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We must harness the power of social and behavioural science against the growing pandemic of antimicrobial resistance

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Standfirst: Social and behavioural science offers a valuable toolkit for combatting pandemics, but has not been broadly applied to tackle the rising pandemic of antimicrobial resistance.

Antimicrobial resistance describes a process whereby microorganisms, such as bacteria, fungi and viruses survive exposure to a medicine that would normally kill them or inhibit their growth, rendering this medication less effective. Left unmitigated, antimicrobial resistance will reverse previous gains in modern medicine and increase global mortality from currently treatable diseases. According to the World Health Organization (WHO), antimicrobial resistance is one of the most significant threats to global health, food security, and development today[1]. In 2019, antimicrobial resistance is estimated to have contributed to the deaths of approximately 4.95 million people, with 1.27 million deaths directly attributed to it[2]. By comparison, the WHO estimated that based on the excess deaths statistics, COVID-19 was associated with 3 million deaths in 2020[4]. If no immediate measures are taken to reduce the spread of antimicrobial resistance, by 2050, it could contribute to up to 10 million deaths annually[3]. The burden is not distributed equally, as it disproportionally affects people from low- and middle-income countries[2].

The importance of behaviour in curbing antimicrobial resistance

One obvious solution to the growing threat of antimicrobial resistance is the development of new antimicrobial medicines; however, this is a complex process that demands substantial time as well as financial and human resources. It is therefore paramount to prevent infections and conserve the effectiveness of existing antimicrobials through the

promotion of their judicious use in public and animal health[3]. Antimicrobial use is a human behaviour. It is the product of human attitudes, policies and choices, embedded in social and cultural contexts. Thus, understanding and managing the behavioural factors related to the prevention of infections and to the overuse and misuse of antimicrobials is critical. This includes reducing inappropriate antibiotic prescribing and consumption across human and animal health, aquaculture and agriculture. It also covers behaviours related to infection prevention and control, hygiene, farm biosecurity and vaccine uptake in public as well as animal health affecting the spread of antimicrobial resistance. Understanding these behaviours, their antecedents, underlying processes and consequences is key for developing effective behaviour-change interventions, and social and behavioural science can provide important insights in this regard.

The antimicrobial resistance research paradox

Antimicrobial resistance has received much less attention from social and behavioural science than COVID-19, although the study of human behaviour appears equally important for managing it and causes a comparable number of deaths. Indeed, as the COVID-19 pandemic gripped the world, social and behavioural scientists quickly mobilised to contribute important insights, ranging from guiding the implementation of measures to limit the spread of the virus to understanding the impact of the pandemic and preventive measures on mental health, social relationships as well as societal and economic systems[5]. Such research engagement has not occurred for antimicrobial resistance.

One indicator of research engagement is the publication record. In 2021 alone, 39,973 research articles were published and recorded in the Social Science Citation Index for the "COVID-19" or "COVID" keywords. In contrast, in the same year, only 546 articles with "antimicrobial resistance" and related terms as the keywords were recorded in the same index. (The reproducible search strategy and the relevant data can be found here: https://osf.io/uvmqk/.) The urgency of the COVID-19 pandemic may have diverted some

research focus, but research productivity concerning antimicrobial resistance had already been consistently low in the years leading up to COVID-19 (e.g., 513 publications in 2019). As of April 2023, in the leading journal for social and behavioural science, Nature Human Behaviour, 110 papers (67 of which were research or review articles) were published on COVID-19. However, only two publications covered the topic of antimicrobial resistance (none of them was a research or review article). Given the current and future impacts of antimicrobial resistance on global health, and the critical need to understand associated behavioural drivers, the limited engagement of social and behavioural science in this area is alarming.

Overcoming barriers to broader engagement

We identify four interrelated barriers to broader engagement in the social and behavioural sciences in understanding and tackling antimicrobial resistance—lack of awareness, an ill-defined research agenda, limited interdisciplinary collaboration, and inadequate incentives—and offer possible solutions (see Figure 1).

Insert Figure 1 here

Raising awareness among social and behavioural scientists

Similar to the awareness gap in the general public[6], social and behavioural scientists might not sufficiently recognise the threat of antimicrobial resistance to human health. This could, in part, be attributed to the temporal gap between present actions and their future consequences, similar to the climate crisis. It is also easy to underestimate the severity of the issue. Indeed, in 2013, even the Chief Medical Officer for England, a champion of antimicrobial stewardship, Dame Sally Davies, admitted to underestimating the gravity of antimicrobial resistance until she became the Chief Medical Officer, despite being aware of it[7]. Moreover, there might be a lack of awareness and recognition of the role of social and

behavioural science in tackling antimicrobial resistance more widely (e.g., among other scientists, public health professionals or funders), which limits the opportunities for engaging and working with social and behavioural scientists.

We therefore propose developing tailored educational resources and awareness campaigns specifically targeting social and behavioural scientists. These resources should raise awareness of the threat and severity of antimicrobial resistance, as well as highlight human behaviour contributing to its increase. The educational materials could be integrated into social and behavioural science curricula, textbooks, Massive Open Online Courses (MOOCs), and professional development programmes such as workshops, conferences, and continuing education opportunities. Some pioneering examples already exist—to name a few—the training curriculum handbook for social scientists on antimicrobial resistance (https://sonar-global.eu/special-soc-amr/) and a MOOC course addressing antimicrobial resistance through a social science lens (https://www.futurelearn.com/courses/social-science-for-tackling-antimicrobial-resistance). Collaboration between professional organisations and universities, from high-income as well as low- and middle-income countries, will be critical for developing and delivering high-quality and engaging educational materials. Through these efforts, we can raise awareness of the severity of antimicrobial resistance among social and behavioural scientists, and inspire them to take action to join efforts in combatting this pressing public health challenge.

Defining a social and behavioural science research agenda on antimicrobial resistance

Another reason for comparatively less research activity might be the lack of a clearly defined and structured research agenda identifying human behaviour linked with antimicrobial resistance. This might reflect the fact that antimicrobial resistance represents a multifaceted and complex problem involving many stakeholders and behaviours, embedded in specific healthcare and food production contexts.

To overcome the barrier of a poorly defined antimicrobial resistance research agenda, it is essential that social and behavioural scientists work together with healthcare providers, epidemiologists, agricultural extension services, veterinary professionals, environmental scientists, policymakers, patient groups, farmers and livestock producers. The aim is to collaborate in identifying research priorities and developing research questions that acknowledge the multifaceted nature of the problem in various domains. Such interdisciplinary teams should aim to identify priority target behaviours and map existing knowledge of barriers and drivers of these behaviours (e.g., by conducting systematic reviews and meta-analyses). They should also devise reliable tools to assess these constructs, and crowdsource and co-design behaviour-change interventions that address the specific needs and contexts of diverse populations in different geographic, cultural, and socio-economic settings, such as minority groups, those experiencing disadvantage, and rural populations. (See the WHO's Tailoring Antimicrobial Resistance Programmes guideline for how to implement such a process.[8])

Recently, first steps in this direction have been made by international (health) organisations[9]. However, a more fine-grained research agenda focusing on both processes and outcomes is key for developing and testing theoretical models of behaviours in the context of antimicrobial resistance and, in turn, devising effective behavioural interventions to tackle the overuse and misuse of antimicrobials across contexts.

Building collaborations within and beyond social and behavioural science

Social and behavioural scientists may face barriers to engaging with the antimicrobial resistance agenda due to a lack of interdisciplinary collaborations. Engagement with stakeholders across a range of sectors, including public and animal health and agriculture, can at times be limited. Interdisciplinary collaboration within and beyond social and behavioural science is critical for translating research insights into evidence-based practice and effective

action, and for evaluating the impact of interventions to understand what works where, for whom and why.

We can overcome this barrier by creating interdisciplinary research teams that include social and behavioural scientists and experts in other fields as well as implementers (e.g., from national and international health organisations), reflecting the reality of cultural and country-specific contexts. Other effective strategies include organising conferences and workshops that bring together researchers from different disciplines and establishing interest groups and networks focusing on antimicrobial resistance within and beyond social and behavioural science (e.g., https://www.antimicrobialsinsociety.org/). Through these efforts, social and behavioural scientists can become more engaged with the antimicrobial resistance research agenda and help to develop innovative and effective strategies for addressing this global health challenge. As a further step in this direction, some of the authors of this article recently founded the *Antimicrobials: Behaviour and Cognition (ABC) Network* (https://www.a-bc.network/). This is a network specifically focusing on human behaviours that are important for antimicrobial resistance. We invite all interested researchers to join and contribute to this bottom-up initiative.

Enhancing incentive structures for social and behavioural scientists

The existing incentive structure for social and behavioural scientists does not match the urgent priority for research on antimicrobial resistance. Scientists may not see sufficient intrinsic and extrinsic value (e.g., funding, prestigious publications) in engaging in this research, given the efforts associated with understanding behaviours in specific environments and interdisciplinary collaboration.

Several measures can be taken to enhance the incentive structure and, in turn, encourage social and behavioural scientists to put antimicrobial resistance on their research

agenda. First, we hope that raising more awareness about the issue, including this opinion piece, will increase the intrinsic value of conducting this type of research. Other researchers may be encouraged to engage with this issue after reading successful real-life examples of how social and behavioural scientists have made significant contributions to combatting antimicrobial resistance. Second, changing the extrinsic incentive will be critical. Therefore, we call for editors of leading multidisciplinary and specialist journals in social and behavioural science disciplines to welcome research on antimicrobial resistance and initiate special issues on the topic. We also urge funding agencies to provide grants dedicated to supporting research on human cognition and behaviours related to antimicrobial resistance. This might prove to be a particularly challenging step due to the overall under-resourcing of antimicrobial resistance, especially in low- and middle-income countries; however, some emerging examples do exist (e.g., calls for transdisciplinary grants on AMR issued by the Economic and Social Research Council UK).

Conclusion: Call for action

Social and behavioural science can make important contributions towards tackling the silent pandemic of antimicrobial resistance. It is imperative for all stakeholders from around the world—social and behavioural scientists, scientists involved in disciplines related to human health and agricultural production, journal editors, funders, and policymakers and implementers—to take concerted action to combat the growing threat of antimicrobial resistance. The increased prioritisation of social and behavioural science through the recent WHO resolution on “Behavioural sciences for better health”[10], which was adopted in May 2023, may provide a great opportunity for support of such joint efforts. It is only by working together that we can develop effective strategies to combat this urgent threat to public health.

Competing Interests

The authors declare no competing interests.

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Figure 1. Four ways to increase social and behavioural science research related to antimicrobial resistance.