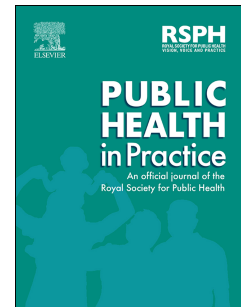


Journal Pre-proof

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PII: S2666-5352(25)00130-2

DOI: <https://doi.org/10.1016/j.puhip.2025.100711>

Reference: PUHIP 100711

To appear in: *Public Health in Practice*

Received Date: 3 April 2025

Revised Date: 10 December 2025

Accepted Date: 16 December 2025

Please cite this article as: G. Kertes, A. Robertson, L. Ackerley, M.B. Liljeberg, C. Swedmark, A. Shephard, T. Bosch, A.M. Bojesen, J. Carreño Louro, M. Calabró, D. Sienkiewicz, P. Jokelainen, M. Bengtsson, L. Thyregod, N. Søndberg, C. Nelander, L. Münter, Enhancing antimicrobial stewardship and health literacy in Europe – moving forward through education and empowerment, *Public Health in Practice*, <https://doi.org/10.1016/j.puhip.2025.100711>.

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Enhancing antimicrobial stewardship and health literacy in Europe – moving forward through education and empowerment

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Abstract

Antimicrobial resistance (AMR) is a silent, growing pandemic of global proportions and impact. This commentary encourages relevant stakeholders to increase their joint commitment to collaboration and systemic action, dedicated antibiotic stewardship and health literacy including a stronger, evidence-based self-care to contribute to solving the AMR challenge. Key factors such as the removal of inadequate access to antibiotics, e.g. over-the-counter (OTC) sale of antibiotics, improving self-care and hygiene can help fight the increasing burden of AMR. Along with the increase in health care literacy, these measures can be implemented swiftly to combat the growing rate of AMR development.

Keywords

AMR, health literacy, antibiotic stewardship, health education, empowerment, Europe, self-care, One Health.

The Current Issue of Antimicrobial Resistance

The European Parliament – in the resolution on the Pharmaceutical Strategy for EU – recognised antimicrobial resistance (AMR) as ‘a major global health problem and a serious risk to the well-being of European citizens that will pose a major challenge to European health systems and societies’ and ‘calls on the EU to provide itself with common therapeutic guide for antimicrobials’.¹ In Europe alone, it is estimated that AMR causes more than 670,000 infections and the death of 33,000 people annually and a loss of €1.1 billion yearly in relation to healthcare costs and productivity.² AMR threatens both the patient safety of several medical procedures, the ability to fight outbreaks in either hospital wards or communities, and overall public health. Yet inappropriate use of antibiotics remains high with predominantly viral respiratory infections representing a typical indication for misuse.

AMR is a threat to both human health and animal health, and it affects environments and ecosystems, causing societal challenges. Therefore, AMR must be addressed using a One Health approach, highlighting that coordinated action across all sectors is key and our health is interconnected with the health of other organisms, including our microbiome.³ An alteration of the composition of the microbiome due to AMR can have negative effects on the host organism. For example, microbes are causally involved in preventing infections in the whole digestive system including the oral cavity and maintaining a healthy condition.⁴ As a first point of contact with airborne pathogens the oral microbiome serves as a protection shield by providing ‘colonisation resistance’ preventing pathogens from colonizing the mouth and throat mucosa.

However, if the microbial inhabitants are disturbed, e.g., by local antibiotics, fungal infections or inflammation of the oral mucosa can occur. If a microbial population is disrupted by antibiotics, pathogens can gain advantage, resulting in systemic infection and inflammation. These infections can be caused by resistant organisms increasing the risk of multidrug-resistant pathogens. Human cohort studies provide persuasive evidence that the amount of antibiotics used by humans – according to recent estimates more than 70 billion antibiotic doses annually – is changing the bacterial diversity in the human microbiome.³ These changes have been associated with asthma, diabetes, autism, irritable bowel syndrome (IBS) which

are costly and detrimental side effects due to the loss and disturbance of microbiome in our bodies.^{3,5}

An urgent need for antimicrobial health literacy and stewardship

Health literacy concerns the organisational and individual capacity to share, process, and apply information towards better health for individuals, communities, and the environment. Health literacy is particularly relevant in the context of AMR to understand the use of antibiotics and the impact on the individual and communal microbiome. Increasing health literacy would empower everyone to understand the effects of antibiotics, to use them more appropriately and enable them to take alternative actions in a timely and appropriate manner. One of the key methods to encourage and boost health literacy is the use of antimicrobial stewardship which includes:

1. Leadership commitment: Demonstrate dedication to and accountability for optimising antibiotic prescribing and patient safety.
2. Intervention and action: Implement at least one policy or practice to improve antibiotic prescribing, assess whether it is working, for whom - and modify as needed.
3. Tracking and reporting: Monitor antibiotic prescribing practices and offer regular feedback to clinicians.
4. Education and expertise: Provide educational resources to clinicians and patients on antibiotic prescribing and ensure access to needed expertise on optimising antibiotic prescribing.
5. Revisit history: Introduce mechanism to review historical licenses and product to assess risk/benefit ratio in relation to new research including prescription status.

Increasing awareness of antimicrobial health literacy and stewardship can help mitigate the harmful effects of AMR in Europe and globally, including the impact on health equity. It is a shared responsibility of decision makers, health professionals, manufacturers, and individuals to decrease the inappropriate use of antibiotics and thereby AMR.

Over-the-counter antibiotic misuse and the impact on AMR and health

Although, there is much global effort to drive behavior changes on the use of antibiotics, non-prescription over-the-counter (OTC) sore throat medicine including lozenges with tyrothricin, gramicidin, bacitracin and neomycin remain available for self-medication in some countries, including Europe.⁶ However, only a small proportion of the sore throat conditions are caused by bacteria such as e.g., group A *Streptococcus*. Sore throats mainly have a viral aetiology (80–95 %)⁷ which makes antibiotics irrelevant for the treatment while adding to the risk of AMR. Easy access to OTC antibiotics could contribute to removal of oral colonisation resistance and creation of ecological niches for resistant organisms caused by overuse of antibiotics. Consequently, this can on the one hand cause significant damage to the immune system due to a lack of biodiversity of the microbiome in the mouth or gut. A microbiome affected by antibiotics increases risks in systemic inflammation and infection as it has a reduced diversity. On the other hand, it facilitates the spread of antimicrobial-resistant organisms. Nonetheless, consumers may not be aware of the impact on AMR for individuals and communities when buying easily available OTC products containing antibiotics, despite their preference to support sustainable solutions and products to thus help solve our global crisis to health and economy. It is therefore important to preserve the efficacy of antibiotics and can be argued that they should not be made available as OTC.⁸

Reducing inadequate access to antibiotics

While we urgently need to develop new antibiotics to improve the current toolbox, it is essential at the same time to limit inadequate access to antibiotics. This includes introducing expanded product labelling to inform about the risk of increasing AMR – and considering withdrawal of OTC products containing antibiotics. Alternatively, OTC antibiotic products could become prescription-only (POM), where appropriate diagnostic procedures can facilitate correct usage.

Moreover, traditional, and cultural practices of prescribing antibiotics should be examined to identify and overcome unsustainable uses of antibiotics and make them fit-for-purpose. Whilst some countries are reviewing and updating their antibiotic usages practices, this needs to occur on a global scale with a One Health approach.

Using a One Health Approach is necessary for combatting AMR

On a systems level, addressing the use of antibiotics and the impact of AMR in the food and agriculture ecosystems alongside accessibility in pharmacies and prescription habits – using a One Health-approach – will help mitigate the increase of AMR within and across countries. This approach should not only consider the impact on humans and animals, but also the biodegradation of our environment – also on a microbiological level – that a misuse of antibiotics represents.⁹ The industrial impact has been identified as a major cause of the spread of AMR e.g., by release of active antimicrobial compounds into the environment. Monitoring hospital sewage and other industrial pathways could, therefore, be a specific point of focus.

Yet, while AMR is relatively high on the agenda in Europe, less attention is given to antibiotics in many countries elsewhere. In a globalised world, pathogens (including resistant strains) can travel and although a local or national top-down approach will not be sufficient to solve this global problem and eliminate the development of antibiotic resistance, local actions may help to reduce inappropriate antibiotic use as seen in low-prescribing countries.

Furthermore, prevention of disease transmission is a crucial factor in reducing the burden of AMR and can be achieved through the means of design, architecture, air conditioning, and improved self-care and hygiene.

Improving self-care and hygiene

There is a strong need for more action to improve health literacy and the ability to self-care in addition to system wide, organisational efforts. This is evident as some patients still believe the misconception that antibiotics can treat viral infections.¹⁰ Recognising the value of an evidence-based, well-educated, informed self-care strategy, including evidence-based solutions may contribute to quality of care and reduce the use of antibiotics.

Investment in educational efforts concerning hygiene and health literacy in healthy school and workplace environments can be seen as low hanging fruit with potential for significant impact.

Targeted efforts to support citizens use of appropriate preventive measures would be both equitable and effective in terms of tackling AMR. Public engagement

campaigns such as the global Antibiotic Awareness Day and increased exchange of good practices are needed to develop people's health literacy. New and stronger communication efforts from basic fact sheets to reflections about antibiotics and AMR in media, public events, and online can overhaul mis- and dis-information breaking through dogma and myths and educate about symptomatic treatments.

Conclusions

The AMR challenge is well recognised but addressed with too little action. There is an opportunity to learn from the ambitious political and societal actions during the COVID-19 pandemic and design bold actions to fight AMR. It is important to realise that the impact of AMR is not just a future, potential risk; it is a clear and present danger to health and wellbeing around the world.²

AMR is unevenly distributed and as such it places a bigger burden on the poorer or socially deprived communities. Low building standards, poor air quality, confined living conditions, and poor access to adequate hygiene facilities are all drivers for infections and thus potentially antibiotic treatments. Vigor and dedication are needed from national and regional stakeholders to boost the AMR agenda and transform the *status quo* by design, interventions, education, monitoring systems and pharmaceutical innovations.

We encourage health care professionals, health communication professionals, decision makers, and civil society to increase their joint commitment to collaboration and action towards system action, dedicated antibiotic stewardship and health literacy including a stronger, evidence-based self-care to contribute to solving the AMR challenge.

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Declarations

a. Ethics approval and consent to participate

Not applicable

b. Consent for publication

All co-authors provided consent for publication

c. Availability of data and materials

Not applicable

d. Competing interests

The authors of this paper represent a wide range of organisations, institutions, networks, and companies from the public and private sector, including the pharmaceutical industry, as listed in the author list. As such, they were invited to share their expert views in this meeting of minds of which the outcomes and recommendations are transparently shared in this article. Apart from declared funding support to Pikka Jokelainen and Dorota Siekenwisch, the authors declare no competing conflict of interest.

e. Funding

Pikka Jokelainen and her contribution was supported by funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773830.

Dorota Sienkewisch and her contribution was supported by funding from the European Union's Horizon Europe research and innovation programme under grant agreement 101060536 — FEAST — HORIZON-CL6-2021-FARM2FORK-01, and from the European Union's European Social Fund+ 101101981 — EuroHealthNet SGA 23.

f. Authors' contributions

The viewpoints presented in this paper are based on the outcomes of the Future Self-Care in Europe Roundtable, a multidisciplinary expert discussion in Copenhagen in September 2022.

g. Acknowledgements

The authors thank the following experts for their contributions: Global Respiratory Infection Partnership (GRIP); Camilla Björn, Research Institutes of Sweden RISE; Denis Bourgeois, University of Lyon; Solveig Langsrud, Nofima; Milka Sokolovic, European Public Health Alliance; Donna Lecky, Public Health England. Robert Skov, ICARS - International Centre for Antimicrobial Resistance Solutions; Sibylle Reichert, International Association of Mutual Benefit Societies (AIM). Medical writing support was provided by Kristine Sørensen, PhD, Founder, Global Health Literacy Academy, President, International Health Literacy Association, Executive Chair, Health Literacy Europe, with funding from Reckitt Benckiser.