom
- Saturnino Luz, Usher Institute, United Kingdom
- Soeren Schubert, Max von Pettenkofer Institute Munich, Germany
- Stephan Harbarth, University of Geneva, Switzerland
- Sue Hill, NHS Englandm United Kingdom
- Tracy Merlin, University of Adelaide, Australia
- Taslimarif Saiyed, Centre for Cellular and Molecular Platforms, India
- Thomas Wichelhaus, University Frankfurt; Paul Ehrlich Society, Germany
- Tjeerd van Staa, Farr Institute Health Informatics Research, United Kingdom
- Valentina Di Gregori, San Pier Damiano Hospital Faenza (ex Univ of Bologna), Italy
- Wouter van der Wijngaart, KTH Royal Institute of Technology, Sweden
- Wilfried von Eiff, HHL Leipzig, Germany

Summary

Rapid diagnostics have been identified as key tools to tackle antimicrobial resistance and their development and use is promoted in multiple strategic initiatives and policy interventions globally. Rapid diagnostic tests are expected to improve patient management decisions, select appropriate therapies, streamline clinical trials and facilitate development of narrow spectrum antibiotics. Furthermore, essential surveillance data will be generated by improved rapid diagnostic testing with enhanced connectivity in future. Nevertheless, there is a substantial gap between the *Need* for rapid diagnostics versus the *Use* of these applications. To identify barriers of development and implementation of rapid diagnostic tests, the Transnational Working Group AMR Rapid Diagnostic Tests (AMR-RDT) was formed in 2017 from about 50 expert stakeholders and funded through the Joint Programming Initiative on Antimicrobial Resistance. At two main meetings in Brussels and a series of further interactions, the AMR-RDT working group addressed these tasks by considering the state of knowledge and understanding of gaps and needs in the areas of biomarkers, technology, target

product profiles, development roadmap, business models and behavioural change. Accordingly, the working group prepared position statements and manuscripts which are in the process of publication to inform the wider AMR diagnostics innovation stakeholder community through dissemination. Members of the working group have presented widely with reference to AMR-RDT and in addition have been consulted by policy makers and funders such as for the consultation meeting of the Innovative Medicine Initiative for Call 13 Topic 3 'The value of diagnostics to combat antimicrobial resistance by optimising antibiotic use' and the UK AMR National Strategy HLSG Diagnostic Subgroup (now AMR Diagnostics Collaborative). The AMR-RDT working group plans a joint meeting with the ESCMID Study Group for Genomic and Molecular Diagnostics (ESGMD) in April 2018 to present and progress the AMR-RDT outputs. In view of the persisting need for rapid diagnostics to tackle AMR, the AMR-RDT working group is determined to extend its activities beyond the duration of the current funding.

Inhibition of antimicrobial drug resistance: Exploiting an old drug as a basis for inhibitory discovery

Coordinator: Klaas Martinus Pos, Goethe University Frankfurt, Germany.

JPIAMR area: Therapeutics

Working Group Partners:

- Laura Piddock, University of Birmingham, United Kingdom
- Dan Andersson, University of Uppsala, Sweden
- Johan Mouton, Erasmus University Rotterdam, The Netherlands
- Peter Hawkey, University of Birmingham and West Midlands Public Health Laboratory, United Kingdom
- Sara Jabbari, University of Birmingham, United Kingdom
- Francisco Fernandez-Trillo, University of Birmingham, United Kingdom
- Thomas Wichelhaus, Goethe University Frankfurt, Germany
- Eugen Proschak, Goethe University Frankfurt, Germany
- Annie Ducher, Chief Medical Officer DaVolterra (SME), Paris, France

Summary

Nitrofurantoins is an old drug class that shows promise for further development to treat Gram-negative infections. The consortium identified a number of present knowledge gaps regarding nitrofurantoins, outlined a research plan for how to fill these gaps, submitted an application to JPIAMR and initiated an application for the H2020 framework.

Introduction

The alarming increase in the numbers of infections by multidrug-resistant Gram-negative pathogens in the EU calls for new strategies and solutions to address bacterial resistance mechanisms. In response to a call from the Goethe University Frankfurt and the University of Birmingham, UK, researchers from both institutions held a 2-day workshop in March 2016 with the aim of designing new strategies and solutions to drug resistance mechanisms. This workshop identified that there is an unmet need for a new oral agent active against multi-drug resistant *Enterobacteriaceae* causing urinary tract infections (UTIs) including in the elderly. To further address the question of feasibility of such a research proposal, we proposed a new network group including researchers from the Birmingham workshop plus

additional experts with skills in medical microbiology, pharmacokinetics, *in vivo* models, and drug discovery/development in industry.

Activities

We organised a two-day event on February 16th, 2017. On the first day, a conference in Frankfurt was held including talks from the WG members and invited experts in the field, discussion and opinion sessions (invited scientists were Ursula Theuretzbacher, Center for Anti-Infective Agents, Vienna, AT; Surbhi Malhotra-Kumar, University of Antwerpen, BE; Bartek Waclaw, University of Edinburgh, UK; Suzanne Geerlings, AMC, Amsterdam, NL; Florian Wagenlehner, University of Gießen, DE). Secondly, on day 2, a working group meeting was held to distill all aspects of the conference and to formulate a research programme which will be the basis of an application to a H2020 call. This event was followed by a meeting on September 28th, 2017 in Frankfurt. Here the Work Packages were defined for a proposed consortium, as well as identification of potential funding opportunities. Moreover, we selected members of the consortium to contribute to a special issue on nitrofurantoin, focussing on its mechanism of action, resistance, PK/PD, and epidemiology. Dissemination will be via a special issue in the journal *Drug Resistance Updates* (IF 10.9).

Results and insights

On these occasions and within the funding period, we focussed on several aspects, which we divided into eight work packages: 1) Basic mechanism of uptake and efflux of Nitrofurantoin *in vitro*; 2) Mode of Nitrofurantoin action; 3) Resistance mechanism, resistance evolution *in vitro*; 4) the molecular design and synthesis of new compounds based on the nitrofuran scaffold; 5) Design and synthesis of inhibitors and delivery systems, thereby increasing/modulating and/or potentiating the permeability/activity of nitrofurans against *E. coli* and in particular multidrug-resistant isolates; 6) Determination of efficacy, PK/PD, Resistance evolution *in vivo*; 7) Transfer to clinical studies (SME-supported); 8) Dissemination, prediction of economic burden, demographics, cost-saving measures.

The intermediate report after the first meeting has been forwarded to Ursula Theuretzbacher, member of the advisory reference group (and has been a participant on the conference on February 16th, 2017), who has given valuable feedback on the proposed research consortium.

Future actions

1. The final report will be forwarded to the two other members of the advisory reference group (Prof. Javier Garau, University of Barcelona, Barcelona, Spain, and Prof. Robert EW Hancock, University of British Columbia, Canada)
2. Members of the consortium are collating the literature on nitrofurantoin and write open access reviews on nitrofurantoin for a special issue in Drug Resistance Updates.
3. The consortium applies for the JPIAMR 6th Call, to address the basic biology of nitrofurantoin mechanisms of action/resistance, as well as to design new nitrofuran-derivatives and test these *in vitro* and *in vivo* (mouse).
4. Within the H2020 framework, the consortium is going to apply for funding within the call "Stratified host-directed approaches to improve prevention, treatment and/or cure of infectious diseases", deadline October 2nd, 2018

Discussion

Share ideas on AMR policy recommendations and research strategies by bringing the PIs in the different projects together to present their work

Overviews of the JPIAMR funded networks engaged participants from different areas of research (Figure 1). Networks spanned all of the JPIAMR pillars (A) and were mostly multidisciplinary (B) spanning at least two pillars. A range of sizes of the networks were represented at the workshop (C).

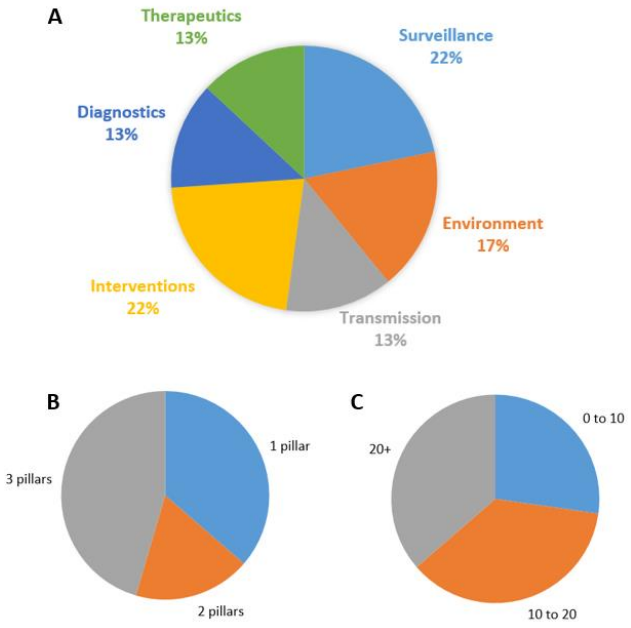

Figure 1. Network coordinators were asked to assign their projects to the different JPIAMR pillars (A). Most projects were assigned to three different pillars (B), and networks ranged from small (0-10), medium (10-20) or large (20+) participants.

Increase awareness of existing networks and identify possibilities for future research collaboration and funding schemes

The major JPIAMR activities engaging the research community in 2018 are research calls, the JPIAMR Virtual Research Institute and the update to the JPIAMR Strategic Research Agenda. Participants from the Networks had the following comments and recommendations on JPIAMR activities:

- Funding:
    - Network calls should be followed by a research call on the same topic to align the network and research funding.
    - Continuation funding for networks would be useful. An appropriate evaluation to prioritise the network outputs would be necessary to support future funding.
    - Funders need to be better at collaborating. JPIAMR should try to connect with the Health Enhancement Research Organisation (HERO: https://hero-health.org/) and private organisations such as the Bill and Melinda Gates foundation, that has funding for AMR.
- SRA update:
    - In late 2018, there will be an open consultation for prioritisation topics for JPIAMR.
- JPIAMR-VRI

- The JPIAMR-VRI will be useful for research alignment but also for identification of funding gaps.

Exchange experiences, approaches and lessons learnt. What has worked and what has not?

This workshop was the first workshop to evaluate the network funding mechanism of any of the JPIs. Participants gave feedback that the network funding gave groups independence and the funding mechanism is important for driving new collaborations, and that it is important for JPIAMR to communicate the outputs. The experiences and evaluation of the network funding as a mechanism could be prepared as a journal article, that could be submitted to the Interagency Coordination Group on AMR (IACG), that was created in consultation with World Health Organization (WHO), the Food and Agriculture Organization of the United Nations (FAO), and the World Organization for Animal Health (OIE).

It is important to enhance interactions during the network programme. It would be beneficial to have a workshop half way through the funding period to encourage a dialogue between the different groups.

Participants agreed that they would prefer to extend the duration of the funding period rather than provide more money for a shorter period, e.g. would prefer two years with 50,000 each year rather than 100,000 in one year. Networks are exploring funding options to continue their work, e.g. H2020, national funding, other funding agencies.

Diversity in research funding is important. Surveillance and diagnostics are a good combination of areas. Antibiotic stewardship is also important since many drugs are not used for what they were designed for. Studies should implement more pharmaceutical know-how in the earlier stage of R&D.

Future alignment and potential coordination of programmes

The AMR community should think of pragmatic fast ways to reduce AMR (and save lives), like providing access to clean drinking water, improved hygiene measures etc. The effectiveness/cost ratio might be much higher than if we develop many new drugs (which is not unimportant). The mapping of issues from community/hospital and high/middle/low income countries would allow identification of research gaps.

The AMR community needs to identify important areas to research. This means that individuals should participate without lobbying their own business/research and who are open for alternative approaches. At the end a programme can be set up which includes the most effective way combatting AMR.

Communication

During the conference JPIAMR Secretariat Communications Officer made interviews with the networks that received funding in the fourth call. For JPIAMR it is key to communicate the outcomes of funded projects. In Frankfurt, a total six interviews were made with coordinators or representatives of selected networks. The content will be used as videos uploaded on JPIAMRs YouTube channel, as podcasts and as posts on the JPIAMR website. Also, the interviews will be shared Twitter linking back to the sources described. The interviews will both communicate the actual results created by the networks but also work as a means to increase general awareness about AMR, to point to each network source material such as papers and to tie important AMR research to JPIAMR as a platform that supports AMR research with a One Health approach.

During the presentations, we received feedback on the importance of communications to disseminate research about the networks and the importance JPIAMR has as a resource and stakeholder that has

capacities to communicate such research. Network coordinators pressed on the good job JPIAMR is doing communicating AMR research and researchers want JPIAMR to keep increasing communications efforts. During the workshops, a few tweets were sent to show that the workshop and the theme was happening. Also, photos were taken of the whole group and during presentation to be used together with featured content.

List of participants

Name	Family Name	Affiliation	Country
Akin	Akkoyun	DLR	Germany
Abraham	Alabi	University Hospital Muenster	Gabon
Dan	Andersson	Uppsala University	Sweden
Antoine	Andremont	JPIAMR Management board	France
Erik	Baars	Louis Bolk Instituut	Netherlands
Till	Bachmann	University of Edinburgh	United Kingdom
Martine	Batoux	French national agency (ANR)	France
Michael	Bauer	Jena University Hospital	Germany
Anders	Bjers	Swedish Research Council/JPIAMR Secretariat	Sweden
Jessica	Boname	MRC/JPIAMR Management board	United Kingdom
Fraser	Broadfoot	Defra Antimicrobial Resistance Coordination	United Kingdom
Edith	Brochu	CIHR/JPIAMR Management board	Canada
Ana Maria	de Roda Husman	RIVM Centre for Infectious Disease Control	Netherlands
Esther	de Valliere	Helmholtz Instituts für Pharmazeutische Forschung	Germany
Eilidh	Duncan	University of Aberdeen	United Kingdom
Inga	Geijlswijk, van	Utrecht University	Netherlands
Kristian	Haller	Swedish Research Council	Sweden
Stefan	Kühne	University Hospital Muenster	Germany
John	Marshall	University of Toronto	Canada
Dik	Mevius	VetCAST, Utrecht Uni., Wageningen Uni.	Netherlands
Virginie	Mouchel	French national agency (ANR)	France
Johan	Mouton	Rotterdam	Netherlands
Rolf	Müller	Helmholtz Instituts für Pharmazeutische Forschung	Germany
Francis	Onwugamba	University Hospital Muenster	Germany
Marie	Petit	BEAM Alliance	France
Laura	Plant	Swedish Research Council/JPIAMR secretariat	Sweden
Marie-Cécile	Ploy	Coordinator of EU-JAMRAI	France
Klaas Martinus	Pos	Goethe University	Germany
Eugen	Proschak	Goethe University	Germany
Craig	Ramsay	University of Aberdeen	United Kingdom
Magda	Rzewuska	University of Aberdeen	United Kingdom
Frieder	Schaumburg	University Hospital Muenster	Germany
Valentijn	Schweitzer	Universitair Medisch Centrum Utrecht	Netherlands
Mark D.	Sobsey	University of North Carolina	USA
Wannes	Vanderhaeghen	AMCRA	Belgien
Linda	van Gaalen	ZonMw	Netherlands
Ana	Vidal	Veterinary Medicines Directorate	United Kingdom
Thomas	Wichelhaus	Goethe University	Germany

Workshop Agenda

Fourth JPIAMR Call Conference

Maximising existing and future research efforts and resource alignment to combat AMR

8-9 March 2018

Relexa Hotel, Frankfurt am Main

AGENDA

Workshop Aims:

- Share ideas on AMR policy recommendations and research strategies by bringing the PIs in the different projects together to present their work
- Increase awareness of existing networks and identify possibilities for future research collaboration and funding schemes
- Exchange experiences, approaches and lessons learnt. What has worked and what has not?
- Future alignment and potential coordination of programmes

DAY ONE: Thursday, 8 March 2018

12:30 -13:00 Registration

13:00 – 13:10 Introduction and Welcome

Session 1 Plenary talks

Moderator: Martin Pos, Goethe University Frankfurt, Germany

13:10 – 13:55 *Antoine Andremont, University Paris-Diderot Medical School, France*
"On the development of different AMR policy recommendations and research strategies"
Followed by Discussion

14:10 – 14:55 *Edith Brochu, CIHR Institute of Infection and Immunity, Canada*
"The JPI Virtual Institute"
Followed by Discussion

15:10 – 15:40 Break

15:40 – 16:10 *Rolf Müller, Helmholtz-Institute for Pharmaceutical Research Saarland, Germany*
"The Helmholtz Centre for Infection Disease and Helmholtz-Institute for Pharmaceutical Research Saarland"

Session 2 Consumption, exposure, spread and surveillance (20 min + 5 min Discussion)

16:10 – 16:35 *Wannes Vanderhaeghen, University of Gent, Belgium*
WG23: "AACTING: Quantification of veterinary antimicrobial consumption at herd level and analysis, communication and benchmarking to improve responsible use"

16:35 – 17:00 *Ana Maria de Roda Husman, RIVM and Utrecht University, The Netherlands*

WG22: “Bridging the gap between exposure to AMR in the environment and impact to human health”

17:00 – 17:25 *Frieder Schaumburg, University Hospital Münster, Germany*
WG6: “Flies (Diptera: Muscidae) and the spread of antimicrobial resistant bacteria”

17:25 – 17:50 *John Marshall, University of Toronto, Canada*
WG15: “The Antimicrobial Resistance in Intensive Care (AMRIC) Network: A global surveillance network to monitor the role of the ICU environment in the emergence of AMR”

17:50 – 18:15 *Erik Baars, Louis Bolk Institute, The Netherlands*
WG12: “Appropriate use of antibiotics: the role of CAM treatment strategies”

18:15 – 18:45 Questions and Discussion

19.00 Working Dinner

DAY TWO: Friday, 9 March 2018

Session 3 Stewardship and treatment strategies

Moderator: Dan Andersson, University of Uppsala, Sweden

9:00 -9:25 *Craig Ramsay, University of Aberdeen, UK*
WG7: “Behavioural approaches to optimise antibiotic stewardship in hospitals”

9:25 – 9:50 *Valentijn Schweitzer, University Medical Center Utrecht, The Netherlands*
WG10: “Consensus group on the design, analysis and reporting of antibiotic stewardship trials”

9:50 – 10:15 General Discussion

10:15 – 10:45 Break

Session 4 Susceptibility and rapid diagnostic tests

10:45 – 11:10 *Till Bachmann, Edinburgh Medical School, University of Edinburgh, UK*
WG20: “AMR Rapid Diagnostic Tests”

11:10 – 11:35 *Dik Mevius, University of Wageningen and University of Utrecht, The Netherlands*
WG8: “VetCAST: Veterinary Committee on Antimicrobial Susceptibility Testing”

11:35 – 12:00 General Discussion

12:00 – 13:00 Lunch

Session 5 Strategies, Research and Development

13:00 – 13:25 *Marie Petit, BEAM Alliance, France*
WG19: “BEAM Alliance”

13:25 – 13:50 *Martin Pos, Goethe University Frankfurt, Germany*
WG26: “Exploiting an old drug as a basis for inhibitory discovery”

13:50 – 14:05 Summarizing comments and initiation of analysis

Session 6 Analysis, Discussion, Collaborations and Future Directions

Moderator: Martin and Dan

14:05 – 14:25 Discussion groups

14:25 – 14:50 Presentation of the results of discussion groups

14:50 – 15:10 General Discussion

15:10 – 15:40 Break

15:40 – 16:00 Future alignment and potential coordination of programmes

16:00 – 16:05 Closing remarks

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Summaries from Working Groups who did not participate in the Workshop

Histidine Kinase Inhibitors as Novel Anti-infectives

Coordinator: Jerry M. Wells, Wageningen University, Netherlands.

JPIAMR area: Therapeutics, Interventions

Working Group Partners:

- Nadya Velikova, Wageningen University, The Netherlands.
- Paul Finn, InhibOx, Oxford, United Kingdom.
- Alberto Marina, Department of Genomics and Proteomics, Institute of Biomedicine of Valencia, Spain.

Summary

The growing problem of antibiotic resistance on the one hand and the lack of newly discovered antibiotics on the other hand presents a major societal problem and threat to human and animal health. This proposal addresses new anti-infective and alternative approaches to tackle AMR and is one priority topic identified in the JPIAMR Strategic Research Agenda.

Bacterial histidine kinases (HK) have been recognised as very promising targets for novel anti-infectives because their potency can be targeted towards two-component systems (TCS) involved in the regulation of key virulence factors and stress response pathways (1), (2), (3). Targeting virulence mechanisms and regulatory mechanisms of antibiotic resistance in pathogens offers some clear advantages, as the drugs disarm pathogens rather than killing them, enabling the host immune system to eradicate them from the body (4). It is also considered that due to the weaker selective pressure against anti-infective drugs, resistance would take longer to develop, if it develops at all. Most important is the fact that by targeting a virulence mechanism only the bacteria that possess that pathogenic trait will be affected, leaving the community of symbiotic microbiota relatively intact.

The rationale for working on histidine kinase inhibitors (HKIs) involved in virulence is that the working group have recently identified a panel of attractive hit compounds with inhibitory activity against HKs from different bacteria that can be used for structure based design of more selective inhibitors of selected TCS HKs regulating virulence and or antibiotic resistance (5). The inhibitors are bactericidal to a panel of Gram-positive pathogens (Gr+), including methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant Enterococci (VRE), and the emerging zoonotic pathogen *Streptococcus suis* with minimal bactericidal concentrations (MBC) of 6-16 µg/ml (5). The HKIs show an antimicrobial effect against *Mycobacterium marinum*, a fish pathogen used in tuberculosis research, and are bactericidal to pathogenic Pasteurella spp. with MBCs ≥ of 8 µg/ml (unpublished data). Killing of other Gram-negatives (Gr-), e.g. *Escherichia coli*, *Pseudomonas aeruginosa*, or *Serratia marcescens* is less effective which we hypothesised to be due to differences in the outer membrane LPS, porin composition or efflux pumps. Indeed, *E. coli* defective in the inner core polysaccharide of LPS were much more susceptible to HKIs compared to the wild type, or strains defective in the outer core polysaccharide (unpublished data). The HKI structures are novel and are not toxic to *G. mellonella* larvae at 40 mg/kg. Furthermore, a single dose of the HKIs (up to 40 mg/kg, 1 h post-infection) attenuated the lethality of *G. mellonella* larvae infected with *S. aureus* 25293 or *S. suis* 3881/S10,

making them attractive compounds to further develop as selective inhibitors of virulence and antibiotic resistance mechanisms.

Several HK inhibitors have been reported over the past several years, including our own promising collection of novel and patented hit compounds discovered by virtual screening (5, 6, 7 and recent reviews 8, 9). Most HK inhibitors developed to date have no or poor activity against Gram-negatives due to the permeability barrier of the outer membrane (9). Here, the research of other groups investigating approaches to overcome the permeability barrier will be very valuable in targeting HK regulating essential virulence mechanisms in Gram-negative AMR pathogens. As the working group includes leading experts in structural biology of bacterial TCS, infection biology, virtual screening, and structure based drug design, we are well positioned to develop more selective and potent inhibitors of HKs involved in regulating genes required for virulence *in vivo*. Ultimately our efforts could lead to the development of narrow-spectrum anti-infective therapies targeted at virulence regulators, with a low potential for resistance development and without affecting the host microbiome.

In order to expedite this research and development plan in the direction indicated, the working group has been drawing on the broader expertise of the international research arena in devising a strategy and aligning research activities with other groups. To date we have organised one of two planned workshops where international experts from academia, industry are invited to discuss research strategies. The first workshop was held in Cambridge, U.K in September 2017 and addressed the following key questions: 1. Can HK (autophosphorylation) inhibitors be optimised to give selectivity against specific TCS involved in virulence and AMR (e.g. through interactions with the ATP lid of the catalytic and ATP-binding domain, by targeting other HK domains, or via a targeted uptake mechanism)? 2. Which TCS and HKs should we focus on in problem multi-drug resistant (MDR) pathogens?

Our second workshop will be held in May 2018 in Oxford United Kingdom and addresses how can we overcome the permeability barrier of Gram-negative cell envelopes?

PhageForward

Coordinator: Thomas Rose, Vrije Universiteit Brussel University, Hospital, Health Tech Campus Jette, Belgium.

JPIAMR area: Therapeutics, Surveillance

Working Group Partners:

- Isabelle Huys, Katholieke Universiteit Leuven, Belgium
- Laurent Debarbieux, Institut Pasteur, France
- Christine Rohde, DSMZ, Germany
- Andrzej Gorski Polish Academy of Sciences, Wroclaw, Poland
- Jean-Paul Pirnay, Queen Astrid Military Hospital, Belgium
- Gilbert Verbeken, Queen Astrid Military Hospital, Belgium

Summary

Antibiotic resistant bacteria represent a major threat to public health and solutions to this problem require actions at several levels of society. This is particularly true for phage therapy, which was

initially proposed in the early twentieth century. Following a period of worldwide expansion this treatment option became almost obsolete in western countries before finally being stopped. In France and Germany, phage treatments were still applied during the 70's while in some eastern countries, especially in Georgia, Russia and Poland it was continuously and successfully used up to present.

The biology of bacteriophages (phages), the natural enemies of bacteria, is now much better known and scientifically described than in the past. However, some questions about the safety of phage preparations in the context of their production process and their reproducible efficacies require more intensive research and pre-clinical and clinical studies. Also the diffusion of appropriate documentation about phage therapy towards the public, the medical community as well as other various stakeholders is lacking.

The project PhageForward aimed to develop an integrated approach to overcome the hurdles that slow down the reintroduction of phage therapy as a regular treatment option in Western Europe.

To realise this, the following actions have been taken:

- Support of the two Centennial Conferences in 2017 and one workshop in 2018
- Centennial Celebration of Bacteriophage Research; Paris, France on April 24-26, 2017

  Programme of the conference

An extra conference day "Phage Therapy Day" and a working dinner were foreseen in order to stimulate interaction and knowledge transfer related to topics which are not purely research oriented

Output: 160 participants that day, a brochure can be found in annex 1

- Centennial Celebration of Bacteriophage Research; Tbilisi, Georgia on June 26-29, 2017

  Programme of the conference

An additional "Summer School" was foreseen in order to give researchers/students as well as clinicians the opportunity to learn more about the practical aspects of phage therapy

Output: 33 participants attended the 1st Practical Course: "Bacteriophage in the nature and in our labs"; 14 participants attended the 2nd Practical Course: "Phage Therapy in Practice", a brochure can be found in annex 2

- Economics, Regulation and the Future of Phage Therapy/Phage Technology Workshop, bio.kitchen, Unternehmertum, The Technical University of Munich, Germany on May 11-12, 2018

  Programme of the workshop

The participation of four key actors to the workshop was sponsored. Regulatory issues with regard to the implementation of phage therapy in Western medicine and the possible exportation of the Belgian dedicated phage therapy framework to Germany were discussed.

Output details still to be determined.

- Publication: Expert Opinion on Three Phage Therapy Related Topics: Bacterial Phage Resistance, Phage Training and Prophages in Bacterial Production Strains in the Journal Viruses
  http://www.mdpi.com/1999-4915/10/4/178/pdf

A second workshop will be held in May 2018 in Oxford United Kingdom and addresses how can we overcome the permeability barrier of Gram-negative cell envelopes?

Contacts

Joint Programming Initiative on antimicrobial resistance (JPIAMR) coordinates national funding from 27 countries and supports collaborative action to fill existing knowledge gaps in AMR; A Strategic Research Agenda (SRA), which outlines key areas to tackle, guides JPIAMR and provides framework for future investment in research priorities. The SRA also serves as a guidance documents for nations to align their AMR research agenda. JPIAMR supports projects through annual calls for proposals.

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