Antimicrobial stewardship – changing risk-related behaviours in the general population

NICE guideline

Draft for consultation, September 2015

This guideline covers interventions to change people's behaviour to help reduce antimicrobial resistance and stop the spread of resistant microbes. This includes making people aware of the importance of using antimicrobials correctly and the dangers associated with their overuse and misuse. It also includes measures to prevent and control infection that can stop people needing antimicrobials or spreading infection to others.

The term 'antimicrobial resistance' is used in this guideline because the scope of the work included all antimicrobials (including antibiotics, antifungals and antivirals). However, most of the evidence on which this guideline is based relates to the use of antibiotics and the prevention of antibiotic resistance.

The terms 'antimicrobial' and 'antimicrobial resistance' are technical terms used by practitioners. The terms 'antibiotic' and 'antibiotic resistance' may be more widely understood by the general public.

Who is it for?

- Commissioners, managers, professionals and professional bodies with responsibility for prescribing and dispensing antimicrobials or with public health as part of their job.
- Those responsible for planning and designing interventions.
- Organisations and individuals with responsibility for providing information

and advice to the public.

- Those responsible for antimicrobial stewardship.
- People who are vulnerable to infection (such as people with suppressed immune systems because of cancer treatment).

This guideline contains the recommendations, context, the Guideline Committee's discussions and recommendations for research. For details of the evidence, see the evidence reviews.

Other information about how the guideline was developed is on the project page. This includes the scope, and details of the Committee and any declarations of interest.

1

2

Contents

Recommendations

People using services have the right to be involved in discussions and make informed decisions about their care, as described in Your care.

Using NICE guidelines to make decisions explains how we use words to show the strength of our recommendations, and has information about safeguarding, consent and prescribing medicines.

1.1 National and local information campaigns

1.1.1 Provide the public with information to:

- prevent infections occurring and to stop them from spreading
- reduce inappropriate antimicrobial demand and use
- raise awareness of antimicrobial resistance.

1.1.2 Use different modes of delivery, for example:

- verbal advice
- multimedia (videos)
- digital resources (interactive websites and apps)
- mass media (in particular social media)
- written materials (leaflets and posters).

1.1.3 Give advice on handwashing that includes:

- Why it is important to wash hands (for example, cold and flu viruses can be transmitted on hands).
- When hands should be washed (such as after using the toilet, before eating, before touching the eyes or mouth, and after touching an animal).
- How hands should be washed, including the need to use soap and water or hand sanitisers if soap is unavailable (see recommendation 1.1.2.4 in NICE's guideline on infection).

1.1.4 Give food hygiene advice including information on:

- The importance of washing hands with soap and water before eating or preparing food, after using the toilet or touching the bin, and before and after handling raw food.
- Preparation and cooking methods. This includes ensuring food is cooked at the right temperature and properly heated throughout before eating.
- How to store food safely, including advice on fridge temperatures, 'use by' dates, and freezing, defrosting and refreezing food.
- Using leftovers safely.

See NHS Choices food hygiene for more advice on food safety and how to prevent infections from spreading.

1.1.5 Raise awareness of antimicrobial resistance by linking to national and international public awareness-raising initiatives (for example, Public Health England's Antibiotic Guardian and European Antibiotic Awareness Day).

1.2 National and local interventions to prevent infection

1.2.1 Ensure interventions directed at the general public aim to prevent and stop the spread of infections. They should address:

- handwashing
- food hygiene
- other aspects of infection prevention not covered in this guideline, such as the need for vaccinations (see NICE's guideline on reducing differences in the uptake of immunisations).

1.3 Interventions to reduce inappropriate antimicrobial demand and use

1.3.1 Provide information about self-limiting conditions that people often wrongly think need antimicrobials, such as colds, flu and earache. Encourage them to use this information to treat themselves at home when it is safe to do so. The information should include:

- How to recognise if they, or someone they are caring for, have such a condition (for example, by using the NHS Choices Symptom Checker).
- The natural course of self-limiting conditions such as a sore throat.
- The symptoms that indicate people should seek medical help.
- How people can self-care. (For example, for symptoms of a cold or flu: rest, drink lots of fluids, take over-the-counter painkillers to reduce temperature, aches and pain.)
- Where to seek advice on self-limiting conditions, highlighting that GPs or A&E should not be the first point of call. Instead, people should be encouraged to use pharmacists and other reliable health resources such as NHS Choices.

1.3.2 Advise people who are prescribed antimicrobials to take the correct dose for the time specified and via the correct route, as instructed by their healthcare professional. Advise people **not to**:

- take antimicrobials without a prescription or advice from a healthcare professional
- keep them for use another time instead of returning them to a pharmacy for safe disposal
- share antimicrobials with other people
- use antimicrobials prescribed for animals
- use antimicrobials obtained from anywhere other than their healthcare professional or pharmacy (for example, from the Internet).

1.4 Public and private childcare settings

1.4.1 Keep the environment and facilities clean to prevent the spread of infection.

1.4.2 Regularly train staff in handwashing and how to clean furniture, floors, toys, toilets and door handles.

1.4.3 Provide soap and hand sanitisers for children, staff and visitors.

1.4.4 Talk to children about the importance of handwashing. Focus on when to wash hands (for example, after using the toilet and before eating). Show them how to do this with soap and water (see recommendation 1.1.2.4 in NICE's guideline on infection).

1.4.5 Involve parents and carers of children in education about handwashing.

1.4.6 Ensure parents and carers are aware of why it is important to prevent antimicrobial resistance and how it could affect their own and other people's health.

1.5 Whole-school approaches to antimicrobial stewardship

1.5.1 Promote a 'whole-school' approach to antimicrobial stewardship. The school environment and staff should enable children to act in a way that prevents or minimises infection. Ensure:

- soap and hand sanitisers are available
- staff set an example by washing their hands after using the toilet and before eating.

1.5.2 Make lessons age-appropriate, face-to-face, interactive and practical. For example:

- regularly demonstrate how to wash hands correctly
- use handwashing training kits.

1.5.3 Teach all children in an age-appropriate manner about:

- where microbes are found
- how microbes spread
- handwashing as a way to prevent and minimise the spread of infections, including:
  - why it is important
  - when to wash hands (for example, after using the toilet, before eating, before touching the eyes or mouth, and after handling animals)
  - how to wash hands (see recommendation 1.1.2.4 in NICE's guideline on infection).

1.5.4 Teach all children in an age-appropriate manner about:

- what antibiotics can and cannot do (for example, they do not cure viral infections)
- appropriate use of antibiotics (see recommendation 1.3)
- antibiotic resistance – how it can develop and why it is an important issue for society and the individual.

1.5.5 Use existing teaching resources. For example, consider using Public Health England's e-Bug website.

1.5.6 Consider teaching other aspects of infection prevention (see recommendation 1.2.1).

1.5.7 Consider how parents and carers can support their children's learning, for example, by teaching their children how and when to wash their hands and use antimicrobials.

1.6 Infection prevention in universities

1.6.1 Put measures in place to change students' infection prevention knowledge and behaviour. Include:

- Online awareness-raising with links to evidence-based information and resources (such as the e-Bug young adult website).
- Posters promoting handwashing displayed in various locations such as public areas of the campus, cafeterias, bulletin boards in halls of residence, and public toilets (in stalls and above urinals).
- One-off events providing free hand sanitisers.
- Food safety campaigns that could include:
  - traditional face-to-face lectures
  - education modules delivered via the web, including digital and social media
  - promotional materials such as fridge magnets and posters.
- Other aspects of infection prevention, such as advice on vaccinations and preventing the spread of airborne infections.

1.6.2 Be aware that, for many students, this is the first time that they will be managing infections on their own. Students need to understand when they can safely self-care and when they need to seek medical help. (See recommendation 1.3 and the NHS Choices symptom checker.)

1.6.3 Consider giving information that aims to reduce inappropriate antimicrobial demand and use. The information should explain to students how to diagnose and self-care if they have a self-limiting condition such as a cold or flu. It should also promote community pharmacies as a source of advice.

1.7 Advice in healthcare settings

1.7.1 Give advice about self-limiting conditions, appropriate antimicrobial use and antimicrobial resistance. See NICE's guideline on antimicrobial stewardship: systems and processes for effective antimicrobial medicine use.

1.7.2 Consider using computer prompts or clinical decision aids to encourage healthcare professionals not to prescribe antimicrobials for someone with a self-limiting condition.

1.7.3 When people seek medical advice for self-limiting conditions:

- Advise them how they can self-care for each of the symptoms. Provide verbal or written advice (see recommendation 1.3.1). The latter could be a digital resource or a format that they can take away, such as a leaflet.
- Highlight that GPs or A&E should not be the first point of call for treatment and information for these conditions. Instead, encourage people to use pharmacies and other reliable health resources such as NHS Choices.

1.7.4 When antimicrobials are not prescribed, give people verbal advice and written information that they can take away about:

- the adverse consequences of overusing antimicrobials
- the likely duration of symptoms with and without antimicrobials
- how to manage their condition without antimicrobials, including being aware of when they should ask again for medical advice.

1.7.5 When antimicrobials are prescribed or dispensed, give people verbal advice and written information that they can take away about:

- what antimicrobials are used for
- appropriate use of antimicrobials
- the consequences of not using antimicrobials appropriately.

See NICE's guidelines on antimicrobial stewardship: systems and processes for effective antimicrobial medicine use and behaviour change: individual approaches.

To find out what NICE has said on topics related to this guideline, see our web

pages on antibiotic use, behaviour change, healthcare associated infections, immunisation, infectious disease prevention and control, respiratory conditions: general and other.

Implementation

This section highlights how the guideline could be implemented by national agencies with a remit for public health, local authorities, NHS England, NHS Trusts and clinical commissioning groups.

Taking a strategic approach

A local area antimicrobial stewardship strategy (that links local authorities and healthcare) could be a useful way of helping to implement the recommendations. This could target:

- The general public, including people who are visiting or using health or social care services.
- People whose social and economic circumstances or health put them at greater risk of acquiring or transmitting infectious diseases and antimicrobial resistant strains. This includes people who:
  - are immunosuppressed (for example, because of cancer treatment, an organ transplant or HIV)
  - have a chronic disease
  - live in crowded conditions (see Shelter's definition)
  - are homeless
  - have been in prison
  - have migrated from countries with a high prevalence of infectious diseases such as tuberculosis (examples include South Asia and sub-Saharan Africa).
- Social care and healthcare practitioners and organisations. See NICE's guideline on antimicrobial stewardship: systems and processes for effective antimicrobial medicine use for details.

The strategy could:

- Refer to any national strategy for antimicrobial stewardship (for example, The Department of Health's UK 5 year antimicrobial resistance strategy 2013 to 2018).
- Identify current and planned population-level interventions.
- Identify the resources that will be needed for interventions.
- Identify the timescales for the package of interventions, highlighting the need for ongoing, sustained action.

Commissioning interventions for the general public

A package of interventions on infection prevention, antimicrobial use and antimicrobial resistance could be more effective than one-off, single interventions because it could:

- Target the whole population.
- Take into account any specific needs with regards to: age, social and economic circumstances, social norms, sexual orientation, gender identity, gender, culture, faith or any type of disability.
- Target all settings (for example, social care, day care, schools, primary care, pharmacies, out-of-hours services).
- Include individual and community-level interventions. See NICE's guidelines on behaviour change: the principles for effective interventions and behaviour change: individual approaches for recommendations on planning, designing, delivering, evaluating and monitoring interventions.

Context

Antimicrobial stewardship refers to 'an organisational or healthcare system wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness'.

Antimicrobial resistance may lead to standard treatments becoming ineffective, causing infections to persist and increasing the risk of them spreading. Although resistance evolves naturally, the use (and misuse) of

antimicrobials speeds up this process. Inadequate infection prevention and control practices, poor sanitary conditions and inappropriate food-handling encourage the spread of infections that may require the use antibiotics.

Improvements in nutrition, hygiene and sanitation and reductions in overcrowded housing have all helped prevent and decrease the transmission of infectious diseases (Davies 2013[1]). The World Health Organization estimates that, along with these broad environmental factors, antimicrobials add on average 20 years to life expectancy (Self-prescription of antibiotics boosts superbugs epidemic in the European Region).

But microbial resistance is increasing and there is a lack of new antimicrobials to treat resistant diseases. It is important to ensure the antimicrobials that are currently effective remain so for as long as possible.

Epidemiology

Infectious diseases are a major cause of illness in the UK. In 2013 for example, 21% of all days lost at work (approximately 27 million days) were caused by coughs, colds and flu and other infectious diseases (Sickness absence in the labour market, February 2014 Office for National Statistics).

The incidence of infectious disease tends to be higher in groups with lower socioeconomic status and outcomes tend to be poorer. For example, they are more likely to have tuberculosis, transmit it to others and to have a drug-resistant strain (Annual report of the Chief Medical Officer 2011: volume one Department of Health).

Viruses (such as HIV), parasites (such as malaria) and fungi (for example, *Candida*) are showing resistance to antivirals, antiparasitics and antifungals respectively. But antibiotic resistance is the main concern.

In the UK, the spread of multidrug-resistant tuberculosis and gonorrhoea is also of public health concern ('Annual report of the Chief Medical Officer 2011: volume one').

[1] Davies SC (2013) The drugs don't work. A global threat. London: Penguin

Interventions and UK policy

National campaigns to raise public and professional awareness of antibiotic resistance may reduce antibiotic prescribing and demand (European antibiotic awareness day 2013 evaluation report Department of Health). But a 2013 survey of 2033 people in the UK by Ipsos MORI (Antibiotics: a cure for the common cold?) showed that:

- 16% wrongly believe antibiotics work on colds or flu
- around 40% think antibiotics can kill viruses
- around 7% do not complete a course of antibiotics.

There is also evidence that most people who ask a healthcare professional for antibiotics to treat a cough are given them (Coenen et al. 2006[2]).

For details on UK policy see the scope for this guideline.

The Committee's discussion

This section describes the factors and issues the Public Health Advisory Committee considered when developing the recommendations. Please note: this section does **not** contain recommendations. (See Recommendations.)

Background

The Committee recognised that the threat of antimicrobial resistance can only be tackled by a combination of interventions and measures that address:

- the prescribing decisions of healthcare professionals
- people's behaviour relating to infection prevention and control, antimicrobial use and antimicrobial resistance
- surveillance to track antimicrobial use and resistance in microbes
- the development of new drugs, treatments and diagnostics
- antimicrobial use in animal husbandry

[2] Coenen S, Michiels B, Renard D et al. (2006) Antibiotic prescribing for acute cough: the effect of perceived patient demand. British Journal of General Practice 56: 183–90

- political commitment to prioritise antimicrobial resistance as a major area of concern for the UK and globally.

Changing when and how people use antimicrobials and changing their behaviour to prevent infection helps to keep current medicines effective for as long as possible. But action is also needed by prescribers, dispensers and regulators.

The Committee noted the importance of ensuring sustained action is taken to reduce antimicrobial resistance. It emphasised that antimicrobial resistance is a long-term problem. It noted that at publication, this guideline will be 3 years into the UK 5-year antimicrobial resistance strategy 2013 to 2018.

The Committee reflected on NICE's guideline on antimicrobial stewardship: systems and processes for effective antimicrobial medicine use which covers prescribers' knowledge and behaviour. It wanted to ensure the 2 guidelines complement each other and are read together. It also wanted to ensure interventions that target both the public and prescribers are included in this guideline if they are not already covered in the antimicrobial stewardship guideline. That is because otherwise, the Committee felt that evidence of effectiveness on these interventions may be missed.

The Committee also noted that NICE guidelines on behaviour change, medicines optimisation and reducing differences in the uptake of immunisations are all relevant to changing knowledge about use and misuse of antimicrobials.

Evidence – effectiveness review

The Committee found little good-quality published evidence about the effectiveness of interventions. The methods used in studies were often not well reported or had potential biases that may have significantly affected their results. This is reflected in the quality ratings for studies, with the majority rated as weak, 12 rated as moderate and none as strong.

The Committee questioned whether the studies were underpowered (had too few participants) to detect any significant differences. It also questioned

whether the effect sizes could be pooled for meta-analysis, but this was not possible because of the diversity of the study outcomes.

Most studies measured knowledge rather than behaviour and when behaviour was measured it was often self-reported rather than observed. The Committee noted that behaviour change needs to be the goal of any intervention, and that changes in knowledge do not necessarily lead to changes in behaviour. It agreed that more research is needed to evaluate changes in behaviour.

The way people's knowledge was measured differed between studies and the Committee questioned the validity of the measures. Some studies only reported an overall 'knowledge score' for a particular topic.

Some used different measures to evaluate an outcome. For example, statements to classify as 'true' or 'false' on handwashing ranged from: "you need to wash your hands after playing in the garden" to "you need to wash your hands after coughing". So an overall score described as 'knowledge of hand hygiene' may actually be a compilation of quite different knowledge measures and may not be comparable between the studies.

In some studies, the baseline levels of knowledge were high. This may have left little room for improvement. Other studies report significant changes, but with the overall level of knowledge remaining low. So an 'effective' result may not be 'clinically significant' (for example, it may not demonstrate a meaningful difference).

There was also a lack of long-term follow-up of changes in knowledge or behaviour.

The Committee also discussed why some studies that measured only prescribing rates as an outcome were excluded. The rationale was that prescribing is under the control of the prescriber, not the patient. Without any direct measure of patients' knowledge or behaviour (for example, changes in consultation rates) it would not be possible to determine whether changes in prescribing were caused by changes in patients' or prescribers' behaviour.

But the Committee felt that if an intervention was solely targeting patients or the general public, then prescribing rates may be a reasonable outcome measure. This is because changes in patient behaviour may be affecting doctors' prescribing habits. As a result, supplementary reviews were carried out.

Supplementary evidence reviews

NICE carried out another evidence review to look at studies that were excluded from the effectiveness review. These studies targeted patients or the general public only and measured prescribing rates.

Papers previously excluded because they only reported on the incidence of infection were also included in the review, because changes to the incidence of infection after an intervention may be due to changes in behaviour.

The Committee noted that the quality of included studies was generally moderate to good.

The review showed that evidence on the effectiveness of parental education interventions in reducing the prescribing of antibiotics for children's respiratory tract infections in primary care is inconsistent. Three US studies found no effect, and the 1 UK study found a significant decrease in antibiotic prescribing.

The interventions all involved written materials but differed in format, content, additional components and mode of delivery. Baseline prescribing levels also differed between studies. The Committee noted that the 1 effective study involved training GPs to discuss written materials with parents, and to give them information on prognosis, treatment options and reasons for re-consultation (warning symptoms to look out for).

The Committee also noted that an educational intervention based in primary care may be effective in reducing antibiotic prescribing for respiratory tract infections in adults below the age of 65. But this was not the case for older adults. It noted that GPs (and their older patients) may think that older people face greater health complications, so GPs may be more likely to prescribe

them antimicrobials. The Committee noted the importance of ensuring interventions are designed to address the beliefs of particular groups such as older adults.

Studies that measured changes in the incidence of infection all focused on hand-hygiene interventions. In childcare settings, changes to hand hygiene did not reduce the incidence of respiratory or gastrointestinal illnesses but could reduce the onward transmission of a gastrointestinal illness to others.

The Committee noted that there was 1 strong-quality UK study, of a bespoke web-based intervention. This reduced the incidence of respiratory illnesses. In the effectiveness review, evidence statements about using educational modules delivered through computers and websites were also based on only 1 or 2 studies. So the Committee decided to look at the antimicrobial use, resistance and infection prevention studies to determine whether education delivered via computer and websites does help change knowledge or behaviour.

The Committee concluded that educational modules delivered this way could help reduce inappropriate expectations of antibiotics and improve food safety knowledge and hand hygiene. However, members believed that the key to success was not the format of delivery, but the content and quality of the intervention.

The Committee noted that interventions need to go beyond raising knowledge and awareness. It discussed the need to give people the motivation to change and the tools to help them to start behaving differently. The Committee also agreed that it is important to give people the opportunity to change (for example, by providing handwashing facilities).

NICE's public health team carried out a rapid review of systematic reviews that evaluated the effectiveness of educational interventions on antimicrobial use or resistance, targeting both the public and healthcare professionals. The Committee noted that these multi-targeted interventions did improve people’s knowledge of appropriate antimicrobial use (specifically in relation to antibiotics) and did reduce antibiotic prescribing for respiratory illnesses.

However, it wasn't possible to determine whether it is better to provide support to help change someone's behaviour alone, or support for changing healthcare professional's behaviour alone or a combination of both. Nor was it possible to determine which components of interventions were more effective than others.

Evidence – qualitative and theory-based

Expert paper 1 reports on the public's awareness and understanding of appropriate antimicrobial use, and prescribing and antimicrobial resistance in the UK. The qualitative evidence identified core behaviours that could reduce people's use of antibiotics for a self-limiting condition:

- self-care or getting advice from a pharmacist for colds, runny nose, flu and other self-limiting conditions
- not requesting antibiotics at a GP appointment
- acting on advice given by their GP if antibiotics are not prescribed (delayed prescription or self-care).

The qualitative evidence was categorised in relation to the COM-B model of behaviour. This relates behaviour to a person's capability, opportunity and motivation. The model was also used as a theoretical basis for proposing areas that have the potential to be effective in changing people's behaviour. The Committee noted that this model is recommended in NICE's guideline Behaviour change: individual approaches and is relevant to how interventions for infection prevention and antimicrobial use are designed and delivered.

Population groups and settings

The Committee noted that interventions targeted specific age groups and life stages. It felt this was a useful way to frame the recommendations. In addition, educational interventions for school-aged children (such as Public Health England's e-Bug website) often combine teaching about antibiotic use, antimicrobial resistance, handwashing and food hygiene. It decided that these should also be combined in the recommendations.

The Committee noted that the populations that use the most antibiotics are people aged 16 to 24 and adults aged over 65. People aged 16 to 24 also misuse antibiotics more than any other age group, whereas antimicrobial resistance is greatest in older age groups. The importance of interventions that target both these age groups was noted.

The need for further research in older age groups was also noted, along with studies focusing on populations whose social and economic circumstances or health puts them at greater risk of getting or transmitting infectious diseases and antimicrobial-resistant strains.

The Committee also noted that even though the reviews only looked at educational interventions, there may be other types of intervention that focus on these populations.

Most interventions took place in healthcare or education settings. Healthcare interventions mainly took place in primary care, but some were undertaken in A&E or pharmacies. Other settings included childcare, homes and communities.

The Committee was concerned that there were no interventions in the workplace or social care, other than childcare settings. It discussed whether it was possible to generalise findings from childcare to other social care settings. Members agreed that the aim of the intervention would be the same. But there was no evidence on how such interventions could be effectively delivered in these alternative settings and to different population groups.

Antimicrobials and antimicrobial resistance − knowledge and behaviour

The Committee noted that most studies focused on improving knowledge of antibiotics rather than antivirals, antifungals or antiparasitics. The interventions usually focused on reducing unnecessary antibiotic use for self-limiting respiratory illnesses (colds and flu).

There is growing concern about the increase in antimicrobial resistance to common treatments, particularly in bacteria that cause urinary tract infections.

For example, *Escherichia coli* resistance to third-generation cephalosporins and fluoroquinolones.

The Committee noted that educational interventions did not tend to improve knowledge of antimicrobial resistance and its implications. The Committee agreed that focusing messages on the effects on society were unlikely to lead to changes in behaviour. Making the messages relevant to individuals, on the other hand, could be effective. Such messages could include the fact that losing effective treatments could directly affect someone's own health, or the health of those close to them.

The Committee also felt that it is important to get across the fact that you don't have to feel unwell to carry an antimicrobial-resistant organism (for example, you could be a carrier of *Clostridium difficile*). It agreed that the fact that someone can spread an antimicrobial-resistant infection to others is another key message that needs to be conveyed. The Committee noted that interventions to prevent infection have been shown to be more effective during epidemics. This is because people are more likely to act in a way to prevent or minimise the spread of infection when they can see it may help them.

The Committee discussed the importance of creating a cultural shift and changing social norms so that people use antimicrobials responsibly.

The Committee felt that self-care needs to become the 'easy choice' for people. It noted the importance of changing people's perceptions that they need to see a GP for self-limiting conditions such as coughs and colds rather than using pharmacists as their first point of contact. It saw the role of the pharmacist as very important. However, it noted that there are also cost considerations for people, because prescribed medicines may be cheaper than over-the-counter medicines, or free for some.

The Committee discussed the importance of people knowing the natural course of an illness – with and without using antimicrobials – and that there is often very little difference in recovery times. The Committee also discussed other ways to improve motivation, such as:

- ensuring people believe they are able to overcome self-limiting conditions without prescribed antimicrobials and can conduct their daily activities without them
- increasing people's confidence in the effectiveness of over-the-counter medicines.

The Committee discussed the possible unintended consequences of interventions that aim to reduce inappropriate antimicrobial use. It noted that people need to know the warning signs that indicate they should seek help from a healthcare professional. It also did not want a situation in which no antimicrobials are prescribed or used.

The Committee noted the potential cost benefits to the NHS of interventions that reduce GP consultation rates. But there was little evidence on this for self-limiting illnesses. However, there was evidence that primary care interventions, such as providing information on antibiotic use, can change knowledge of when and how to use antibiotics.

Although leaflets alone led to improvements in knowledge among adults, this was not the case for parents of young children. There was evidence for both population groups that leaflets, in combination with verbal advice, given either face-to-face or via a video presentation, improved antibiotic knowledge and behaviour.

The Committee noted that most healthcare interventions took place in general practices. There were only 2 studies in pharmacies and 1 in an A&E setting. The Committee discussed the importance of ensuring people receive the right information at the right time. The Committee discussed providing information at the following points:

- before accessing a GP (getting information online or visiting a pharmacy)
- while waiting for a GP or hospital consultation
- during a consultation.

Education on antibiotic use and antimicrobial resistance in schools was more likely to be effective if students were given this information direct in class or

during laboratory activities rather than through computer games, mass media campaigns and videos alone. However, the Committee noted that there were no direct comparisons of these different types of school activity.

There were also some methodological issues with studies of self-learning that did not show a significant effect. A lack of significant intervention effect could be due to the studies being insufficiently powered, or because the intervention needs to be further developed. For example, the e-Bug computer game was made a tedious rather than 'fun' experience by making children complete all levels of the game in a single sitting (hence the low completion rate). Because of these methodological issues, the Committee warned against assuming that such interventions are not effective.

The Committee noted the importance of teachers being role models for preventing the spread of infection. It also noted the importance of providing the right facilities to support children to prevent or minimise the spread of infection (for example, by providing soap or hand sanitisers).

Mass-media campaigns

The Committee noted that although mass-media campaigns could raise the profile of antimicrobial resistance and correct use of antibiotics, they had only a small impact on people's knowledge and behaviour.

There was some evidence from the effectiveness review that these campaigns can increase parents' knowledge of antimicrobial resistance and reduce their desire for antibiotics for their child. But only if they are combined with direct communication from healthcare professionals and staff at childcare centres, and with the education of healthcare professionals.

The Committee discussed expert paper 2. This reported on the impact of international and national awareness-raising campaigns on people's knowledge of appropriate antimicrobial use and antimicrobial resistance. It also reported on how people, as a result, changed their behaviour in relation to antibiotics.

The Committee noted that many resources about self-care, antimicrobial resistance and antimicrobial use are available online. It wanted to ensure that this guideline tells people clearly where to find these resources. However, it noted that their quality and effectiveness had not been evaluated.

Preventing infection

The Committee noted that the effectiveness review had no studies on interventions designed to improve behaviour when coughing and sneezing (such as using and disposing of tissues). So it could not make any recommendations in this area. Recommendations could be made only on hand hygiene and food hygiene interventions. The Committee also noted the importance of other infection prevention activities that were outside the scope of the guideline such as vaccination programmes and promoting safer sex.

The majority of studies of hand hygiene took place with children and young adults in pre-schools, primary and secondary schools and university settings. They indicated that it is possible to improve young children's handwashing behaviour through interactive education, including instruction and use of handwashing training kits.

As with the studies on antibiotic use and antimicrobial resistance, the evidence on the effectiveness of hand hygiene education, based on use of Public Health England's e-Bug website, was mixed. The Committee noted that a possible reason was the high level of existing knowledge before the start of an intervention in some of the study populations.

The Committee was concerned that some may misinterpret this finding and wrongly believe that education in schools was not needed. It felt that education in schools was vital, particularly among students who have little or no knowledge of antibiotics. In addition, it agreed that hand washing behaviour is a habitual practice that, if established when young, is more likely to continue throughout life.

The Committee agreed that the combination of education and provision of hand sanitisers may lead to improvements in hand washing behaviour in

some populations. For example, there was weak evidence for the effectiveness of providing hand sanitisers along with information posters to university students, and for educational interventions in which people were given hand sanitisers to use at home.

Food hygiene interventions were more likely to be targeted at high-risk groups. The studies found were mostly in the US and were community-based. Many focused on improving people's knowledge and behaviour regarding chilling, cooking and washing food. They targeted adults and young people, including:

- young people in inner cities
- parents with low incomes
- women who were pregnant or caregivers
- older people with a high school education or less
- older women
- Latino communities (a person of Latin American origin or descent living in North America).

There were very few studies of educational interventions for schoolchildren on food safety knowledge or practice and the findings were inconsistent.

The Committee noted that some food safety interventions appeared to improve food safety knowledge and practices in the short term. These were:

- food safety campaigns delivered to university students
- mass-media campaigns targeting adults or parents
- campaigns delivered through traditional or social media.

Health economics

Infections and infectious diseases in England cost the NHS an estimated £30 billion per year. Many of these costs are caused by respiratory or gastrointestinal infections (Annual report of the Chief Medical Officer 2011: volume two Department of Health).

The economic costs of antimicrobial resistance are largely unknown (Antimicrobial resistance: global report on surveillance 2014 World Health Organization). The loss of many of the advances in medical care that antimicrobials have supported will be the main economic burden of antimicrobial resistance.

Extremely large economic losses would almost certainly occur if all antimicrobials were rendered ineffectual in the future, even without taking into account the impact on health. So finding ways to delay this will almost certainly be cost effective. However, this cannot be confirmed by modelling because a model would need to be based on assumptions that are not evidence-based.

The Committee agreed that the 'precautionary principle' could be applied. This is about avoiding or delaying catastrophes by ensuring effective measures are in place. In such circumstances, the burden of proof in relation to effectiveness is on those who do not wish to put precautionary measures in place. In the case of antimicrobial resistance, interventions to reduce the spread of resistance could be assumed to be effective unless there was sufficient proof that such interventions are not needed.

Given that it is most unlikely that the effectiveness of such interventions can be disproved, we also need to determine whether a package of such measures is cost effective compared with no intervention. Again, the rules of decision theory no longer apply, because the effects of antimicrobial resistance are so pervasive that it can be assumed that risk aversion is needed.

In addition, since doing nothing is not an option because of the costs of unchecked antimicrobial resistance, this implies that a package of interventions will be cost effective. The composition of the most effective package cannot be determined, but those educational components that are cheap and have potentially large reach can be expected to be highly cost effective.

This section will be completed in the final document.

Evidence reviews

Details of the evidence discussed are in the evidence reviews.

The evidence statements are short summaries of evidence, in a review, report or paper (provided by an expert in the topic area). Each statement has a short code indicating which document the evidence has come from.

Evidence statement number 1.1 (1) indicates that the linked statement is numbered 1 in review 1 and relates to key question 1. **Evidence statement number 1.1 (2)** indicates that the linked statement is numbered 1 in review 1 and relates to key question 2. **Evidence statement number 2.1 (1)** indicates that the linked statement is numbered 1 in review 2 and relates to key question 1. **EP1** indicates that expert paper 1 is linked to a recommendation.

If a recommendation is not directly taken from the evidence statements, but is inferred from the evidence, this is indicated by **IDE** (inference derived from the evidence).

Recommendation 1.1.1: IDE

Recommendation 1.1.2: 1.1–1.15, 1.2 (2)–1.11 (2), 1.1 (3)–1.8 (3), 2.3 (2), 3.1 EP2

Recommendation 1.1.3: evidence statements 1.8 (2)–1.11 (2), 2.3 (2)

Recommendation 1.1.4: evidence statements 1.1 (3), 1.4 (3)–1.8 (3)

Recommendation 1.1.5: EP1, EP2; IDE

Recommendation 1.2.1: IDE

Recommendation 1.3.1–1.3.2: EP1, EP2; IDE

Recommendation 1.4.1–1.4.6: evidence statements 1.10, 1.4 (2), 2.1 (2) IDE

Recommendations 1.5.1–1.5.5: evidence statements 1.9, 1.4 (2)–1.7 (2), 1.2 (3), 2.2 (2 EP1, EP2

Recommendations 1.5.6–1.5.7: IDE

Recommendation 1.6.1: evidence statements 1.8 (2), 1.8 (2), 1.9 (2) and 1.4 (3)

Recommendations 1.6.2 and 1.6.3: EP1, IDE

Recommendation 1.7.1–1.7.5: evidence statements 1.1 (1)–1.7 (1),3.2; EP1; IDE

Gaps in the evidence

The Committee identified a number of gaps in the evidence related to the programmes under examination based on an assessment of the evidence. These gaps are set out below.

1. A limited number of studies on changing people's knowledge about:

- How to reduce the spread of airborne diseases such as tuberculosis and flu (for example, by using tissues when coughing and sneezing and disposing of them appropriately).
- Antimicrobials other than antibiotics (that is, antivirals, antifungals and antiparasitics).
- Using antimicrobials for conditions other than respiratory illnesses.

(Source: reviews 1, 2 and 3)

2. A lack of studies aiming to change people's behaviour in relation to:

- Reducing the spread of airborne diseases such as tuberculosis and flu (for example, by using tissues when coughing and sneezing and disposing of them appropriately).
- Antimicrobials other than antibiotics (that is, antivirals, antifungals and antiparasitics).
- Using antimicrobials for conditions other than respiratory illnesses.

(Source: reviews 1, 2 and 3)

3. A lack of studies to determine whether people comply with instructions on taking antimicrobials including completing the course.

(Source: review 1)

4. A lack of studies measuring as an outcome how antimicrobials are used.

(Source: review 1)

5. A lack of studies evaluating older people's knowledge of antimicrobials and antimicrobial resistance.

(Source: review 1)

6. A lack of studies looking at people in diverse social and economic circumstances.

(Source: review 1)

7. A lack of studies evaluating the effectiveness of interventions to change people's behaviour relating to antimicrobial use, antimicrobial resistance or infection prevention in workplace settings.

(Source: review 1)

8. A lack of cost-effectiveness papers.

(Source: review 1)

Recommendations for research

The Guideline Committee has made the following recommendations for research.

1 Cost-effectiveness

How can the design and reporting of outcomes used in infection prevention and antimicrobial intervention studies be improved, so researchers can identify the cost-effectiveness of interventions?

Why this is important

Lack of studies reporting the costs associated with interventions for either infection prevention or antimicrobial use may act as a barrier to their

implementation. If research funding bodies ensure cost-effectiveness measures are included in research this will provide the data needed to support the analysis of cost-effectiveness.

2 Multi-component interventions

How effective are individual components of multi-component interventions to reduce inappropriate antimicrobial use?

Why this is important

Research indicates that multi-component interventions targeting both the public and healthcare professionals do improve people's knowledge of appropriate antimicrobial use. They also reduce inappropriate antimicrobial prescribing (specifically of antibiotics).

Research to determine the effectiveness of different intervention components will mean more effective interventions to reduce inappropriate antimicrobial use.

3 High-risk groups

What infection prevention and antimicrobial interventions are effective for groups of people at high risk of infection, such as those who are immunosuppressed or have a chronic disease? This includes people who:

- are immunosuppressed (for example, because of cancer treatment or an organ transplant)
- have a chronic disease
- live in crowded conditions (see Shelter's definition)
- are homeless
- have been in prison
- have migrated from countries with a high prevalence of infectious diseases such as tuberculosis (examples include South Asia and sub-Saharan Africa).

Why this is important

Most interventions have not been designed for people at high risk of acquiring or transmitting infectious diseases and antimicrobial-resistant strains. Interventions for these groups have focused on reducing the use of antibiotics for respiratory illnesses. More interventions are needed to address antimicrobial use for other high-risk conditions.

Interventions that effectively improve handwashing and food safety practices and reduce antimicrobial use in low-risk populations cannot be assumed to be effective for high-risk groups. In addition, the lessons learnt from interventions that lead to appropriate use of antimicrobials in low-risk populations cannot necessarily be transferred to high-risk groups.

4 Workplace

How effective are interventions in the workplace aimed at infection prevention and to improve antimicrobial use?

Why this is important

The workplace is an important setting for helping to prevent the spread of infection among large numbers of people. Information on what works will have a positive impact on the economy by reducing the potential rise in sickness absence caused by the spread of infectious diseases.

More UK randomised control trials are needed in a range of workplace settings.

Glossary

Antimicrobial resistance

The loss of effectiveness of any anti-infective medicine, including antiviral, antifungal, antibacterial and anti-parasitic medicines.

Antimicrobial stewardship

An organisational or healthcare-system-wide approach to promoting and monitoring judicious use of antimicrobials to preserve their future effectiveness.

Capability, opportunity and motivation

For any change in behaviour to occur, a person must:

- Be physically and psychologically capable of performing the necessary actions.
- Have the physical and social opportunity. People may face barriers to change because of their income, ethnicity, social position or other factors. For example, it is more difficult to have a healthy diet in an area with many fast food outlets, no shops selling fresh food and with poor public transport links if you do not have a car.
- Be more motivated to adopt the new, rather than the old behaviour, whenever necessary.

This is known as the COM-B model (Michie et al. 2011[3]).

Self-care

Looking after yourself in a healthy way – for example, drinking plenty of fluids and getting sufficient rest when you have a cold.

Self-limiting condition

An illness or condition that either resolves on its own or that has no long-term harmful effect on a person's health (assuming that they are not immunosuppressed). Examples include colds, flu, oral thrush, winter vomiting bug and uncomplicated urinary tract infections.

For other social care terms see the Think Local, Act Personal Care and Support Jargon Buster.

[3] Michie S, van Stralen MM, West R (2011) The behaviour change wheel: a new method for characterising and designing behaviour change interventions, Implementation Science 6: 42

ISBN: