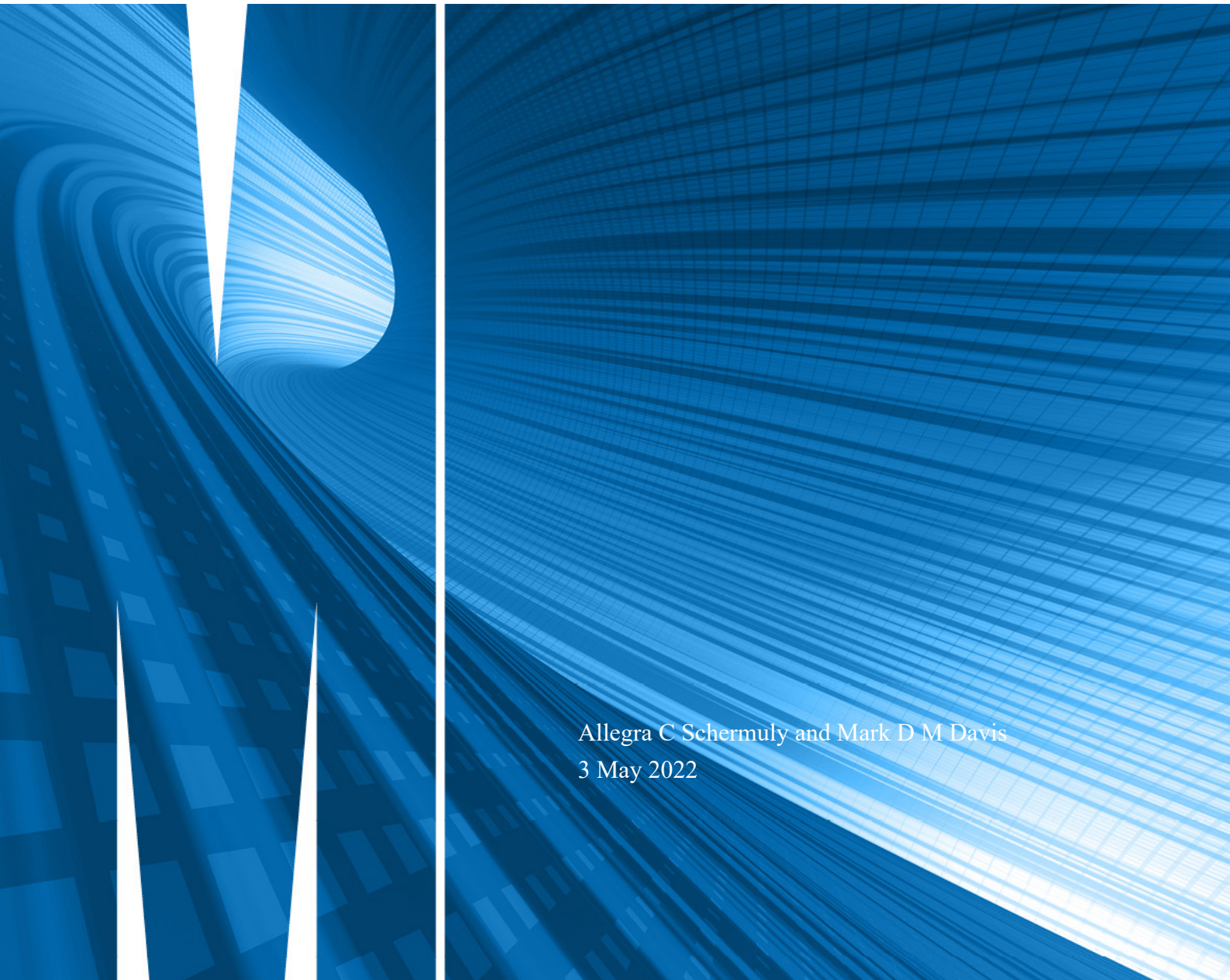
School of Social Sciences

GUIDANCE FOR THE PREVENTION OF ANTIMICROBIAL RESISTANCE WITH GENERAL PUBLICS



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SUMMARY

Research, evaluation and practice guidance indicates that there is no ‘silver bullet’ for the prevention of AMR with general publics. The literature favours the integration of educational approaches into an overall prevention framework that can be sustained over time. Methods of prevention education are hybrids of prevention aims, media technologies, social contexts, practical constraints and resource limitations, often retrospectively justified in terms of their value for the production of outcomes regarding knowledge of AMR and reduced use of antimicrobials. Attributing outcomes to them is therefore difficult. Moreover, singly and in isolation, educational methods are unlikely to lead to substantial and sustained outcomes. Without an integrated approach, education may waste resources, lead to counterproductive fragmentation of messages and weakened trust in expert advice.

Educational approaches are more likely to gain value through synergies with each other, repetition over time, coordination with the governance of antimicrobial use, address to health systems drivers of antimicrobial use, and linking education for antimicrobial consumers, prescribers and dispensers (see Figure 1). A comprehensive and multidimensional evidence base featuring co-design and participatory methods is also needed to set goals and targets and drive the development of educational approaches. Cultural practices (narrative, popular culture, media) and educational institutions also need to be integrated into AMR prevention frameworks for members of general publics. Individuals can be assisted to participate in AMR prevention through advice and guidance specific to their medical, cultural and social circumstances and that features tools and approaches that expand their capabilities to reduce the impact of infectious diseases in their lives.

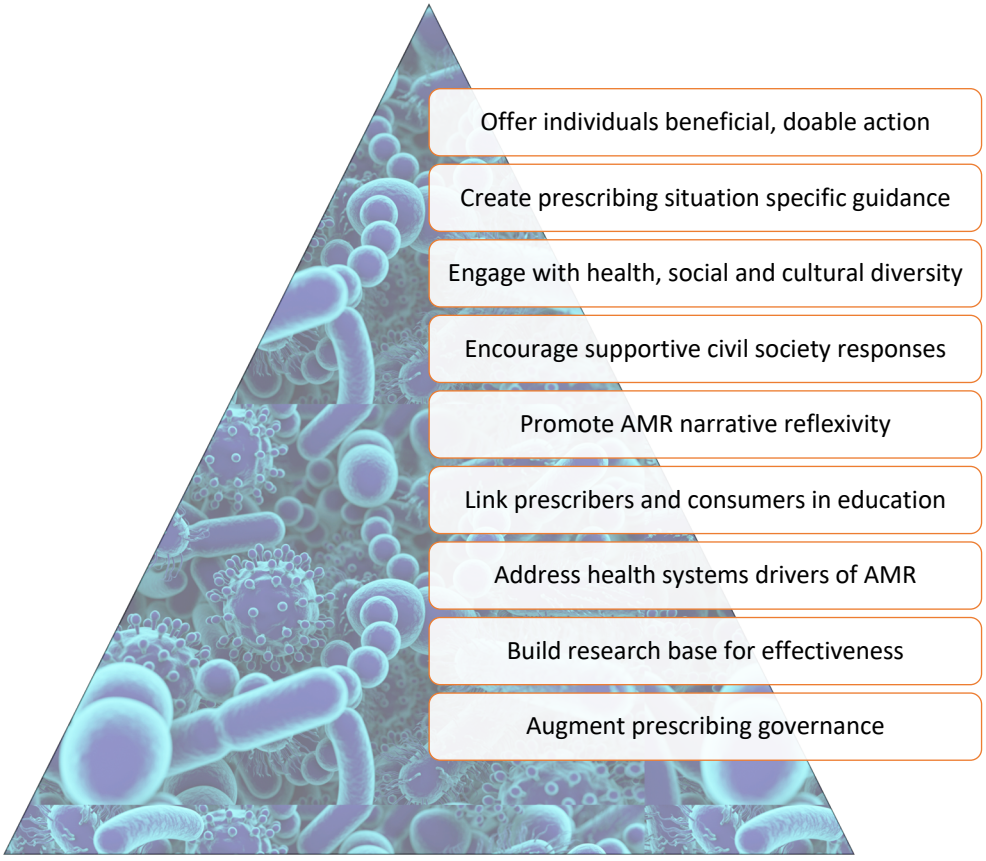

Figure 1. An integrated approach to AMR prevention education with general publics

RATIONALE

This document aims to provide practical guidance to strengthen general public educational approaches to help prevent antimicrobial resistance. It is guided by these questions:

1. Which educational approaches are linked with effective outcomes said to contribute to the prevention of AMR?
2. What evidence, theories and assumptions support effective AMR prevention education outcomes?
3. What insights do the scientific, evaluation and grey literatures offer for the development of AMR prevention educational practices?

We define members of general publics as individuals who consume antimicrobial pharmaceuticals in domestic settings to care for their own health and that of dependent others, including companion non-human animals. The framework we propose, therefore, does not encompass hospital prescribing, dentistry, and animal food production. We have included examples of educational approaches that address school children, but our focus is on the everyday consumers who source antimicrobials to treat symptoms thought to indicate infections.

We adopt a prevention approach in this document to make the point that, to be most effective, information, communication and education need to be integrated with regulatory, economic, policy and other factors that contribute to the reduction of antimicrobial use and AMR (Hall, McDonnell et al. 2018). We also distinguish our approach from science communications, which have a focus on the promotion of public engagement and trust in science (Davies, Halpern et al. 2019). Trust in science is salient but it is not the only focus of AMR prevention education. Hygiene and vaccine programmes contribute to the prevention of AMR and need to be harmonised with efforts to reduce the unnecessary use of antimicrobials (UK Review on Antimicrobial Resistance 2016). However, to provide focus and strengthen prevention education, this document focusses on the consumption of antimicrobials by individuals in domestic settings.

This document synthesises findings of previous systematic and narrative reviews of AMR prevention with general public groups, our own review of prevention education evaluations and grey literature (see appendices A, B and C), and relevant research addressing the design and practice of AMR prevention education.

The need for this guidance was identified in a stakeholder consultation conducted in 2020 with clinicians, policy-makers, researchers and patient advocates in Victoria, Australia (Davis, Lohm et al. 2021). Stakeholder dialogue identified a knowledge gap regarding how best to implement prevention education in light of research, evaluation and practical insights. Wernli et al. (2020) have also noted that educators lack practical guidance, particularly to strengthen One Health approaches. This report focusses on Australia, but where appropriate reflects on international implications, with the aim of strengthening prevention education for general public groups. The document is intended for decision-makers, practitioners and researchers focussed on the prevention of AMR.

BACKGROUND

Growing microbial resistance to antibiotics, antifungals and antiparasitics is a significant threat to health and life (UK Review on Antimicrobial Resistance 2016). Termed antimicrobial resistance (AMR), this threat is weakening the capacity of biomedicine to protect humans and non-human animals from life threatening infections, some of which are associated with surgery or cancer treatment. It is expected that unless AMR is reduced, morbidity and mortality due to infectious diseases will affect many millions across the world by mid-century. Modelling has suggested that AMR was linked with 4.95 million human deaths worldwide in 2019 (Antimicrobial Resistance Collaborators 2022).

1. Individual consumption of antimicrobials

Surveillance data indicates that antimicrobial use in the general population is common in Australia. For example, 40.3% of Australians filled a prescription for at least one antimicrobial in 2019 (Australian Commission on Safety and Quality in Health Care 2021). High rates of antibiotic prescribing outside of accepted clinical guidance was found for patients with bronchitis (81.5%) and sinusitis (80.1%). Australia is ranked 7 out of 32 European countries and Canada for antimicrobial use in community settings.

Knowledge is emerging of the use of antimicrobials for companion animals (Tompson, Mateus et al. 2021). It is estimated that 1:4 dogs and 1:5 cats in the UK were given antibiotics over a two year period (Tompson, Mateus et al. 2021), indicating that receiving antibiotic treatment for their pets is a common experience among pet owners. It is also observed that antibiotic use for pets in the UK is slowly declining. Hardefeldt et al. (2018) analysed pet insurance data in Australia and found that dogs were more likely to be given antimicrobials than cats (5.8 prescriptions per 10 dog years and only 3.1 prescriptions per 10 cat years). Tompson et al. (2021) note that most research on companion animals frames the drivers of use in terms of client pressure and argue that

other factors, such as, business models, professional development, cat and dog physiology, and risk management should also be considered in the effort to reduce antimicrobial use and prevent AMR.

Precise specification is also required of individual behaviours that will help to reduce the use of antimicrobials. In Australia the majority of antimicrobials used in human health community settings are sourced via a PBS/RPBS prescription, though in rural and remote health services for Indigenous people, antimicrobials can be provided without prescription (Australian Commission on Safety and Quality in Health Care 2021). It is also possible to source antimicrobials online for human and animal use (Boyd, Moore et al. 2017), or use them without medical advice during travel (Davis, Lohm et al. 2021). Some Australians may use leftover prescriptions or share them with their family (Hu and Wang 2015, Anderson, Rhodes et al. 2020) or import them from countries of origin (Whittaker, Lohm et al. 2019). In general, however, prevention education that asks individuals to reduce their use of antimicrobials may not make sense for them or have much impact, at least not without concurrent efforts to influence health systems to reduce the overall use of antimicrobials across human and animal healthcare.

Another complication for prevention education is that people who use antimicrobials in community settings are diverse and only some use antimicrobials on a regular basis. Antimicrobial consumers include individuals prescribed an antibiotic by a health professional for their own use, for a dependent person, or for a companion animal. Consumers might have a chronic illness that predisposes them to infection and/or for which infections need to be avoided (Davis, Lohm et al. 2021). These individuals may seek a prescription from a medical practitioner to reduce the risk of progression of their illness. Other individuals might use alternative treatments to manage an infection and therefore see a practitioner for a prescription after having tried other remedies. Parents speak of seeking out advice and using a prescription due to the distress of their child and to adhere to social norms of good parenting. Pet owners speak of similar social and moral imperatives associated with care of their beloved pets. These perspectives indicate that prescribing events may not all have the same psychosocial characteristics, either between individuals or in the life course of a particular individual.

It is also important to recognise the necessary caveats that need to be placed on the weak evidence that exists pertaining to the contribution of individual drivers to antimicrobial use. Research on prescribing has some limitations because it can depend on self-report which may be subject to bias. Medical practitioners may attribute the inappropriate use of an antimicrobial to 'patient demand' because they are aware that they are expected to reduce the use of antimicrobials (Avorn and Solomon 2000). In addition, patient demand might make sense in settings where direct-to-consumer marketing of pharmaceuticals is permitted, as in the USA and New Zealand (DeFrank, Berkman et al. 2020), but its significance is less clear for prescribing in Australia and other countries where direct to consumer marketing is prohibited and access to antimicrobials is regulated. Similar to prescribers, patients may attribute inappropriate prescribing to the medical practitioner to avoid blame. In addition, when asked to report on antibiotic use, consumer recall may be inaccurate because individuals may not know what an antibiotic is or remember if they have been treated with one (Whittaker, Lohm et al. 2019, Lohm, Davis et al. 2020).

2. Individuals and AMR

The relationship between individual use of antimicrobials and AMR is difficult to model and is likely to reflect complex interactions of microbes with medical, social and economic features of health care systems. For example, fluoroquinolone resistance has been observed in community settings in Australia, yet fluoroquinolones are restricted in these settings (Australian Commission on Safety and Quality in Health Care 2021). It is thought that the use of other antimicrobials in community settings is contributing to fluoroquinolone resistance. In addition, antimicrobials are used extensively in hospital and community health settings (Australian Commission on Safety and Quality in Health Care 2021) and in the production of food animals (Tiseo, Huber et al. 2020). Disinfectants used in the home and workplace may also contribute to AMR (Chen, Han et al. 2021) and AMR has been detected in water systems (United Nations Environment Programme 2017). These factors indicate that reduction in individual use of antimicrobials may not be a sufficient condition for the prevention of AMR.

3. Members of general publics in policy settings

Australian public policy on AMR has adopted the One Health approach that emphasises collaboration across human and animal health, food production and the environment (Australian Government 2021). The current implementation plan has these objectives:

1. Clear governance for antimicrobial resistance initiatives
2. Prevention and control of infections and the spread of resistance
3. Greater engagement in the combat against resistance
4. Appropriate usage and stewardship practices
5. Integrated surveillance and response to resistance and usage
6. A strong collaborative research agenda across all sectors
7. Strengthen global collaboration and partnerships

General public engagement is addressed under Objective 3 (Australian Government 2021, page 6), which comprises:

- Develop and implement a coordinated, One Health communication strategy, as well as monitoring and evaluation, to support whole-of-society awareness and behavioural change
- Strengthen public and political awareness to champion and improve the understanding of combatting antimicrobial resistance
- Create new and different key antimicrobial resistance messages that resonate with society
- Drive education and training initiatives across all relevant sectors and increase accessibility to evidence-based best-practice information

The present document addresses the national implementation strategy by:

- Adopting an approach to the prevention of AMR that integrates governance, health systems, economic, social and cultural factors to show how members of general publics could be assisted to participate in the response to this health threat.
- Synthesising the evidence base and practical insights for effective prevention education.
- Developing a practical guidance framework for AMR prevention education.

EFFECTIVE PREVENTION EDUCATION

In this section we examine research and evaluation that supports prevention education with reference to the Australian context. AMR education evaluation science is in a nascent state, partly due to the limitations inherent in outcome and impact evaluation of prevention education in general (Kippax and Stephenson 2016), the fragmented public policy context (Wernli, Jørgensen et al. 2020) and the under-resourced AMR education sector (UK Review on Antimicrobial Resistance 2016). We have adopted an inclusive approach and have included findings from surveys, qualitative research and programme evaluation alongside outcome findings. This inclusive approach generates insights that can guide how to help individuals to reduce their use of antimicrobials and use their prescriptions appropriately.

1. Survey research

Surveys report that most people in the general population do not understand antimicrobial resistance and that lack of understanding is linked with socioeconomic factors. In a systematic review of 26 research articles, Gualano et al. (2015) found that 53.9% of respondents did not know that antibiotics cannot treat viral infections but 59.4% did know of antibiotic resistance. Also reporting on a systematic review, McCullough et al. (2016) found that a median 88% of respondents across the 44 research articles believed that antibiotic resistance referred to the human body and not microbes. Micaleff et al. (2017) quizzed outpatients in a large hospital in England and found that most (85%) failed the question pertaining to the definition of antimicrobial resistance. McNulty et al. (2016) surveyed general practice patients soon after their visits and found that most (88%) preferred that their GP determine need for antibiotics. Only 8% recalled being provided with information about antibiotic resistance and approximately 44% correctly nominated antibiotics as treatment for bacterial rather than viral infections.

The most recent Eurobarometer survey of antimicrobial consumption and AMR knowledge (Eurobarometer 478 2018) comprised a sample drawn from 27 EU member states and the UK. It found that 32% of respondents reported using oral antibiotics in the previous 12 months, which is a small decline from 34% in 2016. There also appeared to be some national variation. In Italy, 47% of respondents had used oral antibiotics in the survey period, while in Sweden 20% and in the Netherlands 21%, had done so. Knowledge of AMR was somewhat poor in the 2018 Eurobarometer Survey. It found that 66% of respondents correctly endorsed the fact that antibiotics are not effective for colds. However, only 25% of respondents were able to correctly answer all four knowledge questions about antibiotics, though there has been a marginal improvement since the 2016 survey. Again some national variation was in evidence. Respondents in Finland and Sweden were most likely to correctly answer the questions while those in Latvia and Romania were least likely to answer correctly.

Across nations, Eurobarometer (2018) was also able to indicate how socio-demographic factors were associated with correct knowledge. In particular, those with more years of education and in professional employment were more likely to respond correctly to the knowledge questions. The survey modelled social inequity by asking respondents how often they were unable to pay household bills. The survey found that those who were not able to pay ‘most of the time’ were least likely to correctly respond correctly to knowledge questions.

We presently lack comprehensive survey data for all Australian citizens. However, Hu and Wang (2015) surveyed Chinese migrants in Australia and found that 24.2% reported that they had used antibiotics without medical consultation and 61% would use leftover antibiotics if they had symptoms. Anderson et al. (2020) surveyed Australian parents with regard to the provision of antibiotics. They found that nearly 1 in 5 parents reported that they had administered an oral antibiotic ‘before or without visiting’ the doctor. Anderson et al. found that parents who believed antibiotics could treat ‘colds’ and ‘influenza’ were more likely to have given antibiotics to their children. An online survey conducted during the COVID-19 pandemic in Australia found that nearly 1 in 5 respondents reported that they had taken antibiotics to ‘protect themselves’ (Zhang, Hobman et al. 2021). Further research is required to place these findings in context. For example, the survey prompts may not provide an accurate picture of antibiotic use as some individuals may not know what an antibiotic is and therefore confuse them with other treatments (Whittaker, Lohm et al. 2019, Lohm, Davis et al. 2020).

Taken together, these findings suggest that prevention education efforts have so far not had great influence over knowledge and behaviour outcomes, or if they have had outcomes, have failed to reach individuals and groups with less education and fewer economic resources.

In addition, there is some evidence that practitioners prescribe against guidelines to optimise treatment and fulfill their caring role in society (Wood, Simpson et al. 2007) to reduce other health risks, particularly for children (Cabral, Lucas et al. 2015) or to avoid health complications among patients with pre-existing conditions and lower socioeconomic backgrounds (Kumar, Little et al. 2003). Social research with prescribers lends only some support to these factors and tends to emphasise the organisation of primary healthcare systems including time constraints (Teixeira Rodrigues, Roque et al. 2013), perceptions of patient anxiety, expectations and pressure, and fear of losing patients (Biezen, Brijnath et al. 2017).

The apparent impact of structural disadvantages on patient knowledge and antimicrobial prescription and consumption indicates that health systems are important drivers of AMR. In addition, longitudinal data for Australia in the manner of Eurobarometer research (2018) would help to monitor the impact of prevention education in the general population.

2. Qualitative research

In-depth interview data sheds light on how individuals interpret the threat of AMR and the meanings and social contexts linked with the use of antibiotics. Finkelstein et al. (2014) conducted focus groups with US parents about antibiotic prescribing. They found that parents used home remedies to treat infections in children and were troubled by the threat of AMR. Accordingly, they endorsed the view that antibiotics should be used only when needed. In contrast, van Hecke et al. (2019) found that parents in England reported that they were at low risk of AMR, possibly because they also reported that they adhered to guidelines to reduce the use of antibiotics.

Qualitative research conducted in Australia offers the view that individuals endorse efforts to prevent AMR (Davis, Lohm et al. 2020, Lohm, Davis et al. 2020, Davis, Lohm et al. 2021). Lum et al. (2017) interviewed individuals from a university in Queensland and also found that they endorsed the reduction in use of antibiotics, however, individuals could not recall public awareness campaigns on the topic. Qualitative research also indicates that those with higher levels of education and an interest in science are more able to explain AMR with some accuracy (Davis, Lohm et al. 2020, Lohm, Davis et al. 2020, Davis, Lohm et al. 2021). A common understanding is that AMR is a feature of the body, not of microbes, as others have previously noted for UK (Brookes-Howell, Elwyn et al. 2012) and NZ publics (Norris, Chamberlain et al. 2013). This focus on resistance of the body to antimicrobials echoes notions of self-defence immunity (Davis, Lohm et al. 2021), which is a dominant understanding of health that attracts both scientific support and is a common feature of advertising for health foods and vitamins (Davis 2022). Whittaker et al. (2019) interviewed an ethnically-diverse group of people attending a hospital due to an acquired antimicrobial resistant infection. Knowledge of AMR and antibiotics was found to be weak and framed by biomedical and lay concepts of health and the body which varied by ethnic background and family practices.

Qualitative research also demonstrates that antimicrobial use is imbued with at times conflicting social expectations, particularly when the individual is responsible for the care of a dependent other. Parents speak of juggling knowledge of the threat of AMR and the imperative to ensure the health of their child (Lohm, Davis et al. 2020). Similarly, pet owners (Dickson, Smith et al. 2019) report emotional attachments with pets and the need to minimise distress when seeking health advice. In a focus group study conducted by Ancillotti et al. (2018) in Sweden, individuals recognised AMR as a serious health threat but spoke of a tension between using antibiotics to solve personal health challenges in tension with the responsibility to reduce the use of antibiotics for collective reasons.

These findings indicate that AMR is a concept that is removed from the lives of individuals and that communication about it is muddied by lay understandings of health and the body. They suggest that prevention education has so far had only some impact, echoing survey findings. Social and cultural inequities also mediate how the body, infection, antimicrobials and AMR are understood and related responses. However, individuals are troubled by the prospect of AMR and endorse efforts to prevent it and recognise the ethics of individual and collective responsibility. Taken together, these findings indicate that prevention education focussed on reducing knowledge gaps and mistakes is compromised by deeply embedded social and cultural factors. It might be more fruitful to provide individuals with actions that they can take to protect their health and that of loved ones while also reducing risk for AMR.

3. Programme evaluation

Most of the published evaluation research has examined the design and delivery of educational approaches, with some attempt to quantify intervention participation and participant perceptions of AMR. These studies show that educational approaches have somewhat limited reach into the lives of individuals and effects on knowledge and behaviour.

Evaluations of the Antibiotic Guardian pledge website demonstrate that it reaches significant numbers of individuals (Chaintarli, Ingle et al. 2016, Newitt, Oloyede et al. 2019). Evaluations demonstrate, however, that the majority of pledgers were healthcare professionals or those who already have existing knowledge of AMR (Bhattacharya, Hopkins et al. 2016, Kesten, Bhattacharya et al. 2018, Newitt, Oloyede et al. 2019). For example in 2017, 56.9% of pledgers were health professionals, 19.4 % were students and teachers, and 23.8 % were members of the general public (Newitt, Oloyede et al. 2019). In response, evaluators have argued that pledgees should be encouraged to engage those outside the health system and therefore who are new to the AMR concept (Bhattacharya, Hopkins et al. 2016, Chaintarli, Ingle et al. 2016, Kesten, Bhattacharya et al. 2018, Newitt, Oloyede et al. 2019).

A similar pattern of health professional participation has been observed in relation to the AMR Twitter-sphere. Analyses of the relative frequency of tweeter activity show that most tweets emanate from the US and UK and are created by key media, scientific and health related agencies (Andersen, Hair et al. 2019, Cumbraos-Sáncheza, Hermosoc et al. 2019). Examples include @WHO, @UN, @WHO_AFRO, @WHO_Europe, @WHOSEARO, @WHOEMRO, @pahowho, @DrTedros @kevinmd and @NEJM (Cumbraos-Sáncheza, Hermosoc et al. 2019). General public participation is present but not prominent, indicating that Twitter may be useful for the AMR industry but less so as a method of outreach. Tweet content analysis indicates that ‘antibiotics’ is more commonly used than ‘antimicrobial resistance’ (Kendra, Karki et al. 2015) and that the majority contain news and information (Scanfield, Scanfield et al.). Media events such as medical breakthroughs or announcements were reflected in increased tweets (Dyar, Enrique Castro-Sanchez et al. 2014, Kendra, Karki et al. 2015). These findings indicate that Twitter works mostly to disseminate news and information for the health and scientific industry and less as a mode of outreach to individuals.

Evaluations also observe that most of the available evidence has an English-language, US/UK bias that limits its utility for diverse communities and individuals (Catalán-Matamoros, Pariente et al. 2019). These biases are important considerations for strengthening the global effort to prevent AMR but they also have relevance for Australia. Understanding how CALD communities and those with less education and interest in science engage with the prevention of AMR is an important agenda for inclusive AMR prevention education. Whittaker et al. (2019) found that members of various ethnic communities sourced health information from news services and sites emanating from their countries of origin; further reinforcing the need for accessible Australian community outreach.

4. Outcome evaluation

Researchers have attempted to generate evidence that prevention education increases knowledge and behaviour thought to reduce the use of antimicrobials. They have done this by using pre- and post-test measures to assess the impact of campaigns or have tracked prescribing data over time and made inferences about any changes temporally associated with prevention education activity. These methods show that prevention education has some effect on knowledge and behaviour outcomes, and therefore impact on AMR.

For example, Ho et al. (2014) surveyed Hong Kong residents about antibiotic use and AMR knowledge before and after a social marketing campaign. They documented increased correct responses to questions about the appropriateness of antibiotics for the treatment of viruses. In Poland, Mazińska et al. assessed knowledge outcomes for the annual European Antibiotic Awareness Day using a repeated before and after survey design (2017). They found that those who recalled any information about antibiotic use were somewhat more likely to correctly report that antibiotics are not effective for viral infections.

In Australia, Wu et al. (2018) tracked data on antibiotic dispensing for respiratory infections from 2004 to 2015 and mapped it against AMR interventions during that period. They were able to demonstrate a 14% decrease in dispensed antibiotics over the timeframe of the data collection, lending some support to the effectiveness of the interventions. These included, GP prescribing feedback, clinical audits, information materials, webinars, pledging and social marketing. The researchers argued that effective education needs to be repeated to benefit from synergies and cumulative effects on the use of antimicrobials (Wu, Taylor et al. 2018).
However, systematic reviews conducted to identify the outcomes of prevention education approaches have found that, in general, the evidence base is currently inadequate (Cross, Tolfree et al. 2017, Price, Gozdzielewska et al. 2018, Wu, Taylor et al. 2018, Catalán-Matamoros, Pariente et al. 2019, Fletcher-Miles, Gammon et al. 2019, Huttner, Saam et al. 2019, Newitt, Oloyede et al. 2019, Wernli, Jørgensen et al. 2020). A key issue is lack of agreed measures for measuring intervention outcomes in responding to AMR (for example, reduced prescribing, raised levels of knowledge in a population, numbers engaging with a campaign to name just a few). This outcome measure diversity presents a major obstacle in terms of both comparison and certainty as to what works (Zowawi, Abedalthagafi et al. 2015, Bhattacharya, Hopkins et al. 2016, Cross, Tolfree et al. 2017, Price,

Gozdzielewska et al. 2018, Catalán-Matamoros, Pariente et al. 2019, Fletcher-Miles, Gammon et al. 2019, Huttner, Saam et al. 2019). In order to address these issues and improve future interventions, researchers argue for the development of agreed outcome measures so that evaluations can be compared and to accumulate knowledge of effectiveness (Ho, Cowling et al. 2014, Price, Gozdzielewska et al. 2018, Huttner, Saam et al. 2019, Newitt, Oloyede et al. 2019).

Because the evidence base does not presently allow nuanced inferences about which prevention education approaches are more likely to lead to the required behavioural outcomes, it is not strictly possible to be precise about which forms of prevention education are most efficacious, for example, social marketing versus classroom education. In response to this problem McParland et al. (2018) conducted a content analysis of the project descriptions of research articles selected for a systematic review (Price, Gozdzielewska et al. 2018). McParland et al. wanted to gain insight into the particular educational methods used in prevention education found to have met the effectiveness criteria of the systematic review. They found that, though behavioural techniques and assumptions were implied in all articles, 4/20 made explicit reference to behaviour change theory. Using the Behaviour Change Wheel (Michie, Atkins et al. 2014) to frame their content analysis, the researchers found that prevention education used some combination of these behaviour change techniques:

- Problem solving
- Commitment to action
- Monitoring of behaviour by others without feedback
- Feedback on behaviour
- Feedback on outcomes of behaviour
- Instructions on how to perform a behaviour
- Information about antecedents
- Information about health consequences
- Demonstration of the behaviour
- Prompts and cues
- Behavioural substitution
- Credible source of advice
- Comparative imagining of future outcomes
- Restructuring the physical environment
- Adding objects to the environment

McParland et al. concluded that explicit and greater emphasis needs to be placed on the underlying change theories and techniques employed in prevention education.

Researchers have also called for attention to prevention education targets for social groups and types of infections. Groups to target with prevention education include young people/the next generation, including by engaging teachers (Gennimata, Merakou et al. 2011, Young, Rajapandian et al. 2015); young people and their parents (Price, Gozdzielewska et al. 2018); parents of young children (Burstein, Trajano et al. 2019); older people and outpatients (Huttner, Goossens et al. 2010); and pet owners (Smith, King et al. 2018, Dickson, Smith et al. 2019). Similarly, targeting by disease such as URTIs (upper respiratory tract infections) prescribing (Cross, Tolfree et al. 2017, Wu, Taylor et al. 2018, Fletcher-Miles, Gammon et al. 2019), colds and flu (Ho, Cowling et al. 2014, Fletcher-Miles, Gammon et al. 2019), or approaches focusing on basic hygiene and infection prevention and control (IPC) (Young, Rajapandian et al. 2015).

Systematic reviews also lend support to integrated approaches to prevention education. For example, there is evidence that multi-level, multi-pronged education that includes clinicians and patients helps to reduce the use of antimicrobials (Cross, Tolfree et al. 2017). Linking global and local campaigns has also been said to be beneficial (Price, Gozdzielewska et al. 2018). Burstein et al. (2019) have argued that effective behaviour change among individuals is more likely if prevention education includes prescribers. These perspectives highlight the view that AMR prevention education is more likely to be effective if it engages with the health systems that prescribe and dispense antimicrobials.

AN INTEGRATED APPROACH FOR EFFECTIVE AMR PREVENTION WITH GENERAL PUBLICS

Despite the gaps in the research informing what does and does not work in AMR interventions (Huttner, Goossens et al. 2010, Cross, Tolfree et al. 2017, Fletcher-Miles, Gammon et al. 2019), it is possible to outline how prevention education could be strengthened.

There is consensus in the peer-reviewed and grey practice literature that prevention education needs to be multi-level, context-specific, integrated with health systems and sustained (Huttner, Goossens et al. 2010, Mazinska and Hryniewicz 2010, Huttner, Harbarth et al. 2013, Zowawi, Abedalthagafi et al. 2015, Cross, Tolfree et al. 2017, Mazińska, Strużycka et al. 2017, National Institute for Health and Care Excellence 2017, Price, Gozdzielewska et al. 2018, Fletcher-Miles, Gammon et al. 2019, Huttner, Saam et al. 2019, World Health Organization: Western Pacific Region 2020). Standalone approaches are unlikely to be effective and fragmentation and inconsistency inhibit the development of effectiveness and are likely to waste scant resources (Food and Agriculture Organization of the United Nations 2020). AMR prevention education needs to integrate organisational, social and individual change (Interagency Coordination Group on Antimicrobial Resistance 2018). Prevention education should strive for coherence across national, regional and local jurisdictions (Cross, Tolfree et al. 2017, Huttner, Saam et al. 2019) and comprise a 'mix of interventions' (Wu, Taylor et al. 2018, page 2) that optimise news media engagement (Ho, Cowling et al. 2014). Prevention education needs to be coordinated over the long-term, including repetition of messages (Huttner, Goossens et al. 2010), so that change is supported and built over time (Wu, Taylor et al. 2018) (Wu et al. 2018). In this way, AMR prevention education can become part of a process of 'cultural change' (Price, Gozdzielewska et al. 2018, page 12) with regard to the use of antimicrobials in society.

In what follows we outline an integrated approach to prevention of AMR with general publics. This integrated approach frames prevention as the combined effect of prescription governance, health service organisation, and social and cultural factors that reduce the unnecessary use of antimicrobials in human and animal healthcare.

1. Augment prescription governance

Researchers have argued that more nuanced governance of access to antimicrobials (Grigoryan, Burgerhof et al. 2007, Huttner, Goossens et al. 2010) could contribute to AMR prevention. Australia has advantages in this respect since prescribing in community human healthcare settings is regulated by international comparison. Further attention to prescribing guidance could yield benefits. For example, the emergence and escalation of private prescribing needs to be addressed to ensure that unnecessary use of antimicrobials is limited (Australian Commission on Safety and Quality in Health Care 2021). The increased use of online prescriptions also needs to be closely monitored for impact on prescribing. The high rates of prescribing for infections not normally regarded as amenable to antibiotics need to be considered more closely (Australian Commission on Safety and Quality in Health Care 2021). Similarly, increased surveillance and regulation of antimicrobial prescribing in companion animal healthcare would also be beneficial for vets and pet owners (Smith, King et al. 2018). Continued and more fine-grained governance of antimicrobial prescribing in the Australian context is likely support successful AMR prevention.

2. Build the evidence base to refine goals, targets and methods for prevention education

Surveillance data, qualitative research and programme evaluation are important elements of effective AMR prevention education. In Europe, Eurobarometer provides survey data that permits the tacking of change in antimicrobial use over time and helps to model its social drivers. A similar approach for Australia might prove useful and help to set prevention goals and generate evidence of outcomes. Survey data of this kind would also be an important adjunct to prescription and AMR surveillance.

Analysts have argued that the evidence to support AMR prevention education needs to be improved by the adoption of agreed input, output, and outcome measures so that evaluation data can be compared and can accumulate to build an evidence base, with clearer specification of relevant theory, e. g. behaviour change theory, social marketing, peer influence, in designing campaigns (McParland, Williams et al. 2018, Fletcher-Miles, Gammon et al. 2019, Huttner, Saam et al. 2019, Davis, Lohm et al. 2021) and attention to the affective features of narratives and imagery in campaigns (Langdridge, Davis et al. 2018).

Sociologically- and anthropologically-informed qualitative research has generated valuable data and insight regarding the social contexts, meanings, norms and moral imperatives that shape how people respond to infections and expectations that they help to reduce AMR. A key benefit of these approaches is matching prevention educational approaches to the lived experiences and cultures of individuals. Expanded use of these methods will continue to strengthen educational approaches.

Co-design, participatory and collaboration research methods also make a significant contribution to prevention education (Wellcome Trust 2013), particularly to promote public engagement and refine methods to reflect the

needs and circumstances of individuals and communities. Co-design methods can foster debate and deliberation to promote the community acceptability and ethical qualities of prevention education. Co-design methods can also help to ensure that individuals obtain advice that serves them more ably and overcome some of the problems of language and meaning linked with biomedical and microbiological framings of the AMR threat.

Educators also recommend that evaluation and reflection be built into prevention education so that practice is subject to cyclical development (World Health Organization: Western Pacific Region 2020). Practitioners are more likely to learn with cyclical evaluation, accumulate knowledge and expertise and therefore be supported to produce more effective educational approaches.

3. Address the health systems drivers of prescribing

The prevention of AMR with implications for individuals would also be supported by attention to the organisational, professional, risk management and economic drivers of antimicrobial prescription in human and animal healthcare. For example, the business models of general practices and veterinary clinics may include pressure on prescribers to see more clients for shorter periods of time, thus facilitating resort to antimicrobial prescribing and reduced time to explain AMR with clients (Biezen, Brijnath et al. 2017, Hardefeldt, Gilkerson et al. 2018, King, Smith et al. 2018, Smith, King et al. 2018, Dickson, Smith et al. 2019) and pressure on clinicians to sustain their clients' goodwill and patronage to sustain their businesses (Biezen, Brijnath et al. 2017, Hardefeldt, Gilkerson et al. 2018, King, Smith et al. 2018, Smith, King et al. 2018, Dickson, Smith et al. 2019). Clinicians have also reported that antimicrobials may be used to moderate the risk of more serious illness (Kumar, Little et al. 2003, Wood, Simpson et al. 2007, Cabral, Lucas et al. 2015). In some clinical settings, professional norms for antimicrobial prescribing may conflict with the latest guidance (Avorn and Solomon 2000). Prevention education for individuals needs to synergise with programmes that support clinicians to adopt more judicious prescribing practices. Apart from gains for the prevention of AMR, consistent approaches for clinicians and their clients is likely to help preserve public trust in biomedicine (Davis, Lohm et al. 2020).

4. Link prescribers, dispensers and consumers in prevention education

Building on the previous point, it is said that an integrated – consumers, prescribers and dispensers – approach to prevention education is advantageous (Cross, Tolfree et al. 2017, Burstein, Trajano et al. 2019, World Health Organization: Western Pacific Region 2020). Prevention education for the general public could mirror interventions for professionals to promote coherence (Burstein et al. 2019; Huttner et al. 2010) and to build synergies (Burstein et al. 2019; Ho et al. 2014; Wu et al. 2018).

5. Promote AMR narrative reflexivity

Narrative awareness is an important element for prevention education (World Health Organization: Western Pacific Region 2020). For example, an apocalypse narrative is used to demonstrate to individuals what might happen if they fail to act in the ways recommended by experts (Langdridge, Davis et al. 2018). This approach, however, may be counterproductive because it places individuals in a quandary, that is, making them feel responsible but unable to act due to the enormity of the challenge (Wellcome Trust 2019). A similar effect derives from the scientific discovery and hero narratives common in AMR news media (Davis, Lyall et al. 2020). Science narratives reinforce the notion that science – and science alone – will solve the AMR challenge. These narratives also tend to locate AMR as a story of interest to those who enjoy science.

Lived experience narratives have also been used to promote public engagement with AMR prevention. These kinds of narrative approaches may provide the basis for reflection on courses of action and public debate, as is common in the fields of narrative medicine and narrative bioethics. In these framings, narratives are sites for reflecting on one's life circumstances and laying claim to the symbolic and material means to act in productive ways on one's healthcare. In this view, increased capacity for critical reflexivity with regard to AMR stories could be fruitful for strengthening the prevention of AMR.

6. Encourage advantageous popular culture and civil society responses

Effectiveness reviews generally endorse the value of building cultural change through engagement with news media, popular culture and the cultural institutions of civil society, for example museums and festivals (Wellcome Trust 2013). Evaluations indicate that prevention is likely to be enhanced if it incorporates links with news media and popular culture (Catalán-Matamoros, Pariente et al. 2019, Newitt, Oloyede et al. 2019). 'Earned media' is seen as an outcome measure in some evaluations (Gonzales, Corbett et al. 2008).

7. Engage with health, social and cultural diversity

Copious evidence from within the field of AMR points to the ways in which medical, social and cultural diversity shapes encounters with antimicrobial treatments and therefore AMR. Consumers of antimicrobials vary considerably in terms of their health status and age, for whom they provide care, and the strategies they may use to manage and treat infections. Migrant populations may take a syncretic approach to healthcare by combining biomedicine and ethnomedicine (Whittaker, Lohm et al. 2019). As Cespedes and Larson (2006) noted, Hispanic people in the United States have been found to self-prescribe antibiotics because of financial and sociocultural barriers to orthodox modes of healthcare. These perspectives imply that catering for social and cultural diversity

is more than simply translating resources into languages other than English (Newitt, Oloyede et al. 2019). Educational approaches need to be relevant for specific health, socioeconomic and cultural circumstances.

8. Develop personalised and situation specific approaches

Research and evaluation lend support to personalised and situation specific educational approaches to counteract the perceived remoteness of the AMR threat. In their recommendations to build public engagement, the Wellcome Trust (2019) advised that helping individuals to appreciate the personal relevance of AMR is somewhat challenging owing to the ways in which it is depicted as a microbiological and biomedical risk. They argued that AMR prevention education avoid overly scientific language as not all individuals understand it or are interested in science, a point reinforced by qualitative research (Davis, Lohm et al. 2020, Davis, Lyall et al. 2020). Encouraging individual action in the present to reduce a future collective risk can be difficult, especially in cultures that emphasise individualised consumerism.

Another consideration is the dominance of notions of the body under threat that often mean that AMR is translated into 'my body resists antibiotics.' This dominant meaning shows up in surveys (McCullough, Parekh et al. 2016) and qualitative research (Brookes-Howell, Elwyn et al. 2012, Norris, Chamberlain et al. 2013, Davis, Lohm et al. 2020). It suggests that explaining AMR in terms of future, collective threat to life makes AMR seem less personally relevant.

For these reasons, AMR prevention education might do better to focus on the personal benefits of changed use of antimicrobials. For example, evaluation of *Antibioticguardian.com* has concluded that increased general public participation requires emphasis of the personal benefits of behaviour change to reduce antibiotics use (Bhattacharya, Hopkins et al. 2016). Practice frameworks also suggest emphasis on personalised and contextually relevant advice (Wellcome Trust 2019, Food and Agriculture Organization of the United Nations 2020). For example, individuals who use antimicrobials regularly due to chronic illness differ from those who seek advice about the occasional infection. Parents of children experiencing illness report that they seek advice due in part to normative expectations regarding parenting. Similarly, pet owners seek advice to reduce distress in their companion animals. Individuals planning to travel face other possible risks with regard to infections and how to manage them.

9. Offer individuals beneficial 'doables'

Research, evaluation and the grey literature support the view that supplying individuals with alternative courses of action for the treatment of infections may have value. For example, research indicates that patient expectations for antibiotics are not universal. Some individuals are willing to delay treatment to see if symptoms resolve of their own accord (Knottnerus, Geerlings et al. 2013) and only a minority of individuals visit with their general practitioner with the purpose of obtaining antibiotics (Linder and Singer 2003). Ong et al. (2007) interviewed patients before and after seeing a prescriber in emergency departments in the USA to ascertain their prescription-seeking intentions and responses. Prescribers were also interviewed and reported that they were more likely to prescribe an antibiotic if they believed the patient wanted it. However, physicians were only able to correctly identify 27% of patients who expected antibiotics. In addition, 87% of those who received an antibiotic and 89% of those who did not were satisfied with the consultation.

In addition, from the points of view of individuals, antimicrobials do more that treat infections (Whyte, va der Geest et al. 2002). They give people a sense of agency when their health is under threat (Lohm, Davis et al. 2020) and help to mitigate the moral imperatives that are associated with good parenting and caring for a companion animal. It is important then to reflect on these psychosocial needs for the development of prevention education.

Prevention education guidance also makes the case for messages and methods that specify what it is that individuals are expected to do in which situation (Wellcome Trust 2019, Food and Agriculture Organization of the United Nations 2020, World Health Organization: Western Pacific Region 2020).

APPENDIX A – EVALUATION LITERATURE SEARCH METHODS AND FINDINGS

The evaluation literature search was undertaken between April and November 2021. Using combinations of the search terms; 'antimicrobial resistance communication'; antibiotic resistance communication'; 'antibiotic resistance intervention'; 'antimicrobial resistance intervention' and 'AMR communication', we examined peer-reviewed research, conceptual and discussion papers focussed on general public prevention education published in peer-reviewed journals between 2010 and 2021. This date range was chosen to capture all the scholarship that could be considered in any way still relevant. The databases Trove (a source of archived material held by the National Library of Australia), Ovid, PsychInfo and Google, plus university library collections were used to search for material. This method meant that the search was not confined to one geographical region. However, the search engines utilised bias results towards English language content, from the English-speaking world, which we acknowledge as a limitation of this method. We also searched the reference lists of the articles captured by these search methods. In total, the search identified 30 items which are listed in Table 1, below. At the culmination of the process, to ensure we had captured all relevant material, we updated the scientific literature review by re-checking reference lists of materials already included, searching the university library website which searches across multiple databases for the dates January 2020-current; 'antimicrobial resistance communication'; 'antibiotic resistance communication'; 'antibiotic resistance intervention'; 'antimicrobial resistance intervention' and 'AMR communication'. This was followed by searches of the Trove, Ovid, PsychInfo databases with same search terms and same time period as above. Finally, we searched within the journals that we had discovered to have published most other similar work: *Journal of Antimicrobial Chemotherapy*, *Euro Surveillance*, *BMC Public Health*, *Journal of Global Antimicrobial Resistance* and *British Journal of Health Psychology* using the same key words, for the same time period - 2020 onwards. This process assured us that we had used the most pertinent work in the field to inform our own.

Table 1. General publics AMR education evaluation literature and key findings

Source & Evidence Type	Study Type/Method	Population/Setting	Intervention/Outcome Measure	Brief Findings
Systematic & scoping reviews				
Burstein et al. (2019), USA; Peer reviewed research	Systematic review	General publics in the US	AMR awareness interventions	1. Both lay publics and medical communities (prescribers) should be targeted by interventions 2. Prescribing guidelines for clinicians are an important tool 3. Key question is how long do changes in knowledge, attitudes and beliefs about antibiotics sustain 4. Educating clinicians to better inform their patients about antibiotics may provide another key avenue for interventions
Catalán-Matamoros et al. (2019), International; Peer reviewed research	Systematic review	Media audiences	Media communications on AMR and antibiotics	1. Healthcare professionals & scientists not used enough in the media as authoritative sources on AMR 2. Policymakers and those planning AMR interventions should take note of narratives circulating via the media 3. Comparison and evaluation of AMR interventions difficult
Cross et al. (2017), International; Peer reviewed research	Systematic review	Publics	English language communication materials for publics which aimed to improve antibiotic use	1. AMR interventions mostly target clinicians and publics 2. It is not clear how long any changes caused by interventions may last 3. Multi-level, multi-pronged interventions are best
Price et al. (2018), International; Peer reviewed research	Systematic review	General publics	Evidence of enhanced awareness or behaviour change that would be positive for responding to AMR	1. Raising AMR awareness must result in behaviour change 2. Evidence-base currently inadequate 3. Global campaigns important as well as more local, population-targeting approaches
Fletcher-Miles et al. (2019), International; Peer reviewed research	Scoping review	Publics	Evidence-base of existing AMR awareness campaigns and how effective are they in leading to long term behaviour change	1. AMR communication does not automatically lead to behaviour change 2. Theory not used enough to inform AMR interventions 3. Good evidence-base for AMR interventions not available
Wernli et al. (2020), International; Peer reviewed research	Scoping review	Review of published literature on interventions for antimicrobial resistance between June 1, 2018, and Feb 28, 2019, plus a literature review on One Health	Formulating a One Health online platform on AMR interventions	1. There is a lack of research on what works in AMR education & communication campaigns 2. A One Health online platform would be one way of providing consistent AMR information to many people internationally 3. The platform would provide a repository of evidence-based information to many stakeholders that could be continuously updated
Evaluations of Antibiotic Guardian				
Bhattacharya et al. (2016), UK; Peer reviewed research	Analysis of Google analytics data from AntibioticGuardian.com between 8/8/14-20/1/15	Visitors to Antibiotic Guardian website	Decision to pledge	1. Stronger messaging in relation to the personal benefits of behaviour change needed 2. Important to sustain impacts of initial AG campaign 3. Vital to work towards engaging target groups outside those who may already have some knowledge or interest in AMR 4. Ability to compare AG data with prescribing data would be helpful
Chaintarli et al. (2016), UK; Peer reviewed research	Online survey	Antibiotic Guardians (AGs)	Self-reported changes in knowledge and behaviour around antibiotics	1. The 'intention-behaviour' gap is a problem that AG should continue to prioritise

				2. Despite limitations, the AG model is quite successful in engaging publics with AMR and this approach could be broadened
Kesten et al. (2018), UK; Peer reviewed research	Semi-structured interviews	Antibiotic Guardians	Impacts of becoming AGs	1. AG reinforces existing behaviours in individuals who already have some knowledge rather than changing behaviours in people who previously knew very little about AMR 2. Increased visibility of the AG campaign should be prioritised
Newitt et al. (2018), International; Peer reviewed research	Comparative analysis of Google analytics data from Antibioticguardian.com for November 2016 and data from the 2016 Eurobarometer survey	Antibiotic Guardians	Impacts of involvement with AG website on AMR awareness and behaviour compared to control group (Europe-wide AGs including translated sites)	1. Following the translation of AG into Russian, Dutch and French, there was an increase in pledges from European/non-English speaking countries 2. More evaluation of AG is needed 3. More promotion of AG across Europe would be beneficial
Newitt et al. (2019), International; Peer reviewed research	Process evaluation including analysis of website metrics, Google analytics and an impact questionnaire	Visitors to Antibiotic Guardian website	Impacts of involvement with AG website on AMR awareness and behaviour compared to control group (UK AGs)	1. Initial evaluation (after 6 months) showed AG to be successful in engaging audience re. AMR 2. Especially among those who already have some prior knowledge about AMR, AG remains an effective engagement tool 3. Working on promoting AG and increasing engagement among other groups would be an effective next step
Evaluations of e-Bug				
De Quincey et al. (2011), International; Peer reviewed research	Analysis of web server logs for the e-Bug website for the period January 2008-November 2009	Visitors to the e-Bug website	Evaluation of user behaviour with the aim of optimising the site's effectiveness as a health care information tool	1. e-Bug is a resource that continued to grow in popularity for teachers and school-aged children (primary and secondary) teaching IPC, antibiotics, AMR and basic hygiene to children in schools as part of the curriculum 2. Cross-promotion of e-Bug site from other health sites and via search engine optimisation vital for success 3. e-Bug has been adapted into several LOTE
Gennimata et al. (2011), Greece; Special supplement	Evaluation questionnaire	Teachers and students participating in the e-Bug curriculum in Greece	Delivery of e-Bug resources (translated into Greek) in schools throughout Greece as part of the curriculum	1.Educating the next generation thought to be an effective focus of efforts – important as Greece was short of financial resources 2. e-Bug materials have been translated into Greek and adapted to align with Greek education and culture 3. The project was championed by teachers and teacher's organisations which was crucial to its success in Greek context
Young et al. (2015), International; Peer reviewed research	Analysis of Google analytics data for the e-Bug website for the period September 2010-August 2013	Visitors to the e-Bug website	Evaluation of user behaviour to inform future change/improvements to site	1. e-Bug targets children via their teachers with information about IPC, antibiotics, AMR and basic hygiene 2. Showed growth and expansion worldwide 3. Visits to the site were seasonal, reflecting the school year in the northern hemisphere 4. Search engines and links from other health-related sites were significant in directing traffic to e-Bug 5. Teacher's networks and organisations' active support, plus connection to existing curricula important in promoting resource
Evaluations of WAAD & EAAD				
Ho et al. (2014), Hong Kong; Peer reviewed research	Telephone survey with structured questionnaire	Randomly selected residents of HK who	Publicity campaigns built around WAAW with follow up surveys to assess impact/awareness	1. Three factors shown to be associated with awareness of WAAW campaign in HK: Age, personal hygiene practices in daily life, the attitude that everyone has a role to play in responding to AMR

		were in the telephone directory		2. Simple messaging was used such as not using antibiotics for colds and flu – this key message appeared to show some success in increasing knowledge and awareness 3. Online tools used in conjunction with other methods of information dissemination 4. HK did not have centralised antibiotic prescribing or dispensing records 5. Successful campaigns have to be conducted on many levels, using many different methods to get the messages out there, be well supported and allow evaluation of what works and utilise HCPs in their delivery – adding up to a whole of community approach to what is a huge paradigmatic change
Huttner et al. (2010), International; Peer reviewed research	Review	22 antibiotic awareness campaigns in high income countries (HICs) 1990-2007	Appropriate use of antibiotics in outpatients	1. All bar one campaign targeted publics and medics, all targeted the general public 2. Those that were formally evaluated appeared to lead to reduced antibiotics use but scientific cause-effect evidence is lacking and it is very hard to accurately measure the effect of AMR interventions 3. Review concluded that it is likely that AMR interventions for publics contribute positively to more careful use of antibiotics in outpatients departments in HICs 3. Most campaigns were part of wider public health efforts to respond to AMR, such as part of national strategies 4. Multi-level, multi-pronged campaigns, repeated over long periods are the most likely to have success 5. The campaigns included targeted parents of young children, older people, low SES and CALD communities
Huttner et al. (2019), International; Peer reviewed research	Online survey	Stakeholders in the organisation or execution of antibiotic awareness campaigns (AACs)	Mapping characteristics of global AACs since 2010	1. Scientific evidence should be prioritised as the basis for AMR interventions and this evidence needs to be augmented 2. Better evaluation of initiatives needed 3. AACs should reflect local contexts, local misconceptions, local problems but nonetheless seek to deliver consistent messages that are relevant globally 4. Nuance is required to convey the correct information and advice to publics on what is a complex topic, with a mix of positive and negative messaging 5. Better use could be made of experts in health communications and social media
Wu et al. (2018), Australia; Peer reviewed research	Analysis of PBS/MBS antibiotic dispensing data 2004-2015	GPs and consumers	URTI prescribing by GPs following specific educational interventions for them and advertising interventions for consumers	1. NPS MedicineWise interventions target HCPs, patients and publics with education and advertising 2. Study concluded that the NPS interventions were successful in reducing in reducing inappropriate prescribing of antibiotics for URTIs in primary care and their effect was cumulative with each intervention building on gains made with the last etc. 3. There was low participation by GPs though, a key group of prescribers here 4. Methodology acknowledged as imperfect as prescribing/dispensing data assumes a recipient actually fills the script and then takes the full course of antibiotics they are prescribed at that time, for that episode of URTI

Cizman et al. (2018), Slovenia; Peer reviewed research	Analysis of outpatient and hospital antibiotic prescribing data	Hospital outpatients and inpatients	Observation of any changes in prescribing following EAADs	1. Evaluating the impact of EAAD in Slovenia 2. Impact measured by antibiotic consumption, increased public awareness, AMR incidence 3. EAAD activities associated with decreased antibiotics consumption in community hospital settings 4. Difficult to differentiate between the effect of EAAD and other factors, despite apparent positive impact of EAAD on some measures 5. More interventions needed
Earnshaw et al. (2014), Europe; Perspective	Description of progress of EAAD from 2008-2014	Europe	EAAD activities from their inception in 2008	1. EAAD designed as springboard for further European AMR campaigns with ECDC involvement 2. 'Team Europe' approach allows countries with greater means to support those without for the benefit of everyone 3. Difficult to measure success due to variation in national context and time taken for initiatives to bear fruit
Mazińska et al. (2017), Poland; Peer reviewed research	Repeated, cross-sectional telephone survey over 5 waves 2009-2011	General publics in Poland	Change in knowledge and attitudes towards antibiotics as a result of EAAD activities	1. Inappropriate antibiotics use, misunderstandings around topic and self-medication remain high in Poland despite some behaviour change success from EAAD campaigns among those who chose to seek out the information 2. Much more needed in terms of interventions of different types to target different aspects of problem 3. Greater use of online tools and social media recommended building on nascent Facebook success in this arena
Rolf von den Baumen et al. (2021), Canada; Peer reviewed research	Population-based time-series analysis of Canadian outpatient pharmacy prescribing data for RTIs between 1 January 2015 to 31 December 2019	General publics in Canada	Antibiotic prescribing rates of the antibiotics that were recommended in the prescribing guidelines for RTIs	1. The rate of antibiotic prescribing for RTIs remained stable over the study period (2015-2019), therefore, as yet the rate does not appear to have been influenced by the *Using Antibiotics Wisely* campaign which commenced in November 2018 2. This finding was consistent across all population groups and for all antibiotics included in the data 3. The Choosing Wisely-led campaign consisted of providing educational resources for prescribers which, as a standalone tactic, may not have been enough to influence the many factors surrounding antibiotics prescribing. A multi-pronged approach may have worked better 4. Only 13 months' worth of prescribing data following the campaign were analysed - this would not have shown changes over a longer time frame. Also, the campaign itself likely needed to be sustained over a longer period as has been shown to be successful elsewhere in impacting antibiotics use
Social media in AMR communication				
Basch et al. (2018), International; Peer reviewed research	Content analysis	YouTube	Online information (videos) about *Clostridium Difficile (c. diff)*	1. The videos were 'authored' by consumers, HCPs, journalists 2. Three main topics: General information about *c. diff*, overuse of antibiotics, symptomatic diarrhoea 3. More contributions by HCPs would be beneficial 4. Videos were very popular – high demand and numerous 5. Shortage of content around prevention which could be an area for HCPs to fill void
Zowawi et al. (2015), Gulf Cooperation	Evaluation of pilot project	Social media users in the GCC states	Distribution of antibiotics awareness messages via Twitter and YouTube in the GCC States	1. Measuring the success of AMR interventions is a widespread problem 2. Interventions must fit with local contexts

Council States; Peer reviewed research				3. Social media: Are they low cost education tools for AMR or is it too hard to measure their impact, especially whether any change is sustained? 4. Personal narratives work well in online AMR interventions 5. Illegal dispensing of antibiotics and buying antibiotics without prescription are serious issues in the GCC States 6 Social media should be involved in AMR communications but not as the only approach
Communicating with publics about AMR				
Langdridge et al. (2018), International; Peer reviewed research	Visual affective analysis of mass media AMS interventions gathered by systematic review	Visual components of antimicrobial stewardship interventions	The role of visual imagery in the effectiveness of AMR interventions	1. Affect within the visual material that comprises AMR campaigns targeting publics is an under recognised tool in encouraging behaviour change, more likely to be deployed tacitly rather than explicitly utilised 2. The value of affect in AMR communication interventions is under theorised 3. Further work is needed to explore how affect should be more effectively used in AMR campaigns in order to stimulate behaviour change
McParland et al. (2018), International; Peer reviewed research	Systematic review of AMR interventions	Theory utilised in AMR interventions	The use of theory in AMR interventions	1. Theory is under-utilised in AMR interventions 2. Behaviour change theoretical constructs and techniques can be recognised in AMR interventions but are not often explicitly acknowledged 3. Greater and more explicit use of theory in AMR interventions is recommended
Will (2020), UK; Peer reviewed research	Discourse analysis	Major UK public health campaigns on AMR (plus evaluations) since 2000	Engagement of UK publics with the AMR message over time	1. Providing more information may not lead to the desired behaviour change around AMR, in fact, it may even be counter-productive and encourage hoarding of antibiotics and self-medication – 'unintended consequences' (p. 64) – beware of thinking of increased awareness of AMR as an end goal which will stimulate the required actions 2. Employing experts as deliverers of AMR messaging is no guarantee that publics will pay attention and act accordingly 3. The 'nudge' behavioural theory of UK governmentality is possibly undergoing a backlash – a phenomenon named 'shrug' (p. 55) 4. 'Ignorance' (p. 55) around AMR is more complex than just being a case of lack of information 5. Traditional public health methods and messaging are proving ineffective in responding to AMR with lay publics in some cases choosing to 'strategic[ally] retreat from engagement' (p. 71)
Miller et al. (2020), US; Peer reviewed research	Survey - patients rated 18 statements about the potential harms (to them personally) of antibiotics if prescribed inappropriately	250 patients of a primary care clinic	The personalisation of potential harms from unnecessary antibiotics	1. Having read and rated the statements, patients were less likely to request antibiotics 2. Statements that made clear the potential harms to patients themselves or their families were the most successful in reducing the likelihood that a patient would request antibiotics from their doctor 3. Statements about the benefits of reducing inappropriate prescribing to wider society were less likely to reduce a patient's propensity to request antibiotics 4. Statements focussing on antibiotic resistance were also less likely to encourage a patient to ask for 'nonindicated' antibiotics

Rogers Van Katwyck et al. (2020), International; Conceptual paper	Synthesis	Existing evidence base on AMR policy interventions	Framework for planning, conducting & disseminating research on AMR policy interventions	1. The framework recommends: - better ways to prioritise research on AMR interventions - robust systematic reviews - research that responds more appropriately to stakeholders - use theory in design of interventions - improve evaluation design - build & improve each new intervention upon what has been learnt from previous/existing attempts - evolve standard ways to measure success - improve governance in reporting & evaluating interventions - improve collaboration & dissemination of what works
Davis et al. (2021), Australia; Discussion paper	Qualitative interviews & media content analysis	General publics	General public explanations of AMR, infections and antibiotics	1. Increasing public awareness and action on AMR is a policy priority but plans to develop interventions are underdeveloped 2. Understanding about the general public contribution to AMR incidence and prevalence is not developed enough to lead to specific interventions 3. Goals and targets for public awareness and action are not specified in implementation plans for AMR strategies 4. Theoretical basis for AMR interventions is weak

APPENDIX B - GREY LITERATURE SEARCH METHODS AND FINDINGS

The grey literature search was carried out between May and June 2021. Using the search terms in Table 2, we searched online via Google and via the websites of Australian organisations considered likely to have the authority, knowledge and interest to produce resources advising about AMR communication or interventions (see Table 3). Internationally, we searched websites for the Tripartite Agencies (WHO, FAO, OIE), CDC, ECDC and to provide some further coverage of Europe, government and health agency websites in the United Kingdom, Denmark and Spain. From these searches, 41 examples of English language resources were collated. These comprised 33 AMR-specific resources and eight general health resources. Resources were considered suitable for inclusion if they contained advice or suggestions about the practice of AMR or health communication that was closely aligned. Most were excluded on the basis that they were not about the practice of health interventions or communication, but contained more general information about AMR or health promotion. Nine resources aligned closely with the review questions and were included - seven AMR-specific and two general health communication resources and these are outlined in Table 4. Each website was also searched for AMR/AMS or antibiotic-specific pages and tabs. If these were present, they were also searched using the same keywords (Table 2) in addition to the main site search facility.

Table 2: Grey literature search terms

antimicrobial(s)	*health communication*	*antibiotic communication*	*antibacterial*
antibiotic(s)	*antimicrobial resistance communication*	*health promotion*	*antimicrobial communication*
antimicrobial resistance	*antibiotic resistance communication*	*antibiotic awareness*	*effective communication*
antibiotic resistance	*Communication*	*AMR communication*	*AMR*

Table 3: Grey literature search websites and jurisdictions

Global	WHO WHO WPR OIE FAO
United States	CDCs
European Union	Euro CDC
Australia	NPS MedicineWise Choosing Wisely Australia
United Kingdom	Public Health England (PHE) NHS England UK Health and Security Agency (UKHSA) Office for Health Promotion GOV.UK Advisory Committee on Antimicrobial Prescribing, Resistance and Healthcare Associated Infection (APRHAI) National Institute for Health and Care Excellence (NICE) Public Health Scotland Public Health Wales Public Health Agency (Northern Ireland) The King's Fund Wellcome National Institute for Health Protection (interim name for UKHSA) NHS Improvement NHS Digital Health Education England The Care Quality Commission Department of Health and Social Care Joint Biosecurity Centre The Royal Society for Public Health
Denmark	The Danish National Institute for Public Health (NIPH) The Danish Ministry of Health The Statens Serum Institute (SSI) National Food Institute The National Antibiotic Council The Danish Society of Public Health Danish Integrated Antimicrobial Resistance Monitoring & Research Program (DANMAP) Danish Health Authority The Danish Institute for Quality and Accreditation in Healthcare (IKAS) Amgros Danish Regions and Local Government Denmark National online health portal The Danish Medicines Agency
Spain	Ministry of Health, Consumption and Social Welfare Spanish National Health System (MSCBS) Coordination Centre for Health Alerts and Emergencies (CCAES) Spanish Agency of Medicines and Medical Devices (AEMPS) Spanish Agency for Food Safety and Nutrition (AESAN) Spanish Association of Public Health and Healthcare (SESPAS) National Institute for Health Management General Directorate of Public Health Quality and Innovation The Advisory Council for Health and Social Services

Table 4. AMR education grey literature findings

Source	Method	Population or setting	Intervention key learnings	Summary
1. AMR-SPECIFIC COMMUNICATION RESOURCES				
Improving communications for antimicrobial resistance (AMR) in Africa: How should we move forward? **(Food and Agriculture Organization of the United Nations 2020)**	Online forum discussion based around 6 questions: *1. What is the biggest communication challenge related to AMR and inappropriate antimicrobial use in Africa?* (p. 1) *2. What is the best approach to communicate about other antimicrobials (antifungal, antiparasitic, antiviral, pesticides)..?..*(p. 2) *3. How can we get the topic of AMR included more often in the media?..*(p. 4) *4. What communication channels, methods or mechanisms…will have the greatest impact at field level in African countries?* (p. 5) *5. Which group of stakeholders…should be considered a priority for targeted key messages aimed at raising awareness..?* (p. 6) *6. At national, regional and continental levels, who…should take leadership and responsibility for awareness and advocacy activities on AMU and AMR?* (p. 7)	Representatives from across Africa	•Farmers are either uninformed about AMR or do not think it is relevant to them personally •Governments have not prioritised AMR •Farming across the continent is diverse and governance structures are fragmented •Language and lack of formal education create barriers to communication strategies •Messaging should be kept simple •The term antimicrobial resistance (AMR) should be used more consistently •Targeted communications are best •AMR messaging needs to be more clearly linked to the behaviour change action required •Engage outreach workers (gatekeepers) for hard to reach groups •Leverage existing initiatives (WAAW) •Better utilise and engage various communication channels, e.g., social media, storytelling, educational curricula, interpersonal communication channels, visual communication, traditional institutions •Use One Health as basis for all communications (AMR should be treated as an issue with impacts across sectors and communication should reflect this) •More impetus required for national government ministries to work together to undertake AMR communication and to involve and meaningfully collaborate with other relevant organisations (national, regional, continental, governmental and non-governmental) where appropriate	•The AMR communications advice that emerged from this forum underscores the magnitude of the task of responding to AMR globally but also offers a few practical ways to start to respond to the communication challenge posed by AMR •The advice is Africa/farming-specific but most points have wider applicability •Many of the challenges of tackling AMR are reflected: Collaboration, fragmentation, magnitude of the problem, complexity, deciding which stakeholders to prioritise •Personalising both the problem and the messaging helps •Governments and media need to be persuaded to prioritise AMR •Consider the different language needs of communities
Meeting the Challenge of Antimicrobial Resistance: From Communication to Collective Action: (IACG)	Discussion paper presenting a framework to maximise existing AMR communication opportunities, introduce new communication ideas and piggyback off existing initiatives where possible to stretch resources	WHO Interagency Coordination Group on AMR (IACG)	The five domains: ***1. Targeting priorities*** (pp. 10-13) •Prescribers, dispensers and consumers all have different but important roles in AU and addressing AMR. Identifying key moments ('*hotspots*') for communications or interventions in the practices of these groups is one way to prioritise communication opportunities	•Focusing on the five domains facilitates making the leap from just raising awareness to stimulating action - both individual and society-wide - involving many different organisations and scales •Measurement/surveillance/monitoring and evaluation of initiatives and outcomes are also emphasised as the mechanism by which progress towards change will be measured. Various versions of this last component (also called MEL in some documents = Measurement,

Discussion Paper **(Interagency Coordination Group on Antimicrobial Resistance 2018)**			•Always use evidence to inform priorities for AMR communications •Piggyback AMR communications onto existing health, agricultural and environmental programs to make the most of resources and opportunities ***2. Raising awareness*** (pp. 14-17) •Changing people's behaviour requires more than just awareness-raising. You have to engage them in the process and bring them along with you as part of it •Utilise existing expertise of government organisations in large scale campaigns - do not reinvent the wheel •WAAW is a good start but look to other successful global health awareness drives to see what else has been successful and what can be added to the AMR response or to what other campaigns can an AMR angle be added •Build a global repository of information (housed within the WHO) and examples of successful communication interventions that can be used by all to inform more local efforts that can be tailored to local conditions ***3. Supporting behaviour change*** (pp. 18-23) •'restrictive' (rules-based) and 'enablement'(advice and feedback) techniques have both been successful in bringing about behaviour change in hospital prescribing and could be considered in other domains such as animal health •Effective communication to respond to AMR must involve: *'effective targeting', 'multimodal campaigns', 'changing the choice architecture'* and *'multi-pronged approaches'* •Monitoring (also called measurement or surveillance in the various examples presented here), evaluation and learning from the successes and failures of communication initiatives are all crucial to the success of AMR communications •Incentives are one way of encouraging behaviour change (financial and non-financial) •Behaviour change approaches should be incorporated into existing professional development and education where possible in the human health, animal health and environmental professional domains •Learning from one's peers is a highly effective method for professionals ***4. Enabling collective action*** (pp. 24-27) •Leverage the efforts of individual stakeholders by encouraging collective action in this space - this could be done using existing networks such as unions or professional organisations or by large organisations	Evaluation, Learning) feature in several of the examples described in this review

			like WHO creating support by offering information (the global repository) or networking opportunities to bring actors (activists) together •Maximise use of novel technologies - both to collectivise, and in the surveillance and information areas •Professional education should include a response to AMR both from a practice perspective and that professionals have key roles to play in encouraging behaviour change in others and communication about AMR within their field and more broadly •Unions, professional organisations and credentialling bodies have a key role here in relation to ensuring that codes of conduct and professional regulations/guidelines/codes of practice all reflect a response to AMR ***5. Monitoring for accountability*** (pp. 27-31) •Monitoring, evaluation and learning is a feature of most effective communication strategies •Monitoring is the responsibility of all involved - it should be both top-down and bottom-up •Monitoring enables maximisation of the impact of communication strategies and ensures best use of resources. It also forms the basis of being able to change strategies that are not working or adjust them to be more effective, also to see which ones work well and could be used more widely •Transparency of information and surveillance data is vital here •Ideally should aim to continually evaluate communication strategies according to goals to retain momentum	
Antimicrobial stewardship: changing risk-related behaviours in the general population **(National Institute for Health and Care Excellence 2017)**	NICE Guideline (National Institute for Health and Care Excellence UK)	Human health stakeholders: Local council public health teams, GP practices & CCGs, healthcare providers, childcare and education sectors, prescribers, community pharmacists, general publics	•Aim of guideline is to raise awareness of AMR by highlighting key areas for behaviour change and informing stakeholders on where they can go to get more information •The document is a mixture of guidelines, practical suggestions for interventions or areas for change and communication advice •In the guideline, NICE also list key areas for AMR interventions that could be the focus of communication strategies: -Prescribing decisions -Actions in relation to IPC, AU and AMR by all stakeholders -Surveillance -Developing new treatments -The animal sector	AMR communication interventions should: •Be 'strategically coordinated' (p. 28) •Target antimicrobial use (AU) and IPC •Be national and local •Include healthcare professionals and publics •Be made relevant to individuals' circumstances/personalised where possible •Think big - real change will necessitate a 'cultural shift' and 'changing social norms' (p. 30) •There's evidence that IPC interventions are more effective during pandemics as the benefits become stark to people, so leverage this (this document is from 2017 but the point is highly relevant now) •Leaflets are an effective communication method for most adults but parents of small children need more such as face to face or video discussion

			-Raising the political profile of AMR globally	•Teacher buy-in and commitment required for interventions run in schools - aim not to make AMR awareness communication tasks a chore/box-ticking exercise in amongst everything else teachers have to fit in •Mass media campaigns alone do raise awareness but this does not necessarily translate to behaviour change without reinforcement by other methods of communication and engagement such as discussion with healthcare provider •Interventions need to do more than just raise awareness, they must encourage people to change and give them practical tips on how
The effectiveness of national and local campaigns in changing the public's behaviour to ensure they only ask for antimicrobials when appropriate and use them correctly **(Expert testimony for NICE 2017)**	NICE expert paper headed by the Pharmacist Lead for AMR/S at Public Health England (PHE) Dr Diane Ashiru-Oredope	To inform NICE Guideline above	This expert testimony reviewed the evolution of the European Antibiotic Awareness Day (EAAD) awareness raising campaign and materials into the 'Antibiotic Guardian' model	•The EAAD campaigns were seen to have raised public awareness of AMR but that awareness was not apparently translated into behaviour change. The review suggests that this may have been because real impact can only be achieved with a campaign that uses a variety of methods and is continually re-enacted and reinforced over several years •As a result, the EAAD aims were reformulated to prioritise action and behaviour change by increasing the level of engagement of the campaign mediums with healthcare professionals and publics. •The focus also changed from a single day (AAD) to a website www.antibioticguardian.com. •This new methodology attempted to ensure intentions were translated into concrete actions by using 'if-then statements' in a pledge that could be taken after watching an informative video on AMR •Tentative evaluations of Antibiotic Guardian appear to show that it is having some success in initiating behaviour change, particularly among healthcare professionals who made up a significant proportion of pledgers •Plans to expand and build on these early successes included trying to increase engagement with publics such as via schools or councils •Features to allow easier utilisation of the data collected by Antibiotic Guardian to map successes will also be built into future versions as well as the functionality for sharing of personal stories by pledgers
Public education interventions to reduce pressure on prescribers to prescribe inappropriately [indirectly changing the behaviour of	NICE expert paper headed by Behavioural Insights Lead Researcher Dr Tim Chadborn	To inform NICE Guideline above		This expert testimony is also based around the idea that knowledge alone is not enough to change behaviours around AU, prescribing etc., rather, 'opportunity and motivation' (p. 2) are two important factors that must be present to drive behaviour change.

prescribers through changing the behaviour of the public] **(Expert testimony for NICE 2017)**				
Reframing resistance: How to communicate about antimicrobial resistance effectively **(Wellcome Trust 2019)**	Review of existing resources, media analysis, stakeholder interviews and public message testing across 7 countries: UK, US, Germany, Japan, India, Thailand and Kenya - to capture the Global South and North	Experts, scientists, leaders, organisations etc. whose responsibility it is to communicate with publics about AMR	Problems with existing communication strategies: •No one term is used to capture the issue of AMR overall so audiences cannot link all the stories and realise the significance of the problem •Framing of AMR narratives are diverse and fragmented, ranging from war and apocalypse metaphors to economic and healthcare framings •Mainstream media coverage is not adequate and consistent •Media often centres on sensationalist, 'outbreak' type stories, rather than tying these episodes to an overall narrative or theme. The amount of media coverage is highly variable between countries •AMR social media presence is low key, low volume and limited mostly to experts talking among themselves with little opportunity for wider publics to become engaged via this medium •These missed opportunities with communications lead to publics not realising AMR is a significant issue that they should be calling for political action on - in the same way as climate change, for example •Wellcome suggest re-setting the public narrative on AMR based on the 5 evidenced-based principles that emerged from their research •They advise doing this by formulating 'headline' and longform' narratives (p. 30). Headline narratives would act as 'hooks' to grab the public's attention and provide a basis to launch further communications and information dissemination which would be the longform narratives - these would be more detailed, encouraging public support and action around the issue	The document lays out 5 principles for communicating about AMR based on Wellcome's research: ***1. Frame antimicrobial resistance as undermining modern medicine*** (pp. 14-17) •Publics can struggle to see AMR as a problem that affects them personally •The issue of AMR is more compelling when its impact is seen to be widespread across healthcare, i.e., it could impact anyone •Frame AMR as a phenomenon that could return humanity to the past in terms of medicine where people routinely died from infections - the 'back in time' message is effective •Use healthcare examples relevant to the context of the audience ***2. Explain the fundamentals succinctly*** (pp. 17-24) •Clear, consistent, jargon-free explanations of AMR work best with publics •Clarity accentuates credibility •Avoid overly scientific or technical explanations. Microbial, for example, is a term that is not well understood •Getting the message across that it is microbes that develop resistance, not people, is key - it is a highly common misconception globally that it is individuals' bodies that are resisting antimicrobials. This undermines the message that it is a problem that affects us all •Although this research did not settle on a single descriptor that could be most effectively used for AMR in public communications, the investigators agreed that an 'umbrella' term would prove helpful. Finding the best term to use here would be a big step forward •Mention the human role in AMR but also the animal angle to emphasise the broad nature of the problem •If the problem is made to sound too overwhelming, people switch off as it appears hopeless •'Overuse' of antibiotics was seen as the most effective, least judgemental way of putting the problem clearly, but distinction must be drawn between individual overuse and

				collective overuse or people don't think it applies to them personally •Note that overuse as well as human or animal use of antimicrobials are descriptions that can be understood quite differently across global regions ***3. Emphasise that this is a universal issue; it affects everyone, including you*** (pp. 24-27) •Augment personal buy-in to make messaging more effective •The risk profile of AMR is increased by people realising it is an issue that affects everyone •But must retain the personal angle in messaging to heighten the need for an individual sense of responsibility for responding to the problem. Strike balance between outlining the magnitude of the problem as something that impacts us all globally and retaining a sense of personal relevance for audiences to stimulate personal action •Restricting messaging to certain groups (especially so-called 'vulnerable groups') can lessen the impact of communications overall by decreasing the sense of personal relevance for others. 'Vulnerable groups' was also not a term that was well-understood globally •Personal narratives (storytelling) work really well as a way of getting the AMR message across ***4. Focus on the here and now*** (pp. 27-28) •'Catastrophic' or 'apocalyptic' messaging is overwhelming and people turn off, become cynical or misunderstand the message •Future forecasts are not as effective as messages concentrating on what is happening right now, in the present ***5. Encourage immediate action*** (pp. 28-29) •A 'we can do this' tone in messaging is conducive to public engagement •Messaging that lets publics know what they can do •Communications should incorporate a 'clear and specific call to action' (p. 28)
Micro-Combat: Learning About Antimicrobial Resistance and How to Fight Infectious Disease with a Card Game **(Barcelona Institute for**	A role play card game to communicate information about infections, infectious diseases, pathogens, relevant medications and antimicrobial resistance	School-aged young people	Harnesses the idea that play is a significant site for learning: *'The aim of the card game is to eliminate other players by attacking them with germs: the pathogens can be more or less virulent. However, to attack an opponent, the player must hold cards representing a bacteria, virus, fungus or protozoa, and the corresponding route of transmission. As happens in real life, players who are attacked can escape the effects of the disease if, for example, their immune system is good or they take specific precautions, or if in the course of the game*	•This example of AMR communication represents something different in terms of creatively using media, emphasising the need for diverse communication strategies that successfully target different groups •This particular tool could be used in educational curricula in conjunction with other types of AMR communication

Global Health 2017)			*they have acquired powerful cards (representing specific medicines and products or actions capable of curing injuries and fighting vectors or germs). However, the attacker can also overcome this defence with cards representing drug-resistance.'* (directly cited from website)	
2. GENERAL HEALTH COMMUNICATION RESOURCES				
Communication for health (C4H): Building on experiences in the context of Covid-19 to strengthen use of strategic communications in the Western Pacific Region **(World Health Organization: Western Pacific Region 2020)**	A report summarising an online workshop	WHO WPR	•Communication is a key health intervention, as vital to a response as scientific data and expertise •Endorsed by WHO, the Communication for Health (C4H) framework uses approaches from strategic communications to inform the way that health communication should be done across its many contexts •Health communication should have ***IMPACT***: ***-I****nformed by data, evidence and theory* ***-M****easurable* ***-P****lanned* ***-A****udience- and people-centred* ***-C****ollaborative* ***-T****argeted (p. 5)* •As such, communication will be more audience-specific and resonate better with people, engaging their '*hearts*' (p. 5) as well as their '*heads*' (p. 5) •Personal narratives, experiences and storytelling when communicating health messages are key methods of C4H •Listening to publics as well as communicating with them; engaging civil society organisations of all kinds; involving diverse community leaders and trusted public voices; prioritising building trust and taking the communities along with you are part of the overall paradigm of C4H •Knowing the audience and why they may behave as they do will lead to more effective communication being developed	•Start communication with the key action you want to stimulate - WHAT you want people to do •Use plain language •Remember, personal narratives are an effective method of communicating health information - people calculate risk based on emotions •People have to feel motivated to change their behaviour - so let them know WHY the action is important •Keep text short •Make use of images and graphics •Use a mix of communication media to reach different audiences •Measure/monitor, evaluate, learn (MEL) - use this model from the start to continually improve strategies - outcomes are the litmus test of what is working - be prepared to evolve strategies once they are underway
Sharing Our Practice: Successes and challenges of public engagement in the Wellcome Trust's UK Centres	Report from a one-day workshop held by Wellcome in the UK	Experts, scientists, leaders, organisations etc. whose responsibility it is to communicate with publics about AMR	•The document emphasises that making the right choice of audience for different types of engagement activities and delivery formats is a foundation of their success or failure •Evaluation of the success of engagement formats and activities should be built in from the start •Activities need not cost a lot, although some will require investment •Experts and potential science communicators must be assured that public communication is a part of their role that will be valued and given the required support	•As a large, public-facing science and research organisation, Wellcome Trust prioritises public engagement including communication about its various research projects. This is a model that could be taken up by other organisations in relation to AMR •Many of the engagement methods described are designed not just to inform but also to stimulate discussion and debate and enable audiences to become more involved in the topic or issue - participation has been shown to be a significant factor in getting publics on board with an issue Key takeaways:

(Wellcome Trust 2013)			both financially and from a personal and professional development perspective, such as, support for any training that may be needed to enable emerging experts to become confident and proficient in the respective media or communication medium •Organisations like Wellcome can also model these priorities with senior staff being involved and promoting the importance of communication in their own work •The document presents several case studies of novel ways of doing science communication and engagement with publics: -Using stand-up comedy -Reading groups and book clubs -Mobile app-based games -Online information resources designed by and for specific groups of stakeholders -School and student study days and visits (e. g. to research labs etc.)	**1. Choose your audience carefully** Some examples of stakeholder groups and groups to target for communication are: •Schools - different levels of communication for different ages •Adult publics - define by interest group, e. g., by age or via 'gatekeepers' (p. 2) such as social groups like the Women's Institute (UK CWA equiv.) •Patient groups and healthcare professionals - often already interested in research so can springboard off that •Families - difficult to target without face to face media like visits or exhibitions to go to •Difficult topics - be aware of any potentially difficult or controversial topics for different audiences. Extra preparation of communicators may be needed **2. Be prepared to try a variety of formats depending on your audience** •Creative arts, including comedy, exhibitions and installations - potentially including the audience themselves in the creation (stimulating discussion, debate and questions) •Mass media including TV, film, gaming, online platforms and forums **3. Motivators** Think of public engagement, and especially communication, as a key component of research impact which is now a requirement for most research grants **4. Obstacles** •Getting researchers to prioritise public engagement among all the other priorities and commitments •Supporting researchers as communicators in public engagement activities with time, training and funding •Organisational culture - make conducive to prioritising engagement such as with role modelling of this from the top of the organisation with key experts/leaders

APPENDIX C: LIST OF GREY LITERATURE

1. 'A Primer for Media: Antimicrobial Resistance in the Western Pacific Region' (WHO WPR 2016)
2. 'Action for Healthier Families Toolkit: A Primer for Policy-makers and Health-care Professionals' (WHO WPR 2018)
3. 'Communication for health (C4H): Building on experiences in the context of Covid-19 to strengthen use of strategic communications in the Western Pacific Region' (WHO WPR 2020)
4. 'Choosing the channels of communication: A review of media resources for 11 countries in the WPR' (Tobacco-Free Initiative & Health Promotion Unit WHO WPR 2004)
5. 'Tackling antimicrobial resistance_WHO WPR factsheet' (WHO WPR 2019)
6. 'Meeting the Challenge of Antimicrobial Resistance: From Communication to Collective Action' Interagency Coordination Group on AMR (IACG) Discussion Paper (IACG 2018)
7. 'Communication skills for antimicrobial resistance (AMR) in Asia and the Pacific' (OIE 2020) https://rr-asia.oie.int/en/events/communication-skills-for-antimicrobial-resistance-amr-in-asia-and-the-pacific/
8. 'Improving communications for antimicrobial resistance (AMR) in Africa: How should we move forward?' (FAO 2020)
9. 'CDC Clear Communication Index: A Tool for Developing and Assessing CDC Public Communication Products' (CDC 2014) https://www.cdc.gov/ccindex/
10. 'Communication toolkit for professionals in hospitals and other healthcare settings' (ECDC n.d.) https://antibiotic.ecdc.europa.eu/en/communication-toolkit-professionals-hospitals-and-other-healthcare-settings
11. 'Communication toolkit to promote prudent antibiotic use aimed at general public' (ECDC n.d.) https://antibiotic.ecdc.europa.eu/en/publications-data/communication-toolkit-promote-prudent-antibiotic-use-aimed-general-public
12. 'Communication toolkit to promote prudent antibiotic use aimed at primary care prescribers' (ECDC n.d.) https://antibiotic.ecdc.europa.eu/en/toolkit-primary-care-prescribers
13. 'Toolkit for engaging in social media activities promoting prudent antibiotic use' (ECDC n.d.) https://antibiotic.ecdc.europa.eu/en/plan-campaign/toolkit-social-media
14. 'Communication toolkit on antibiotic use: How to promote prudent antibiotic use with focus on self-medication with antibiotics' (ECDC n.d.) https://antibiotic.ecdc.europa.eu/en/toolkit-general-public-self-medication
15. 'Australians' knowledge of antibiotic resistance better but not enough' (NPS MedicineWise 2018) https://www.nps.org.au/media/australians-knowledge-of-antibiotic-resistance-better-but-not-enough
16. 'Antibiotic resistance: the facts' (NPS MedicineWise 2021) https://www.nps.org.au/consumers/antibiotic-resistance-the-facts
17. 'Croakey - Choosing Wisely in Australia: broadening the conversation to reduce low-value healthcare' (Choosing Wisely Australia 2017) https://www.choosingwisely.org.au/news-events/in-the-news/croakey-choosing-wisely-in-australia-broadening-the-conversation-to-reduce-low-value-healthcare
18. 'Antibiotic resources for consumers' (Choosing Wisely Australia n.d.) https://www.choosingwisely.org.au/resources/consumers-and-carers/antibiotic-resources-for-consumers
19. 'Antibiotic resources for clinicians' (Choosing Wisely Australia n.d.) https://www.choosingwisely.org.au/resources/health-professionals/antibiotic-resources-for-clinicians
20. 'English Surveillance Programme for Antimicrobial Utilisation and Resistance (ESPAUR): Report 2019 to 2020' (Public Health England [PHE] 2020)
21. 'Antibiotic Awareness: Key messages' (PHE 2019)
22. 'Antimicrobial Resistance Resource Handbook' (PHE 2017)
23. 'World Antimicrobial Awareness Week (WAAW) & European Antibiotic Awareness Day (EAAD): Resources toolkit for healthcare professionals in England in the context of the COVID-19 pandemic' (PHE 2020)
24. 'Antimicrobial stewardship: changing risk-related behaviours in the general population' (National Institute for Health and Care Excellence [NICE] 2017)
25. 'Expert paper 2 - The effectiveness of national and local campaigns in changing the public's behaviour to ensure they only ask for antimicrobials when appropriate and use them correctly' (NICE 2017)
26. 'Expert paper 7 - Public education interventions to reduce pressure on prescribers to prescribe inappropriately [indirectly changing the behaviour of prescribers through changing the behaviour of the public]' (NICE 2017)
27. 'Antimicrobial stewardship: systems and processes for effective antimicrobial medicine use' (NICE 2015)
28. 'Sharing Our Practice: Successes and challenges of public engagement in the Wellcome Trust's UK Centres' (Wellcome Trust 2013)
29. 'Engaging with Impact: How do we know if we have made a difference?' (Wellcome Trust 2013)
30. 'Reframing resistance: How to communicate about antimicrobial resistance effectively' (Wellcome Trust 2019)
31. 'The Danish Government Programme on Public Health and Health Promotion 1999-2008: A case study' (published Sept 2001 by Finn Kamper-Jørgensen for WHO Europe)
32. 'National action plan on antibiotics in human healthcare: Three measurable goals for a reduction of antibiotic consumption towards 2020' (Ministry of Health and the Elderly 2017) https://sum.dk/publikationer/2017/juli/national-handlingsplan-for-antibiotika-til-mennesker
33. 'One Health Strategy against Antibiotic Resistance' (Ministry of Health/Ministry of Environment and Food of Denmark 2017)
34. 'Inspiration and Ideas: One Health Integration in Surveillance' (National Food Institute, Technical University of Denmark 2019)
35. 'Tackling antimicrobial use and resistance in pig production: Lessons learned in Denmark' (FAO/Ministry of Environment and Food of Denmark/Danish Veterinary and Food Administration 2019)
36. 'Mission Report: ECDC country visit to Spain to discuss antimicrobial resistance issues' (ECDC 2018)
37. 'Strategic Action Plan to reduce the risk of selection and dissemination of antibiotic resistance' (Agencia Españolade Medicamentos y Productos Sanitarios [AEMPS] 2015)
38. 'National Antibiotic Resistance Policy and Implementation in Spain: Challenges, Opportunities, and Recommendations' (Solomon 2019)
39. 'In Spain, apocalyptic scenarios of antibiotic resistance, but little action' (Belmonte 2016)

https://correctiv.org/en/latest-stories/super-bugs/2016/08/08/in-spain-apocalyptic-scenarios-of-antibiotic-resistance-but-little-action/
40. ‘Micro-Combat: Learning About Antimicrobial Resistance and How to Fight Infectious Disease with a Card Game’ (IS Global Barcelona Institute for Global Health 2017)
https://www.isglobal.org/en/-/micro-combat-un-juego-para-aprender-a-luchar-contra-las-infecciones-y-las-resistencias-antimicrobianas?redirect=https%3A%2F%2Fwww.isglobal.org%2Fen%2Fsearch-results%3Fp_p_id%3D3%26p_p_lifecycle%3D0%26p_p_state%3Dmaximized%26p
41. ‘Campaign for the prudent use of antibiotics: "Antibiotics are NOT good for everything" (AEMPS 2019)
https://www.aemps.gob.es/la-aemps/campanas/campana-para-el-uso-prudente-de-los-antibioticos-los-antibioticos-no-valen-para-todo/

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