

Commentary

National Antibiotic Resistance Strategy for Human Health in France

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France is a country with 67 million inhabitants and is part of the European Union. Antibiotic consumption in humans is higher in France as compared to the European average, especially in outpatient settings (1–2). The burden of antibiotic resistance is also high, as compared to the European average, with an estimated 5,500 deaths per year associated with multidrug-resistant bacterial infections (3). Encouraging results have, however, been observed over the last several years: antibiotic consumption in the community, in nursing homes and in hospitals showed a decreasing trend, as well as certain resistant bacteria, such as 3rd-generation cephalosporin- or fluoroquinolone-resistant *Escherichia coli* (1–2,4–5). The COVID-19 pandemic has had a dramatic impact on antibiotic consumption and its long-term impact on antibiotic resistance is being carefully monitored (1).

Antimicrobial resistance (AMR), in particular antibiotic resistance, is a long-standing priority for the French government. Action plans in human health coordinated by the Ministry of Health have been in place for more than 20 years, while plans in animal health have been coordinated by the Ministry of Agriculture since 2012 (6). The first Interministerial Committee for Health was dedicated to AMR, with a specific focus on antibiotic resistance. In November 2016, the French government adopted the Antibiotic Resistance Interministerial National Action Plan, using a One Health approach (7). This action plan is organized around five objectives: 1) raising awareness among the general public and healthcare professionals; 2) education; 3) research and innovation; 4) monitoring and surveillance; and 5) interministerial and international action governance. Regular One Health brochures are published, presenting a brief overview of the implemented initiatives and their impact (1,8).

The most recent sectorial operational plan in human health was released by the Ministry of Health in February 2022: the 2022–2025 national strategy for preventing infections and antibiotic resistance in

human health (9). The synergy between antibiotic stewardship and infection prevention and control activities is underlined, encompassing the prevention of viral and bacterial community-acquired and healthcare-associated infections. A series of performance indicators are included, with defined targets, to monitor progress at national and regional levels.

We present below a selection of some actions conducted in human health, that might be of interest to an international readership. For more information on the other actions, annual reports and summary brochures are regularly published and available online (8,10).

RAISING AWARENESS AMONG THE GENERAL PUBLIC AND HEALTHCARE PROFESSIONALS

Santé publique France (Public Health France) has developed a nationwide communication campaign that started this year targeting healthcare professionals and the general public. These actions will continue during the coming years. The aim of this campaign is to raise awareness among the public and healthcare professionals about the importance of antibiotic stewardship and to empower them to take action. Several preliminary studies have been carried out to better define targets and key messages to change general public and healthcare professionals' behavior. This campaign will be based in particular on the Antibioclac platform (11), a therapeutic decision-support tool in antibiotic therapy for healthcare professionals, and Antibio'Malin (12), a thematic online space containing practical information for everyone.

Launched in November 2019 on the Santé.fr website of the Ministry of Health, the Antibio'Malin platform offers the general public short and simple thematic information describing all the antibiotics prescribed by healthcare professionals in the community, as well as the most frequent infections

(12). It aims to inform everyone on the subject, giving them the means to act individually to prevent antibiotic resistance. Healthcare professionals can also use this resource in their communication with patients.

EDUCATION

Understanding antimicrobial resistance and its drivers is of utmost importance for a sustainable effect of prevention campaigns and measures. Contributing to the teaching of children and teenagers, E-Bug is an online educational resource, initially developed as part of a European project (13). It details micro-organisms, common infections, hygiene, and the use of antibiotics and vaccines. E-Bug offers free and fun tools, regularly updated, to facilitate the teaching of infections and antimicrobial resistance to children and teenagers at school, using a One Health approach. This platform is supported by several French ministries and agencies and is available to teachers, with additional resources also targeting parents.

In order to strengthen the training of healthcare students and contribute to raising awareness of the public, the theme of “preventing infections and antibiotic resistance,” from a One Health perspective, is now a national priority of the Health Service for Health Students. The introduction of a health service for all health students (medicine, pharmacy, odontology, maieutics, nursing, and physiotherapy) is part of the national health strategy, whose first axis is to implement a policy of prevention and health promotion in their interdisciplinary curriculum.

Funded under the Priority Research Program on Antibiotic Resistance, the PROMISE project is a One Health professional meta-network on antibiotic resistance, bringing together 21 national networks and over 40 academic partners (14). One of the main objectives consists in the creation of initial training modules involving veterinarians, medical students, and pharmacists. These training modules have a One Health approach and aim to build bridges between the different scientific communities and reinforce prevention practices by all health professionals.

RESEARCH AND INNOVATION

In 2020, the Priority Research Program on antibiotic resistance was launched, with a funding of 40 million euros, coordinated by the Inserm national research agency (15). This program uses a One Health

perspective and focuses on three main cross-cutting actions: 1) developing and creating platforms, networks, and observatories dedicated to antibiotic resistance; 2) strengthening research teams through calls for expressions of interest or interdisciplinary calls for projects and human resources; and 3) coordinating a research network on antibiotic resistance for countries with limited resources. Intended for the academic scientific community and industry stakeholders, the related National Antibiotic Resistance Interface website (part of the Priority Research program on antibiotic resistance) is intended to be a common, intersectoral, and interactive entry point, identifying public and private actors, platforms and networks, coordinating and animating activities, and listing research and innovation projects focused on antibiotic resistance (15).

ENSURING ACCESS TO EXISTING ANTIBIOTICS

A three-year project “Ensure the availability of antibiotics,” as part of the Technical Support Instrument co-financed by the European Union, started in November 2020. The aim of the project is to identify and implement pilot measures in France to tackle the root causes of the lack of availability and shortages of off-patent antibiotics used in human and veterinary medicine. The European Commission’s Directorate General for Structural Reform Support (DG REFORM) and the WHO provide technical assistance to the French Government with the participation of five ministries and two national agencies (16). The first public report presenting the most suitable measures for addressing the root causes of shortages in the human and veterinary sectors will be released soon (16).

ANTIBIOTIC STEWARDSHIP AND INFECTION PREVENTION AND CONTROL

In August 2021, the High Council for Public Health (HCSP) was asked by the Ministry of Health to produce scientific recommendations on basic actions everybody could implement in everyday life to prevent common infections. These recommendations are expected in early 2023. They will be used to guide future awareness activities.

Since 2021, access to rapid diagnostic tests for sore

throat is facilitated in community pharmacies. These tests have already been made freely available to medical doctors for many years. They make it possible to determine the viral or bacterial origin of a sore throat in a few minutes, thanks to a throat swab taken by a doctor or a pharmacist. More than 80% of sore throats are viral and do not require antibiotics (17). Rapid sore throat tests, therefore, allow antibiotics to be taken only when necessary and preserve their effectiveness.

The national strategy is implemented at the regional level in the three healthcare sectors (hospitals, medico-social facilities and services, and the community) by the Regional Health Agencies (ARS), which are responsible for mobilizing all regional actors involved in the topic. Two types of regional centers provide support to the ARS. To address infection prevention and control (IPC), the centers for the prevention of healthcare-associated infections (CPiAs) are responsible at the regional level for the prevention of healthcare-associated infections and the control of cross-transmission of infectious agents. They provide expertise and support and run networks of IPC professionals (IPC teams in hospitals and nursing homes). On the other hand, the regional centers for antibiotic stewardship (CRAtb) carry out regional missions of expertise and support, including a strategic mission on antibiotic stewardship, and animation of networks of health professionals in charge of the antibiotic stewardship activities (multidisciplinary teams and referents).

As detailed below, five national surveillance and prevention missions for healthcare-associated infections and antibiotic resistance are coordinated by Santé publique France. The scope of these national missions covers the entire patient healthcare pathway: community, nursing homes, and hospitals. These missions produce not only surveillance data, but also prevention, training, and communication tools for professionals and the general public.

MONITORING AND SURVEILLANCE

The French national public health agency (Santé publique France) is in charge of a national notification system for uncommon healthcare-associated infections and emerging antimicrobial-resistant strains. Every five years, it conducts a national point-prevalence survey on healthcare-associated infections and antimicrobial treatments in hospitals and nursing homes, according to the European Center for Disease Prevention and Control (ECDC) methodology.

In addition, the above-mentioned French network for the prevention of healthcare-associated infections and antibiotic resistance gathers five national missions, coordinated by Santé publique France (18). The objectives of these missions are to support the national agency in producing surveillance data on healthcare-associated infections, antibiotic use and resistance, and to produce or make available to the regional IPC and antibiotic stewardship regional centers mentioned before infection prevention and control and media communication tools; the scope will be extended to antibiotic stewardship in 2023. This network contributes to the European surveillance system coordinated by the ECDC.

In order to assess One Health collaborations between surveillance systems in human health, animal health, and the environment, the Surv1Health project has been conducted by the ANSES national agency, in collaboration with Santé publique France (19).

INTERNATIONAL ACTIONS

The 2017–2021 European Joint Action on antimicrobial resistance and healthcare-associated infections was a joint action of the European Union (EU) on antimicrobial resistance and healthcare-associated infections, coordinated by France. It brought together 44 partners and 45 stakeholders (e.g., ECDC and OECD) and encouraged synergies between EU Member States in developing and implementing effective health policies to combat the growing threat of antimicrobial resistance and reduce healthcare-associated infections. This joint European action has also facilitated the exchange of best practices and discussion among policymakers to improve the implementation of national action plans. A summary of the main actions taken and recommendations made is available online (20).

A One Health ministerial conference on antimicrobial resistance was organized by France in March 2022, within the French Presidency of the Council of the European Union (21). The aim was to assess the European Union's progress on this major public health issue and identify areas for improvement and explore the unmet needs at the European level.

In conclusion, we have presented a brief overview of the French strategy to tackle antibiotic resistance in human health that is part of a larger interministerial One Health action plan. Some progress has been made, but room for improvement is still there and the efforts must be maintained and reinforced, in line with the

European and international contexts.

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