Relevant ProMED-AMR posts:
Below is a list of several recurring themes which are highlighted in ProMED AMR posts. The posts can be found at https://promedmail.org/promed-posts/ by searching the archive number after selecting ProMED-AMR.

General antibiotic overuse

Theme(s):
- Increasing antibiotic use in many countries is exerting an enormous selective pressure for emergence of organisms resistant to these drugs.
- Global public awareness about the danger posed by the overuse and misuse of antimicrobials is required.

Selected ProMED-AMR post(s):
- WHO (02): AMR fact sheet, threats to global health
    - Archive number 20200802.7637035.

Antibiotic overuse in human medicine

Theme(s):
- Over the counter (OTC) sale of antibiotics to the general public without prescription occurs in both high and low/middle income countries (LMICs) for self-medication. One of the main drivers of global per capita antibiotic use was the increase in per capita antibiotic use in some LMICs, where there is a high incidence of infectious diseases and where antimicrobials have become readily accessible and affordable.
- See the executive summary from the 2021 CDDEP report: The State of the World's Antibiotics 2021[1]: "Globally, antimicrobial consumption is accelerating worldwide, particularly in LMICs, as the drugs become more accessible and affordable. The use of antibiotics that the World Health Organization deems critically important for human health increased 91% worldwide and 165% in LMICs between 2000 and 2015." "The other major factor driving resistance is the widespread use of antibiotics in agriculture and aquaculture. The fast-growing demand for animal protein has increased the use of antimicrobials in the animal health sector."

Selected ProMED-AMR post(s):
- Antimicrobial stewardship (03): lack of progress, AMR, CDDEP 2021 report[1]
    - Archive number 20210207.8172269.

Antibiotic overuse in COVID-19

Theme(s):

- The increase in empiric use of antibiotics, driven by care of patients critically ill with severe COVID-19, is anticipated to increase the emergence of multidrug resistant (MDR) nosocomial bacterial pathogens.

Selected ProMED-AMR post(s):

- COVID-19 (04): USA, antibiotic use, hospitals, 1st 6 months, 2020
    - Archive Number: 20210315.8248560.

Antimicrobial overuse in veterinary medicine, farmed animals and aquaculture

Theme(s):

- Over-the-counter (OTC) sale of antibiotics to farmers for use on livestock for growth promotion and for the routine prevention of diseases caused by overcrowded and unsanitary feedlot conditions is another driver of AMR in some countries. OTC sale of antibiotics for fish farming, where large numbers of fish are concentrated in limited volumes of water is another driver of AMR. The high density of fish farms makes them more vulnerable to infections and the rapid spread of disease[2].

Selected ProMED-AMR post(s):

- Antimicrobial overuse, animal (11): global, aquaculture, increased AMR
    - Archive Number: 20201216.8022811
- Surveillance (07): Asia-Pacific region, aquaculture, FAO/OIE guidelines
    - Archive number 20200712.7566741

Antimicrobial overuse in plant agriculture

Theme(s):

- Antibiotics are also being sprayed widespread on crops in the USA for management of bacterial plant diseases, which can allow for emergence of resistance, not only of plant pathogens but also the soil/ground water microbiome.
- Antibiotics are reported to be used on crop plants in all WHO regions of the world with the exception of Africa (no data for Europe) and the main crop on which they are used is rice[3].

Selected ProMED-AMR post(s):

- Antibiotic overuse, crops: USA, EPA, streptomycin, citrus greening & canker dis.
    - Archive Number: 20210331.8278199.

Mechanisms of antimicrobial resistance

Theme(s):

- Use of one class of antibiotic may result in emergence of resistance to other classes of antibiotic, if the gene that encodes resistance to one class of antibiotic is linked to genes that encode resistance to other antibiotic classes, or if the gene encodes a mechanism responsible for resistance to multiple other classes of antibiotics, such as increased production of multidrug efflux pumps.
- Similarly, replacement of antibiotics with anti-bacterial heavy metals, such as copper, may result in emergence of resistance to the heavy metal plus resistance to antibiotics whose resistance mechanisms are encoded by genes linked to genes that encode resistance to the heavy metal.

Selected ProMED-AMR post(s):

- Surveillance (27): USA (TX) ARGs/ARB in urban wild bird feces, contaminated soil
    - Archive Number: 20201115.794525
- Antimicrobial development (04): new antibiotics for complicated intraabdominal infection
    - Archive Number: 20210331.8280736.

Regulation of antimicrobial use

Theme(s):

- Pesticide trade groups in the USA, as well as internationally, are influencing development of policy on widespread use of antibiotics on crops unopposed by countervailing forces.

Selected ProMED-AMR post(s):

- Antimicrobial overuse, crops (03): industry trade grp influence, AMR policy dev
    - Archive Number: 20201004.7833624

Development of new antimicrobial agents

Theme(s):

- Development of new antimicrobial drugs with novel mechanisms of action has been slow and limited.
- WHO undertakes an annual review of antibacterial agents in the clinical development pipeline. "The first report launched in September 2017 showed that the current pipeline is insufficient to treat the WHO priority pathogens, TB and C. difficile.[4]" As of September 2019, a total of 49 antibiotics and 10 biologicals were in clinical development with: 31 antibiotics and 8 biologicals targeting priority pathogens; 12 antibiotics targeting Mycobacterium tuberculosis and 6 antibiotics and 2 biologicals targeting Clostridium difficile[5].

- Research in drug discovery to combat AMR is being coordinated on an international

Selected ProMED-AMR post(s):

- Antimicrobial development (03): antibiotics in development, December 2020
    - Archive Number: 20210310.8238416
- Antimicrobial development (11): new drugs, phase III clinical trials, Gram-neg
    - Archive Number: 20200922.7801497
- Antimicrobial development (02): broad-spectrum synthetic polymer antibiotics
    - Archive Number: 20200718.7587448

<u>Surveillance of AMR</u>

Theme(s):

- Improved and coordinated surveillance activities on a local, regional, and international basis are necessary to detect and monitor of AMR bacteria and resistance genes.
- The WHO Global Antimicrobial Resistance Surveillance System (GLASS), launched in October 2015 and supports a standardized approach to the collection, analysis and sharing of AMR data at a global level. It encourages and facilitates the establishment of national AMR surveillance systems among WHO member states to help inform decision-making and drive national, regional, and global actions. By July 2019, 82 countries, territories and areas were enrolled in the AMR module. Of these, 65 provided both information on the status of their national surveillance system and AMR data for 2018[6].

Selected ProMED-AMR post(s):

- Surveillance (34): challenges, AMR surveillance in LMICs Archive Number
    - Archive number 20210403.8286823
- Surveillance (33): LMIC, gaps in surveillance
    - Archive Number: 20210403.8286680
- COVID-19 (10): WHO guidance, no antibiotics, mild & moderate disease, lower AMR
    - Archive Number: 20201023.7885451
- WHO (04): whole-genome sequencing, AMR surveillance report
    - Archive Number: 20200925.7812075
- WHO (02): AMR fact sheet, threats to global health
    - Archive Number: 20200802.7637035.

<u>Surveillance of AMR in the environment</u>

Theme(s):

- Wastewater from pharmaceutical facilities, hospitals, homes, aquaculture, and runoff from farmland contaminate the environment with antibiotics, resistant bacteria, and resistance genes.

- The accumulation of resistance genes in the environmental microbiome from human, livestock, fish, and plant overuse of antibiotics is inevitably transferred to human pathogens.

Selected ProMED-AMR post(s):

- Research & innovation (32): USA (NJ) microplastics in wastewater, nidus for AMR
    - Archive number 20210321.8260363
- Surveillance (19): USA (WA) AMR intestinal bacteria, seal, porpoise, Salish Sea
    - Archive number 20210306.8231182
- Research & innovation (18): eliminating MDR bact., hosp. wastewater by actinobacteria
    - Archive number 20210221.8192202
- Research & innovation (17): Sweden, hospital wastewater selects for MDR
    - Archive number 20210220.8202788
- Surveillance (32): USA (PR) human wastewater contamination., post 2017 hurricane Maria
    - Archive number 20201119.7956779
- Surveillance (22): UK monitoring AMR wastewater
    - Archive number 20201027.7891088
- Surveillance (19): USA (VA) monitoring wastewater antibiotic resistance genes
    - Archive number 20201012.7856297
- COVID-19 (07): antibiotic use, burden on wastewater treatment
    - Archive number 20200901.7736094
- Research & innovation (02): AMR superbugs, health risk, sea swimmers
    - Archive number 20200810.7662935
- Antibiotic environmental contamination: India, government action plan
    - Archive number 20200727.7615232
- Resistance determinants: China, urban sewage, possible source
    - Archive number 20200715.7577092
- Surveillance (07): Asia-Pacific region, aquaculture, FAO/OIE guidelines
    - Archive number 20200712.7566741.

<u>Antimicrobial stewardship</u>

Theme(s):

- Antimicrobial stewardship (AMS) is increasingly recognized as essential for healthcare institutions to adopt and implement effectively.

Selected ProMED-AMR post(s):

- Antimicrobial stewardship (12): UK, RCVS Knowledge, lead initiative for farms
    - Archive Number: 20210325.8268133
- Antimicrobial stewardship (11): Australia, report on progress, AMR strategy
    - Archive Number: 20210324.8267470;

- Antimicrobial stewardship (09): Qatar, appropriate antibiotic prescription
    - Archive Number: 20210324.8256580;
- Antimicrobial stewardship (08): USA, ASP, effectiveness in 402 US hospitals, 2018
    - Archive Number: 20210321.8260819;
- Antimicrobial stewardship (07): Asia Pacific, capacity, gaps, AMR burden
    - Archive Number: 20210310.8238790;
- Antimicrobial stewardship (06): India, public health, serious threat, combat AMR
    - Archive number 20210309.8236647;
- Antimicrobial stewardship (05): USA, uncomplicated UTI, inappropriate rx, women
    - Archive number 20210301.8220509;
- Antimicrobial stewardship (04): India, combined strategy, tertiary care hosp.
    - Archive number 20210223.8208299;
- Antimicrobial stewardship (03): lack of progress, AMR, CDDEP 2021 report
    - Archive number 20210207.8172269; and
- Antimicrobial stewardship (02): Jordan, KAP antibiotics, resistance, pharmacists
    - Archive number 20210130.8149915

AMR outbreaks

Theme(s):

- ProMED-AMR has described outbreaks of antimicrobial resistant pathogens in various settings, including hospitals and the community. For example, typhoid fever caused by extensively drug-resistant (XDR) *Salmonella typhi*, which began in Pakistan in 2016 and was initially seen in the USA in travelers returning from Pakistan, has been reported since November 2019 in nine cases who had no history of international travel. No epidemiological linkage among cases was noted. This outbreak prompted a change in empiric antibiotic recommendations for all patients in the USA with suspected typhoid fever.

Selected ProMED-AMR post(s):

- Surveillance (16): Pakistan, XDR S. Typhi, continued outbreak, assessment
    - Archive number 20210224.8210141
- Surveillance (14): USA, non-imported XDR S. Typhi infections, 2019-2020, alert
    - Archive number 20210213.8189138.

How to slow down the spread and evolution of AMR

Theme(s):

- Spread and persistence of AMR in healthcare facilities is due in part to failures in infection control.

- Improving sanitation in low-income countries would decrease human diarrheal disease and the use of antibiotics to treat it.
- Development of microbial diagnostic technologies, especially rapid point of care diagnostics, allow initial use of narrower spectrum antibiotics targeting specific pathogens, rather than broad-spectrum empiric antimicrobial therapy.
- Improved funding is necessary on a local, regional, and international basis to combat AMR.

Selected ProMED-AMR post(s):

- COVID-19 (03): USA (MD) nosocomial, COVID-19 unit, MDR-GNB, infect control lapses
    - Archive number 20210303.8225739;
- COVID-19 (02): nosocomial MDR pathogens, infection control lapses
    - Archive number 20210129.8147730;
- COVID-19 (01): USA (FL) Candida auris, nosocomial spread, infection control lapses
    - Archive number 20210109.8087713
- COVID-19 (06): preparedness for expected AMR pandemic
    - Archive number 20200816.7674452
- Antimicrobial stewardship (03): lack of progress, AMR, CDDEP 2021 report
    - Archive Number: 20210207.8172269;
- Antimicrobial stewardship (02): increased global consumption, LMIC, challenges
    - Archive Number: 20200730.7627540
- Antimicrobial stewardship (12): community, LMIC
    - Archive Number: 20201116.7946477
- Research & innovation (08): gonorrhea, POC/RDT, antibiotic susceptibility
    - Archive Number: 20200824.7709522
- Research & innovation (03): resistant gene profile, affordable, portable diagnostic kit
    - Archive Number: 20200812.7667344.
- Antimicrobial development (12): India, klebicin research, USA/UK/Germany funding
    - Archive Number: 20201007.7842076;
- Antimicrobial stewardship (04): Bhutan, One Health partnerships
    - Archive Number: 20200827.7720292;
- Antimicrobial development (07): UK/South Africa collaboration
    - Archive Number: 20200820.7697420;
- Research & innovation (04): AMR spread, India waterways, UK/India
    - Archive Number: 20200812.7669688;
- Research & innovation: UK/India collaboration
    - Archive Number: 20200730.7627515;
- AMR grant: Timor-Leste, improve lab diagnostic capacity & antimicrobial data use
    - Archive Number: 20200726.7613229;
- Announcements (03): One Health strategy, Ireland
    - Archive Number: 20200716.7579662;
- Announcements (02): pharma industry AMR Action Fund

    - Archive Number: 20200711.7557618;
- Announcements: WHO & Pew Charitable Trust, urgent action
    - Archive Number: 20200708.7553013;
- Surveillance (05): Fiji, One Health
    - Archive Number: 20200703.7536145
- Surveillance (04): Sub-Saharan Africa, 4 countries, AMR Pfizer and Wellcome, SPIDAAR
    - Archive Number: 20200627.7511261

References

1. *The Center for Disease Dynamics Economics & Policy (2021) The State of the World's Antibiotics 2021.*
2. *Miranda CD, Godoy FA, Lee MR. Current Status of the Use of Antibiotics and the Antimicrobial Resistance in the Chilean Salmon Farms. (2018). Frontiers in Microbiology. 9:1284.*
3. *Taylor P, Reeder R. (2020). Antibiotic use on crops in low and middle-income countries based on recommendations made by agricultural advisors. CABI Agriculture and Bioscience 1:1 https://doi.org/10.1186/s43170-020-00001-y*
4. *Center for Infectious Diseases Research and Policy. (CIDRAP) (2020) Emails show pesticide industry effort to influence AMR guidelines*
5. *World Health Organization (2020). Antibacterial Agents in Clinical Development*
6. *World Health Organization (2020) Global antimicrobial resistance and use surveillance system (GLASS) report - Early implementation 2020*