Antimicrobial stewardship: Changing risk related behaviours in the general population

Evidence reviews 1-3: Collated evidence statements

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Review 1: Antimicrobial stewardship - The effectiveness of educational interventions to change risk-related behaviours in the general population: A systematic review

Review carried out by RAND Europe

Research question 1: 'Which educational interventions are effective and cost-effective in changing the public's behaviour to ensure they only ask for antimicrobials when appropriate, and use them correctly?'

Pharmacist – led interventions targeting patients or carers of patients

Evidence Statement 1.1(1) Pharmacist-led verbal education, supplemented with an information leaflet

There is weak evidence from one non-randomised controlled trial (non-RCT) (-)1, one randomised controlled trial (RCT) (-)2 and one pre–post study (-)3 indicating that verbal education on antibiotic adherence from a pharmacist, or the combination of written and

verbal education on antimicrobial (AM)use and antimicrobial resistance (AMR) delivered by pharmacists, can improve patients' adherence to treatment and knowledge of AM use, but that written and verbal education did not increase awareness of AMR. However, baseline awareness was high, potentially leaving less room for knowledge gain.

One non-RCT1 (-) (Spain; n=138) found that individualised verbal education about treatment characteristics, duration, dosage regime and how to use the antibiotic delivered by a pharmacist to patients and/or carers before collecting an antibiotic prescription, lead to increased adherence (a OR 2.23 [95%CI:1.01 to 4.93] p=0.047).

One RCT2 (-) (Australia; n=34) found that the provision of a patient education leaflet plus verbal education from a pharmacist led to improved knowledge of antibiotics (the mean difference in 'antibiotic knowledge' score increased by 33.3% (± 40.8), from 60.0% (± 43.9) to 86.6% (± 17.2) (p=0.008). Conversely, in the control group (who received a 'Consumer Medicines Information' leaflet only), there was a non-significant decrease in knowledge of antibiotics; the mean difference in 'antibiotic knowledge score decreased from 83.3% (± 23.6) to 80.0% (±35.8) (p=non-significant (ns)). No statistical comparisons were made between the control and intervention groups.

One pre–post study3 (-) (USA; n=130) reported that pharmacist-led verbal education and a patient educational leaflet and handout significantly improved patients' overall understanding of AMR, from 56.5% at baseline to 78.3% at follow up (p=0.026). However, the change-from-baseline for all three individual component questions/statements was non-significant, potentially because baseline knowledge of the participants was already high. The results also indicated some improvements in patients understanding of the appropriate use of antibiotics. There was a significant increase in the number of patients who correctly reported that antibiotics should not be used to treat viral infections for two out of the four conditions surveyed: cold, from 58.7% to 80.4% (p=0.02), and flu with body aches, from 34.8% to 60.9% (p=0.02).

Applicability:

While none of the studies were conducted in the UK, the evidence is directly applicable to people in the UK as there are no obvious differences in the population, context or setting of the studies compared with the UK context.

1. Munoz et al. 2013 (-)
2. Northey et al. 2010 (-)
3. Rodis et al. 2004 (-)

Interventions based in general practice and/or led by a GP targeting patients or parents of paediatric patients

Evidence Statement 1.2(1) Video- and information leaflet–based interventions in general practice and/or led by a GP targeting parents of paediatric patients

There is weak evidence from two RCTs (+)[1] (-)[2] and one non-RCT (-)[3] that the combination of an educational video on antimicrobial use and antimicrobial resistance, supplemented by an information leaflet delivered within a primary care setting, can improve parents' knowledge of appropriate antimicrobial use and expectations of antimicrobials for their child, but that it was not effective in improving awareness of AMR.

One RCT[1] (+) (USA; n=206) found that a 20-minute video programme, supplemented by an information leaflet, both of which aimed to educate parents on the problem of bacterial

resistance to antibiotics and their appropriate use to prevent the development of resistance, did not have an impact on knowledge scores or any of the five statements related to beliefs, but did have a significant impact on one of the five behaviour statements: there was a reduction in saving antibiotics for later use when compared with the control group, 3.82 vs 3.62 (p=0.02).

One RCT[2] (-) (USA; n=499) conducted in a paediatrician's office reported that an information leaflet ('Your Child and Antibiotics') and a video presented by a GP on judicious use of antibiotics was effective in increasing parents' knowledge of when to use antibiotics for all five statements related to appropriate use of antibiotics for specific conditions in children compared with control, but for only one out of the five more general statements related to increasing awareness of AMR.

One non-RCT[3] (-) (USA; n=771) conducted in a GP's office found that provision of an information leaflet ('Your Child and Antibiotics') and a video in waiting rooms significantly improved knowledge of when to take antibiotics in those who reported seeing the video vs those who reported not seeing the video at 36 weeks post-intervention: 7.1% vs 29.2% thought that antibiotics should be used to treat a child with fever or a cold ($p \leq 0.001$), and 13.8% vs 44.3% wanted/expected the doctor to prescribe antibiotics for their child ($p < 0.001$).

Applicability:

While none of the studies were conducted in the UK, the evidence is directly applicable to people in the UK, despite differences in the broader healthcare context in the USA, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Bauchner et al. 2001 (+)
2. Taylor et al. 2003 (-)
3. Wheeler et al. 2001 (-)

Evidence Statement 1.3(1) Communication and/or information leaflet-based interventions in general practice targeting parents of paediatric patients

There is inconsistent evidence from one RCT(-)[1] and one cluster-RCT (+)[2] on the effectiveness of educational interventions that aim to improve patient doctor dialogue during a GP consultation, supplemented by an information leaflet, on parents expectation of antibiotic treatment or 'intention to consult', but there was significant reduction in antibiotic consumption.

One RCT (-)[1] (USA; n=80) found that an intervention to enhance communication between parents and their child's physician (involving role play) and/or an information leaflet ('Your Child and Antibiotics'),plus a fact sheet about antibiotics and AMR, did not significantly change parents' expectations of antibiotic treatment for their child compared with the control group, who were given information on child nutrition. We note that the results were not clearly presented and that therefore no clear data can be presented here.

One cluster-RCT[2] (+) (England and Wales; n=558 children) found that online training for GPs in combination with a booklet, designed to be used as a consultation aid (to increase doctor/patient communication) and a take home resource for parents, led to significant reductions in antibiotic consumption (22.4% in intervention vs. 43% in control; aOR [95% CI 0.18 to 0.66]) and parents' intention 'to consult if their child had a similar illness' (55.3% in intervention vs. 76.4% in control; aOR 0.34 [95%CI 0.20 to 0.57]).

Applicability:

While one of the studies was not conducted in the UK, the evidence is directly applicable to people in the UK, despite differences in the broader healthcare context in the USA, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Alder et al. 2005 (-)
2. Francis et al. 2009 (+)

Evidence Statement 1.4(1) Cold pack and information leaflet–based intervention in general practice led by a GP targeting adult patients

There is weak evidence from one non-RCT (-)[1] (USA; n=299 analysed) that an information leaflet ('Antibiotics – Did You Know?') distributed in a primary care setting to all participating adult patients, significantly decreased the patients' perceived need for antibiotics at post-test follow up ($p<0.001$ [pre vs. post for all participants]) and increased their knowledge of appropriate antibiotic use (i.e. for what illnesses one should take antibiotics) ($p<0.034$ [pre- vs. post for all participants]). A sub-sample of patients were allocated a cold pack which contained products designed to provide symptomatic relief, and subgroup analysis revealed that an increase in appropriate antibiotic use knowledge was significantly larger for the education group ($p<0.002$), but not for those who received both education and a cold pack' kit.

Applicability:

While the study was not conducted in the UK, the evidence is directly applicable to people in the UK as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Alden et al. 2010 (-)

Evidence Statement 1.5(1) Information leaflet (with or without delayed prescription) targeting patients

There is inconsistent evidence from one RCT (-)[1] and one nested-RCT (+)[2] on the effectiveness of information leaflets within a primary care setting to reduce antibiotic use in patients with lower respiratory tract infections.

One RCT (-)[1] (UK; n=807) conducted in a primary care setting found that providing patients (with acute lower respiratory tract infection) with an information leaflet about the natural history of the condition, had no significant effect on antibiotic use ($p=0.58$), satisfaction with treatment ($p=0.24$) or belief in antibiotics ($p=0.73$) when compared to no leaflet. Patients in this study were also randomised to receive no prescription, delayed prescription or immediate prescription, but leaflet vs. no leaflet results were not presented within each of these prescribing practices.

One nested-RCT[2] (+) (UK; n=212) found that an information leaflet about the natural course of lower respiratory tract symptoms and the advantages/disadvantages of antibiotic use provided to patients with acute bronchitis who were judged by their GP not to need antibiotics but given a prescription with the advice that they did not need it, significantly

reduced inappropriate antibiotic use. Patients in the intervention were significantly less likely to take the antibiotics prescribed compared with patients in the control, who received standard care (RR 0.76 [95%CI: 0.59 to 0.97], p=0.04).

Applicability:

While one of the studies was not conducted in the UK, the evidence is directly applicable to people in the UK as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Little et al. 2005 (-)
2. Macfarlane et al. 2002 (+)

Evidence Statement 1.6(1) Interactive computerised education module based in A&E targeting patients

There is weak evidence from one pre–post study (-)[1] (USA; n=686) that an educational interactive computerised kiosk situated in an A&E department reduced the desire for antibiotics in patients presenting with acute respiratory infection (ARI). This study found that the proportion of patients with a low desire for antibiotics increased after completing the module, from 22% to 49% (p<0 .001), and that the proportion who strongly wanted antibiotics decreased from 34% to 27% (p<0.001). Change in desire was positively associated with self-report of having learnt something new at the end of the module (aOR 1.67 [95%CI: 1.14 to 2.45]).

Applicability:

The evidence is partially applicable to people in the UK. This is because the population attending A&E for acute respiratory infections in the USA may be more likely to be uninsured and to have lower socioeconomic status; in those respects it may differ from the population in the UK.

1. Price et al. 2011 (-)

Evidence Statement 1.7(1) Video or information leaflet based in A&E targeting parents of paediatric patients

There is weak evidence from one RCT (-)1 (USA; n=337) that an animated video or information pamphlet delivered in an emergency department of a hospital significantly increased parents' mean rank self-reported knowledge score of appropriate antibiotic use immediately post intervention and at four weeks follow-up, compared to controls. There was no difference in mean score between the video and pamphlet group post intervention (p=0.19) but the video group performed significantly better at four weeks follow up (p=0.04). The video group was also significantly less likely to report that they would ask paediatrician for antibiotic if their child had an illnesses (such as cold and fever) that had been discussed during the intervention than the pamphlet group: 35.4% vs. 14.5%, respectively (p=0.003).

Applicability:

The evidence is partially applicable to people in the UK. This is because the population attending A&E for acute respiratory infections in the USA may be more likely to be uninsured

and to have lower socioeconomic status; in those respects it may differ from the population in the UK.

1. Schnellinger et al. 2010 (-)

Evidence Statement 1.8(1) Culturally appropriate, home-based educational intervention targeting Latino population

There is weak evidence from one pre–post study1 (+) (USA; n=422 analysed) that a culturally sensitive home-based educational intervention can increase participants' knowledge of whether it is appropriate to take antibiotics for a cold, sore throat, asthma and influenza ($p<0.01$ for each).

Applicability
The evidence is partially applicable to the wider UK population, as the study population may differ from the population in the UK. The intervention could be conducted in the UK context and is likely to be relevant to other ethnic minority groups as well.

1. Larson et al. 2009 (+)

Interventions based within primary or secondary schools and/or targeting school aged children

Evidence Statement 1.9(1) School-based interventions led by a teacher targeting school children or interventions targeting school aged children

There is inconsistent evidence from four pre–post studies – three (-)1,2,4 and one (+)5 – and one RCT (-)3 concerning whether school-based interventions can positively impact on students' knowledge and understanding of the concepts of bacteria, antimicrobials and appropriate antimicrobial use.

One pre–post study1 (-) (UK; n=1736 [school n=62, online n=1674]) found that an e-Bug-developed 'junior student'–level computer game for 9- to 12-year-old children did not significantly change students' knowledge of appropriate antibiotic use (e-Bug is a Europe-wide antibiotic and hygiene teaching
resource).

Two pre–post studies (-)2 (+)3 (UK; n=48 and n=251, respectively) found that a two-day workshop titled Antibiotics and Your Good Bugs, for children 9 to 10 years of age, or a 'Bug Investigators' pack, for children 10 to 11 years of age, effectively improved knowledge of microbes/infection and antibiotics and appropriate antibiotic use but did not have any effect on awareness of AMR.

One pre–post study4 (-) (Portugal; n=42) found that a one-week hands-on programme, whose title translates as Microbiology Recipes: Antibiotics a la carte, for high school students aged 15 to 16 years old significantly improved students' knowledge of bacteria and antibiotics, appropriate antibiotic use and awareness of AMR ($p<0.05$ improvement on all questions).

One RCT5 (-) (Italy; n=249) found that an educational food safety campaign, whose title translates as Mission on the Invisible World (which included information on bacteria), did not significantly progress the students' knowledge of 'insight into flu and antimicrobial resistance' (p-values were not reported).

Applicability

While two of the studies were not conducted in the UK, the evidence is directly applicable to people inthe UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Farrell et al. 2011 (-)
2. McNulty et al. 2001 (-)
3. McNulty et al. 2007 (+)
4. Fonseca et al. 2012 (-)
5. Losasso et al. 2014 (-)

Intervention based in day care centre led by health educator/child care provider targeting parents

Evidence Statement 1.10(1) Day care–based intervention led by health educators/child care providers targeting parents

There is weak evidence from one RCT1 (-) (USA; n=659) that the provision of educational materials (brochures, leaflets, colouring sheets and handouts on appropriate antibiotic use) disseminated by care workers may lead to improvements in knowledge of appropriate antibiotic use among parents with a college education (9-point knowledge median score pre vs. post intervention: 7 vs 6.5, $p<0.01$), but not for parents without a college education (median score 6 vs 6, $p=0.20$).

Applicability:

While the study is not set in the UK, the evidence is directly applicable to people in the UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Croft et al. 2007 (-)

Interventions implemented within the community

Evidence Statement 1.11(1) Mass media campaign (advertisements in magazines and newspapers, posters and leaflets) at the community level

There is weak evidence from two US studies (one cluster RCT (+)1 and one non-RCT (-)2) indicating that media campaigns delivered within a community setting have no effect on a community's knowledge of antibiotics, demand for antibiotics, or use of antibiotics without a prescription.

One cluster RCT1 (+) (USA; 2000 n=nr; 2003 n=5580) involved a multicomponent educational intervention consisting of six mailed newsletters highlighting misconceptions about antibiotic use for conditions such as colds sent to low-risk patients, as well as other educational materials (stickers, posters, information leaflets and fact sheets) made available in waiting rooms of local paediatric providers, pharmacies and child care centres, versus nothing in the control communities. There was no significant improvement in knowledge scores or demand for antibiotics in intervention communities compared with control

communities (aOR 1.2 [95%CI: 0.8 to 1.7]). In sub-analysis, however, a significant impact was observed by insurance provider: the proportion of parents with high antibiotic knowledge significantly increased among parents of Medicaid-insured children (aOR 2.2 [95%CI: 1.1 to 4.5]), but not among parents of non–Medicaid-insured children (aOR 1.0 [95%CI: 0.6 to 1.4]).

One non-RCT2 (-) (USA; pre-intervention n=273, post-intervention n=293, control post-intervention n=306) showed that a mass media campaign specifically targeting a Latino population was not effective in decreasing the number of antibiotics bought without a prescription in the past 12 months (OR 0.85 [95%CI: 0.27 to 2.63]) and was ineffective at changing participants' beliefs that antibiotics should not be available without a prescription; 30.6% in the intervention community believed they should be available without a prescription before the intervention, compared with 48.0% after and 35.8% in the control post-intervention ($p<0.05$).

Applicability

The evidence is only partially applicable to people in the UK. This is because the study populations in these studies or the services available to them may differ from those in the UK. It should be noted that antibiotics cannot be legally obtained in the UK without a prescription.

1. Huang et al. 2007 (+)
2. Mainous et al. 2009 (-)

Evidence Statement 1.12(1) Mass media campaign (information leaflet, posters, nurse educators, newspaper articles) and GP intervention targeting parents at the community level

There is weak evidence from one RCT1 (-) (USA; n=430) that a community-based intervention involving an information leaflet ('Your Child and Antibiotics'), posters, nurse educators, newspapers articles, and a GP intervention to promote appropriate antibiotic use was effective at increasing parents' knowledge of AMR.

The difference in change in knowledge from baseline to post-intervention was significantly greater for the intervention group than the control, namely, 10% ([95%CI 1.9 to 18.1] $p=0.015$). In terms of decreasing parents' desire for antibiotics for their child, the change in desire from baseline to post-intervention was significantly greater for the intervention, namely, -8.4% (-13.9 to -2.8) ($p=0.003$). The evidence related to parents' understanding of when to use antibiotics was less clear; at post-intervention the mean score was significantly lower (better) in the intervention area than control (2.7 vs 3.5, $p<0.001$); however, the change from baseline for the intervention and control groups was not significantly different (-1.1 vs -0.8, $p=0.07$).

Applicability

While the study was not conducted in the UK, the evidence is directly applicable to people in the UK as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Trepka et al. 2001 (-)

Interventions targeting the general public

Evidence Statement 1.13(1) Interactive science show based in a holiday resort targeting families with children

There is weak evidence from one pre–post study1 (+) (UK; n=406) that a science show and interactive stalls based on the e-Bug educational packs can significantly improve knowledge of antibiotics, knowledge of appropriate antibiotic use (e.g. not keeping antibiotics for later use), and AMR in children aged 5 to 11 years old. Children's knowledge significantly improved for all questions; overall, the percentage of children correctly answering questions increased by 25% ($p<0.001$). For parents the impact was less marked; knowledge increased for all three questions related to antibiotics and for one of the two questions related to AMR, but not for questions related to antibiotic use. However, baseline knowledge was 95% for both questions.

Applicability

The evidence is directly applicable to parents and children in the UK.

1. Lecky et al. 2014 (+)

Evidence Statement 1.14 (1) Web based educational intervention targeting the general public

There is weak evidence from one pre–post study1 (-) (UK; n=277) that a health information website significantly improved peoples' attitudes towards prescribing (i.e. expectation of being prescribed antibiotics for acute otitis media decreased), but that, overall, it did not significantly improve peoples' awareness of AMR (significant for only three out of seven statements tested) or improve knowledge of appropriate antibiotic use (e.g. taking a full course) (significant for only three out of the six statements tested).

Applicability

While the study was conducted in the UK, it may not be directly applicable to the wider population given that it was conducted in a museum setting and almost a quarter of respondents were doctors.

1. Madle et al. 2004 (-)

Evidence Statement 1.15(1) Mass media (advertisements in magazines and newspapers, posters and leaflets) and GP interventions at the population level

There is weak evidence from three pre–post studies (-)1,2,3 and one repeated cross-sectional survey (-)4 that mass media campaigns targeting the general public do not have an effect or have only a small effect on knowledge of and attitudes towards appropriate antibiotic use.

A pre–post study1 (-) (New Zealand; 1998 n=282, 2003 n=387) that collected information on public views and use of antibiotics for colds in adolescents and adults in 1998 and subsequently from 2002 found that the national campaign did not change the public's understanding of antibiotic efficacy against viral infections (41% vs. 38% p=0.9). When specific symptoms were evaluated, however, there was significantly improved knowledge of appropriate antibiotic use for six out of the 13 symptoms. Despite limited impact on

knowledge, however, the number of respondents reporting that they consulted a doctor about a cold or flu significantly decreased from 62% to 45% (p<0.001).

One pre–post study (with control post-intervention)2 (-) (UK; 2008 n=1888 [England=1706,Scotland=182; 2009 n=1830[England=1707, Scotland=123]) reported that the 2008 English public antibiotic poster campaign had no impact on the proportion of incorrect answers among English respondents to the statement 'Antibiotics work on most coughs and colds'. The incorrect response decreased from 40% in 2008 to 37% in 2009, p=0.30. Compared with Scotland, there was no significant difference for nine out of ten questions related to attitudes towards antibiotic use. Self-reported changes in use of antibiotics did not significantly change for two out of the three measures; the number of English respondents reporting that they kept left-over antibiotics significantly increased, from 2.2% to 7.0%, p<0.001. Compared with Scotland, self-reported changes in use did not significantly differ for two out of the three measures.

One pre–post study3 (+) (UK; 1999 n=982, 2000 n=1941) found that a nationwide public education campaign known as CATNAP (Campaign on Antibiotic Treatment and the National Advice to the Public) that promoted the need to cherish and preserve your normal bacterial flora, locally enhanced to include more channels of promotion, did not significantly change the public's knowledge of appropriate antibiotic use. There was no change for all seven of the general questions posed, while for questions related to appropriate antibiotic use among children, a significant change was only observed for one out of the five questions – the proportion of adults who agreed that children should be prescribed antibiotics for fever significantly decreased, from 56% to 49% (follow-up difference -7% [one-sided 95%CI: -13.5]).

A repeated cross-sectional survey4 (-) (Australia; 1999 n=1614; 2000 n=1603; 2001 n=1800; 2003 n=1200; 2004 n=1200) reported on a community campaign to reduce inappropriate use of antibiotics for the common cold in adolescents and adults. There was a significant decline in those who believed taking antibiotics for cold and flu is appropriate, from 28.7% pre-programme in 2002 to 21.7% in 2004 (percentage-point change 7.0 [95%CI: 3.5 to 10.5]). A comparison of successive yearly consumer surveys revealed a significant decrease in self-reported use of antibiotics to treat a cough, a cold or the flu, from 10.8% in 1999 down to 7.4% in 2004 (percentage-point change 3.4 [95%CI: 1.3 to 5.5]).

Applicability

Two of the studies were conducted in the UK. The other two studies are directly applicable to people in the UK as there are no obvious differences in the population, context or setting in these studies compared with the UK context.

1. Curry et al. 2006 (-)
2. McNulty et al. 2010 (-)
3. Parsons et al. 2004 (+)
4. Wutzke et al. 2007 (-)

Research question 2: 'Which educational interventions are effective and cost-effective in changing the public's behaviour to prevent infection and reduce the spread of antimicrobial resistance?'

Evidence statements relating to: Infection and/or hand hygiene

Interventions based in healthcare settings

Evidence Statement 1.1 (2) Healthcare centre–based intervention led by nurses targeting veterans with spinal cord injuries and disorders

There is weak evidence from one pilot RCT study1 (-) (USA; n=69) that a nurse-administered patient educational intervention about methicillin-resistant Staphylococcus aureus (MRSA) in veterans with spinal cord injuries and disorders does not alter participants' knowledge of MRSA (p=0.81) or their self-reported hand hygiene behaviours following such activities as using the toilet (p=0.83); it may, however, improve participants' perception that the intervention altered their hand hygiene behaviour (p=0.02).

Applicability

The evidence is partially applicable to people in the UK population, as the population in this study is likely to differ from the wider UK population.

1. Evans et al. 2014 (-)

Evidence Statement 1.2 (2) Waiting room of A&E based intervention targeting paediatric patients and their parents

There is weak evidence from one pilot RCT 1 (-) (USA; paediatric patients n=60, parents n=57) that hand hygiene education, with or without the use of Glo Gel (to show unclean hands under black light) in a hospital emergency department setting, significantly improved hand cleanliness in paediatric patients pre to post intervention 16.3 (±3.66) to 17.9 (±3.91), with a mean improvement score of 1.60 (±4.7) (p=0.02); there was no significant difference between the groups (p=0.82). For adults there was no significant difference between pre and post intervention (mean improvement score 0.46 (±5.03), p=0.55). There was also a significant improvement among paediatric patients from pre to post intervention for self-reported washing hands of with warm water (70% vs. 85%, p=0.01) but no difference in other behaviours (i.e. wash hands before dinner; wash hands after bathroom). There was no difference between intervention and control for any self-reported behaviour outcomes (p>0.6 for all three questions). There was no difference from pre to post intervention or between the intervention and control in parents self-reported hand hygiene behaviour (p>0.9 for all), but baseline compliance with hand hygiene behaviour was high.

Applicability

The evidence is partially applicable to people in the UK population, as the population attending A&E for acute respiratory infections in the USA may be more likely to be uninsured and to have lower socioeconomic status; in those respects it may differ from the population in the UK

1. Fishbein et al. 2011 (-)

Intervention based in the home led by researchers targeting the Latino community

Evidence Statement 1.3(2) Culturally appropriate, home-based educational intervention targeting Latino population

There is weak evidence from two pre–post (+)1 (-)2 that a culturally appropriate, home-based educational intervention significantly improved knowledge of respiratory infection prevention and improved hand hygiene behaviour (i.e. use of sanitizer) and uptake of influenza vaccination in urban Latinos.

One pre–post study1 (+) (USA; n=422 analysed at end) found that a culturally sensitive, home-based educational intervention led to improved mean composite knowledge scores (out of 10) from 5.19 (□1.60) pre-intervention to 5.91 (□1.71) post-intervention (p<0.001). While the proportion of participants reporting that they use alcohol-based hand sanitizer some of the time increased from 1.4% to 66.8% (p<0.001), the proportion washing with antibacterial soap decreased from 45.3% to 24.9% (p<0.001). Finally, there was a reported increase in the number of households with one or more members receiving an influenza vaccination, from 63.7% to 73.9% (p<0.001).

One pre–post study2 (-) (USA; n=509) reported significant improvements in households' knowledge of prevention and treatment strategies for all three interventions, namely, (1) education only; (2) education and hand sanitizer; and (3) education, hand sanitizer and face masks. The change in knowledge score was significantly greater for the education and hand sanitizer group compared with the other groups, from 5.48 to 7.24 (out of a score of 10) (p<0.001). Likewise, while rates of vaccination increased in all three groups, it was greatest in the education and hand sanitizer group compared with the other groups, increasing from 19.0% to 57.1% (p<0.001).

Applicability

The evidence is partially applicable to the wider UK population, as the studies' populations may differ from the population in the UK, although the intervention could be conducted in the UK context and is likely to be relevant to other ethnic minority groups.

1. Larson et al. 2009 (+)
2. Larson et al. 2010 (-)

Interventions based within pre-school or primary led by a teacher targeting young children

Evidence Statement 1.4(2) Preschool- or primary school–based interventions involving appropriate hand hygiene instruction and other educational activities
There is weak evidence from two pre–post studies (-)2 (-)3 and one cluster RCT (-)1 that hand hygiene instruction, with additional educational activities, may improve hand hygiene behaviour in preschool and primary school children.

One cluster RCT1(-) (Switzerland; n=61) found that hand and nail hygiene instruction in kindergarten classes, for children aged 4 to 6 years old, had a limited effect in improving hand cleanliness (0% both hands clean to 100% both hands dirty) among children who received the intervention, from 34% to 22% (p=0.30) four weeks after the intervention, but that it did have a significant impact on nail hygiene (0% both sides of all 10 fingers clean to 100% both sides of all 10 fingers dirty), which improved from 68% to 53% (p=0.007) among children. The authors reported that the observed improvements for both hand and nail hygiene were significantly greater among children in the intervention than control (p-values

were not reported). We note that the way in which the results are presented by the authors is not clear.

One pre-post study2(-) (USA; n=406) reported that parents and teachers observed a positive improvement in the hand hygiene of children attending the second grade of primary school over the course of a four week, multicomponent education programme, broadly involving appropriate hand washing education, a UV fluorescent glow which allowed the children to observe how well they had washed hands, teacher– student discussions and a range of materials (e.g. stickers, colouring sheets): 64% of parents and 94% of teachers reported that the frequency of hand washing increased (p-values were not reported).

One pre–post study3 (-) (USA; n=35) found that a day care–based intervention for children aged 3.5 to 5 years old, involving hand washing instruction, the Glo Germ UV light, singing, a story, and a video, improved hand washing behaviour in preschool children: the use of soap was observed to increase from 54% to 87%, and rubbing hands together for more than ten seconds increased from 20% to 53% (p values were not reported). Parents of the children perceived that children's understanding of the relationship between germs and hand washing increased.

Applicability:

While none of the studies were conducted in the UK, the evidence is directly applicable to people in the UK as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Ramseier et al. 2007 (-)
2. Tousman et al. (2007) (-)
3. Witt and Spencer 2004 (-)

Evidence Statement 1.5(2) Primary school–based interventions involving appropriate hand hygiene and respiratory etiquette, and placement of hand sanitizers for teachers and students

There is weak evidence from one cluster RCT (-)1 (USA; n=167) that a multicomponent educational intervention may improve hand hygiene behaviour, hygiene etiquette and knowledge of germs in primary school students.
The intervention involved educating teachers and students about appropriate hand hygiene, hand etiquette, and 'cover your cough' behaviours; providing information about 'germs' and influenza; and placing hand sanitizer in all classrooms and common areas. The average number of times students washed/sanitized their hands per day was 3.95 in the intervention school vs 3.08 in the control school (p=0.014). Appropriate behaviour related to covering coughs and sneezes was higher in intervention than control schools: 3.76 vs 3.29, p=0.002. Students in the intervention schools also had improved knowledge of how to stop the spread of germs (p<0.001).

Applicability:

While this study was conducted in the USA, there are no obvious differences in the population, context or setting of the study compared with the UK.

1. Stebbins et al. 2010 (-)

Interventions based in schools and/or targeting children nine years of age or older

Evidence Statement 1.6(2) E-bugs educational interventions targeting children 9 years of age or older

There is inconsistent evidence from five studies (four pre–post studies (-)1,2,4 (+)5 and one non-RCT (-)3) concerning whether or not e-Bug-based interventions improve knowledge of microbes, awareness of infection, infection prevention and/or hand hygiene among children aged 9 to 15 years old.

One pre–post study1 (-) (UK; n=1736 [school n=62, online=1674]) found that an e-Bug computer game for 9- to 12-year-old children did not lead to a significant improvement in children's knowledge of microbes/infection/hand hygiene. Knowledge significantly changed for only 3 out of 21 questions: 2 related to knowledge of microbes (p=0.001 and p=0.02) and 1 related to the benefits of using soap
(p=0.02).

One pre–post study2 (-) (UK; n=225) found that, following a modified e-Bug lesson plan, 9- to 11-year old children showed a significant improvement in overall knowledge of microbes, hand hygiene and farm hygiene (p<0.001). However, improvements were not shown for all questions within each topic.

One non-RCT study3 (-) conducted in the Czech Republic, England and France, found that the e-Bug educational pack focussing on knowledge of prudent antibiotic use and hygiene significantly improved children's 'knowledge of infection' in some countries/regions, but not in others. In England (n=2136), knowledge of microbes, of how infections are spread, and how to treat and prevent infection did not significantly differ in junior school children (9- to 11-year-olds) exposed to the intervention compared with children in the control schools. But the authors reported that there were significant improvements among senior school children (12- to 15-year-olds) for all outcomes immediately following the intervention and at six months follow up (p-values were not reported).

One pre–post study4 (-) (UK; n=48) found that a two-day workshop titled Antibiotics and Your Good Bugs, for children aged 9 to 10 years old, did not significantly increase the number of children who correctly identified the need to wash their hands after various activities. However, baseline values were high: the overall score increased from 94% to 96% (p=0.5).

One pre–post study5 (+) (UK; n=251) found that use of a 'Bug Investigators' pack for children aged 10 to 11 years old resulted in a significant increase in the proportion of children who correctly identified that they needed to wash their hands after all 10 activities presented, from 90% to 94% (p<0.001).

Applicability

While one of the studies included study sites outside of the UK, the evidence is directly applicable to people in the UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Farrell et al. 2011 (-)
2. Hawking et al. 2013 (-)
3. Lecky et al. 2010 (-)
4. McNulty et al. 2001 (-)
5. McNulty et al. 2007 (+)

Evidence Statement 1.7(2) School-based educational interventions targeting children 9 years of age or older

There is weak evidence from one pre–post study (-)1 and one RCT (-)2 that school-based interventions can improve hand washing behaviour.

One pre–post study1 (-) (USA; n=73) found that a five-week hygiene intervention programme called High Five for Healthy Living was effective in improving hand washing behaviour in 11- to 14-year-olds (predominantly African American) attending an afterschool club; 67% of students improved their test scores by 10% (p-values were not reported).

One RCT (-)2 (Italy; n=249) found that an educational programme involving multimedia and movies taught in either a practical or a theoretical class, targeting fifth grade students (aged 9 to 11 years old),significantly improved appropriate hand hygiene behaviour in both classes (Incidence Risk Ratio (IRR) 3.4 [95%CI: 2.2 to 5.2]) and 3.2 [95%CI: 1.9 to 5.5]), but did not improve knowledge of hand hygiene in either class (IRR 1.1 [95%CI: 1.0 to 1.2] and 1.0 [95%CI: 0.9 to 1.2]).

Applicability

While neither study was based in the UK, the evidence is directly applicable to people in the UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Baker et al. 2012 (-)
2. Losasso et al. 2014 (-)

Evidence Statement 1.8(2) Poster campaigns displayed in university restrooms

There is inconsistent evidence from one RCT (-)2, one pre-post study (-)2 and one non-RCT (-)3 concerning whether or not posters placed in public toilets in university buildings improve the frequency of hand washing or the use of soap, but there does appear to be a significant increase in the use of hand sanitizer.

One RCT1 (-) (USA; n=252 observations, n=95 surveys) conducted in public toilets on a university campus found that posters with different descriptive norm messages (a high-prevalence message: ‘Four out of five college students wash their hands EVERY time they use the bathroom.’ or a low-prevalence message: ‘One out of five college students wash their hands EVERY time they use the bathroom.’) led to a significant increase in the frequency (low prevalence vs. no poster aOR 19.39 p=0.006; high prevalence vs. no poster aOR 6.53 p=0.033) and length of time that participants washed their hands in seconds (high prevalence 9.94 (±7.78), low prevalence 9.57 (±7.78), no poster 6.04 (±7.58), p=0.04) compared to no poster, but not for use of soap (p=0.54). Positive attitudes towards hand washing were significantly greater for the high and low prevalence message compared to no message (p=0.01).

One pre–post study1 (-) (USA; n=1,005 observations, n=188 surveys) found that a hand hygiene poster campaign targeting university students did not increase observed rates of hand washing but did significantly increase the use of soap during hand washing, from 58.0% to 78.1% (p<0.001). Women were observed to wash their hands and use soap significantly more frequently than men (90% vs 80%, p<0.001).

One non-RCT3 (-) (USA, n=not measured) conducted in public buildings on a university campus found that signs promoting hand hygiene placed next to a hand sanitizer

significantly increased hand sanitizer use. Depending on the framing of the message on the sign, the usage increase ranged from 40.6% to 66.4% compared to dispensers with no sign ($p<0.01$). The greatest usage was observed when the message 'Stay healthy this season. Sanitize your hands' was placed next to dispensers and the smallest increase was for the message ('Germs are out to get you. Get them first!. The signs had a consistent influence on usage over time and were not significantly moderated by temporal trends ($p>0.10$).

Applicability

While the studies were not conducted in the UK, the evidence is directly applicable to people in the UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Lapinski et al. 2013 (-)
2. Mackert et al. 2013 (-)
3. Updegraff et al. 2014 (-)

Evidence Statement 1.9(2) Message campaign and hand sanitizer targeting university students

There is weak evidence from one non-RCT (-)2 and one non-RCT (-),3 indicating that university-based poster campaigns, with the provision of hand sanitizer and/or a researcher interacting with students, can lead to an increase in the rates of hand washing with had sanitizer and an increase in frequency of hand washing per day.

One non-RCT3 (-) (USA; n=6454) evaluated the impact of an information poster ('Sanitize your hands to prevent cold and flu') placed next to cashier counter en route to a food and drink service in a cafeteria, access to hand sanitizer, and a researcher promoting hand hygiene, compared with the poster and sanitizer alone. On days when all three interventions were implemented, the percentage of students using hand sanitizer was high (60%) compared with those days when only two components were implemented (15–18%) (p-values were not reported).

One cluster non-RCT2 (-) (USA; n=430) found that a poster campaign detailing the 'Top 10 gross things students have on their hands', coupled with free hand sanitizer, posted in student halls of residence, effectively improved students' knowledge of the role of hand hygiene in infection control. While students' perceived frequency of engaging in hand hygiene did not differ between the intervention and control, the reported rates of weekly hand washing (students provided weekly reports documenting hand washing activity) were significantly higher among intervention students than controls; 0.48 vs 0.43 times per hour, $p<0.02$.

Applicability

While none of the studies are set in the UK, the evidence is directly applicable to people in the UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Fournier and Berry 2012 (-)
2. White et al. 2003, 2005 (-)

Interventions targeting the general public

Evidence Statement 1.10(2) Web-based interactive module targeting the general population

There is weak evidence from one RCT1 (+) (UK; n=517) that a web-based interactive module conducted over four weeks significantly improved self-reported rates of hand washing in adults and that the improvements were sustained eight weeks after the intervention (on a scale of 1[zero to two times per day] to 5 [more than ten times per day]): 4.45 in intervention vs 4.12 in the control ($p<0.001$). The intervention also increased positive attitudes, and intentions of hand washing, when compared with controls who received no intervention.

Applicability

The evidence is directly applicable to the UK population.

1. Yardley et al. 2011 (+)

Evidence Statement 1.11(2) Mass media campaign targeting the general population

There is weak evidence from one pre–post study1 (+) (Germany; 2008 n=2006, 2009 n=2006), which investigated perceptions of hand hygiene before and after a public campaign titled Wir gegen Viren [Us Against Viruses], that the perceived efficacy of hand hygiene and coughing into the sleeve as an infection control method increased over time among the general public: aOR 1.54 [95%CI: 1.31 to 1.80] and aOR 13.07 [95%CI: 10.00 to 17.08], respectively.

Applicability

While the study was not conducted in the UK, the evidence is directly applicable to people in the UK, as there are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Meilicke et al. 2013 (+)

Research question 2: 'Which educational interventions are effective and cost-effective in changing the public's behaviour to prevent infection and reduce the spread of antimicrobial resistance?'

Evidence statements relating to: Hygiene and/or food safety

Intervention based in the home led by a community facilitator targeting adults living in a 'deprived' community

Evidence Statement 1.1(3) Home-based interventions targeting adults from a 'deprived' community

There is weak evidence from one pre–post study2 (+) (UK; n=904) that a home-based food storage education intervention targeting adults living in a deprived community, provided by a

community-based facilitator, effectively improved peoples' knowledge of and behaviour around appropriate refrigeration. The proportion of respondents who identified, and had their fridge set at, the correct operating temperature increased from 31.7% to 78.4% (p<0.01) and 69.3% to 84.2% (p=0.03), respectively; the proportion of refrigerators containing food past its 'use by date' significantly decreased, from 10.1% to 5.2% (p=0.03), and the proportion of refrigerators in which raw meat and cooked food were stored incorrectly decreased from 16.2% to 7.1% (p=0.04) and 14.7% to 7.2% (p<0.05), respectively.

Applicability

The evidence is partially applicable to the wider UK population, as the study population was a deprived community, and therefore may differ from the wider UK population.

1. Ghebrehewet and Stevenson 2003 (+)

Interventions based in schools and/or targeting school aged children

Evidence Statement 1.2(3) Primary school-based interventions targeting school children or interventions targeting school-aged children

There is inconsistent evidence from two pre–post studies (-)1 (-)2 and one RCT (-)3 that school-based educational interventions have an impact on children's knowledge of appropriate food handling.

One pre–post study1 (-) (UK; n=1736 [school n=62, online=1674]) found that an e-Bug computer game for 9- to 12-year-old children did not improve children's knowledge of appropriate food handling, as assessed by means of three questions.

One pre-post study2 (-) (USA; n=300) found that a web-based food safety programme targeting middle school students (approx.10 to 13 years of age) had a significant impact on mean knowledge food safety score for students in grade seven (52.2% (±15.19) vs. 65.2% (±16.44), p<0.001) and eight (49.8% (±16.83) vs. 60.1% (±20.35), p<0.001) but not among students in grade six 56.0% (±15.62) vs. 56.0% (±20.12) p=ns). How far the student progressed through the programme's required lesson and the total usage of the programme were both significantly correlated with learning achievement: r2=0.065, p<0.00, and r2=0.0353, p=0.005 respectively.

One RCT2 (-) (Italy; n=249) found that an educational programme involving multimedia and movies taught in either a practical or a theoretical class, targeting students aged 9 to 11 years old, significantly improved knowledge of appropriate 'food handling' among children attending a practical class (IRR 1.1 [95%CI: 1.0 to 1.3], p<0.001) but not among children attending a theory-based learning class (IRR 1.0 [95%CI: 0.9 to 1.1]).

Applicability:

One study was conducted in the UK, and the other was conducted in Italy. In the latter study, there are no obvious differences in the population, context or setting of the study compared with the UK.

1. Farrell et al. 2011 (-)
2. Lynch et al. 2008 (-)
3. Losasso et al. 2014 (-)

Evidence Statement 1.3(3) Summer enrichment programme targeting school children

There is weak evidence from one pilot pre–post study1 (-) (USA; n=22) that an education programme provided to youth aged 6 to 16 years old from low-income families may have effectively improved knowledge of food-borne illness and food safety across all survey questions asked. For example, knowledge of the importance of washing hands before handling food increased by 76% among 13- to 16-year-olds and by 91% among 6- to 12-year-olds (p-values were not reported), and knowledge that harmful bacteria are found in raw poultry and unpasteurised milk increased by 77% among 13- to 16-year-olds, but by only 9% among 6- to 12-year-olds.

Applicability

While the study was not conducted in the UK, the evidence is likely to be partially applicable to the UK population as the study population may differ from the wider UK population.

1. Comer (2002) (-)

Interventions based in a university targeting students

Evidence Statement 1.4(3) University-based interventions targeting students

There is weak evidence from one non-RCT (+)[1] and two pre–post studies (-)[2,3] that food safety campaigns targeting students at university significantly improved food safety knowledge, attitudes and practice.

One non-RCT study[1] (+) (USA; n=710) found that a multicomponent university campaign involving food safety lectures and/or a Facebook fan page for online food safety education significantly increased knowledge scores from pre- to post-intervention for students in the intervention ($p<0.05$) but not the control ($p=0.06$). The change in knowledge was significantly greater among students who took the lecture compared with students who only looked at Facebook (p-values were not reported). The change in attitude was significantly greater in all intervention groups compared with the control (p-values were not reported). Change in food safety practices was significant from pre- to post-intervention for all groups, including the control ($p<0.05$); the group who just received the lecture had significantly lower scores than the groups who accessed the Facebook fan page (p-values were not reported).

One pre–post study[2] (-) (USA; n=1,159) found that a food safety campaign effectively improved most food safety knowledge measures of students (with the exception of hand washing procedure): overall mean scores (on a scale of 1 to 8) significantly increased, from 3.29 (1.61) to 4.17 (1.84) ($p<0.001$) and the campaign significantly improved students' use of soap before cooking ($p<0.001$) and after using the toilet ($p<0.001$).

One pre–post study[3] (-) (USA; n=71) found that an interactive computer module had a significantly positive impact on students' food safety attitude scores, which increased from 114.5 to 122.2 out of a possible 147 points ($p\leq0.001$). Beliefs scores increased from 85.8 to 97.6 out of a possible 119 points ($p\leq0.001$) and self-reported food safety practices increased from 19.0 to 21.0 out of a possible 27 points ($p=0.001$). In subgroup analysis, health majors outperformed non-health majors across all three measures ($p<0.05$).

Applicability

While none of the studies were conducted in the UK, the evidence is directly applicable to people in the UK. There are no obvious differences in the population, context or setting of the study compared to the UK context.

1. Bramlett Mayer and Harrison 2012 (+)
2. Maurer Abbot et al. 2012 (-)
3. Yarrow et al. 2009 (-)

Interventions based within the community

Evidence Statement 1.5(3) Community-based interventions targeting parents

There is weak evidence from two RCTs (-)1,3 and one cluster non-RCT (-)2 that workshops or a multimedia intervention targeting parents result in modest improvements in food safety behaviour.

One RCT1 (-) (USA; n=168) found that a workshop including topics on food safety (in addition to other topics) improved self-reported food safety behaviour among low-income parents. It is not clear how effective this intervention was compared with the control group, who received the intervention at a later time point to those in the intervention group, because results are presented pre–post intervention within each group: for those who received immediate education the mean score (on a scale of 1 to 50) increased from 34.9 to 42.8 (p-values were not reported), while for those who received the education later it increased from 35.4 to 42.8 (p-values were not reported).

One cluster non-RCT2 (-) (USA; n=600 analysed at end) found that a mass media campaign involving traditional mass media (such as posters and radio advertisements) and newer social media methods, including YouTube videos and an iPhone/iPad application, had a significant impact on food safety behaviour (e.g. appropriately throwing away leftovers) among those in the intervention communities
compared with those in the control; 50% vs 38% (p=0.009).

One RCT3 (-) (USA n=394) found that a multimedia intervention (computer kiosk) or information leaflets given to pregnant women and mothers improved the overall food safety score for women in both groups (on a scale of 1 to 5). The interactive multimedia group increased from 3.8 to 4.1; the leaflet group increased from 3.8 to 3.9. The difference in change between groups was only significant when
controlling for age, though the size of the effect was small (p=0.03).

Applicability:

While none of the studies were conducted in the UK, the evidence is directly applicable to people in the UK. There are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Dollahite et al. 2014 (-)
2. James et al. 2013 (-)
3. Trepka et al. 2008 (-)

Evidence Statement 1.6(3) Classes for youths and adults

There is weak evidence from one pre–post study1 (-) (USA; n= 602 [youths=229 youths, adults=373]) that food preparation classes provided to youths and adults are effective in improving all of the safe food handling behaviours tested. The proportion reporting that they washed their hands before preparing food increased by 38% for youths and 11% for adults ($p<0.001$ for both); likewise, the proportion reporting that they washed fresh fruits and vegetables before preparation increased by 29% for youths and 8% for adults ($p<0.001$ for both) and the proportion using a clean knife and cutting board to prepare fruits or vegetables to avoid cross-contamination increased by 36% for youths ($p<0.001$) and 7% of adults ($p=0.013$).

Applicability

While the study was not conducted in the UK, the evidence is directly applicable to people in the UK. There are no obvious differences in the population, context or setting of the study.

1. Brown and Herman 2005 (-)

Evidence Statement 1.7(3) Mass media campaigns targeting adults

There is weak evidence from one pre–post study (+)1 and one non-RCT (-)2 that mass media campaigns may lead to minor short-term improvements in food safety knowledge and some short-term changes in food safety behaviour.

One pre–post study1 (+) (USA; n=250) found that the mass media Fight BAC! Campaign, targeting the Latino community, was effective at improving food safety knowledge among participants who had seen the campaign compared with those who had not seen the campaign (aOR 3.54 [95%CI: 1.74 to 7.18]).However, the campaign only had a significant effect on two of nine food safety behaviour practices:
proper hand washing increased from 94% to 99% ($p=0.04$) and proper meat defrosting technique increased from 7% to 14% ($p=0.01$).

One non-RCT2 (-) (UK; n=38) found that a UK-based mass media intervention designed to improve safety behaviour during food preparation had some immediate effectiveness on observed food safety behaviour that was not sustained 4 to 6 weeks later. Overall the mean score for food safety malpractice score among controls ranged from 9,501 to 9,845 (scoring scale not reported) over the course of the study. For the intervention group, the mean score decreased from 12,373 to 7,322 immediately after intervention, but increased to 9,835 after a period of 4 to 6 weeks (p-values were not reported). In the intervention group, the immediate intervention effect upon all targeted behaviours was either ‘low’ or ‘moderate’ (effect sizes ranging from 0.18–0.47) (p-values were not reported).

Applicability

The evidence is only partially applicable to the wider UK population, as the studies populations may differ from the wider population of the UK, although for the US study the interventions could be conducted in the UK context and the results are likely to be relevant to other ethnic minority groups.

1. Dharod et al. 2004 (+)
2. Redmond et al. 2006 (-)

Evidence Statement 1.8(3) Computer-based interventions targeting adults

There is weak evidence from one RCT (+)1 and one pre–post study (-)2, that education delivered via a computer, with or without printed materials, may improve food safety knowledge but not food safety behaviours.

One RCT1 (+) (USA; n=446) found that neither web-based nor printed materials significantly improved adherence to any of the 10 food safety practices tested (p>0.05 for all) or intention to consume any of the 12 risky food groups (p>0.05 for all) among older adults (aged 70 to 75 years old). However, many appropriate practices, such as storing leftovers for no more than five days and refrigerating leftovers within two hours, were already high at baseline (89.8% and 94.0%, respectively).

One pre–post study2 (-) (Sweden; n=92) found that a computer-based education programme significantly increased knowledge of food safety in adults immediately following the intervention related to cross contamination (52% vs 87% (p≤0.001)) and knowledge of the correct storage temperature for smoked salmon and raw mincemeat (22% vs 67% (p≤0.001) and 23% vs 67% (p≤0.001), respectively). However, there was no significant improvement in food safety behaviours; the proportion of participants refraining from tasting raw mincemeat non-significantly increased, from 80% before to 88% (p=ns) three weeks after, while the proportion checking the fridge temperature non-significantly decreased, from 51% to 41% (p-values were not reported).

Applicability

The evidence is directly applicable to people in the UK. There are no obvious differences in the population, context or setting of the study compared with the UK context.

1. Kosa et al. 2011 (+)
2. Nydahl et al. 2012 (-)

Review 2: Supplementary evidence review –patient/public education antimicrobial resistance and infection prevention interventions with prescribing rates and incidence of infection as outcome measures

Research question 1: Which educational interventions are effective and cost effective in changing the public's behaviour to ensure they only ask for antimicrobials when appropriate and use them correctly?

Patient-targeted education interventions with antibiotic prescribing as main outcome

Evidence statement 2.1(1) Parental education interventions targeting antibiotic prescribing for children's respiratory tract infections in primary care

There is inconsistent evidence from four studies (RCT (++)1,cluster RCT (+)2, non-RCT (+)3 and a before-and-after study (+)4) concerning whether parental education interventions lead to a reduction in prescribing antibiotics for children's respiratory tract infections within primary care. All three US studies1,3,4 found no effect, while the one UK study2 found a

significant decrease in antibiotic prescribing following a patient education intervention. Interventions all involved written materials but differed in format, content, additional intervention components and mode of delivery. Baseline prescribing levels also differed between studies.

One RCT[1] (++) (US; n=247 control, n=252 intervention) found no significant difference in the mean number of prescribed antibiotics for upper respiratory tract infections symptoms between the intervention (parent received a pamphlet and videotape on the judicious use of antibiotics) and control (parent received a brochure on injury prevention) in children younger than 24 months. The number of antibiotic prescriptions per patient: 2.2 ± 2.6 vs 2.5 ± 2.9 in the intervention vs control respectively over 12 month study period; *P*=0.23.

One cluster-RCT[2] (+) (England and Wales; n=31 control practices, n=30 intervention practices) assessed whether a patient education booklet for parents of children (aged 6 months to 14 years) presenting with acute respiratory tract infections, delivered by clinicians trained to use it during consultations and given as a take-home resource, led to a reduction in antibiotic prescribing. The patient education booklet provided information on prognosis, treatment options and reasons for re-consultation. The intervention led to significant reductions in self-reported antibiotic prescription rates (55.3% in intervention vs. 76.4% in control; aOR=0.29 [95%CI: 0.14 to 0.60]).

One non-RCT[3] (+) (US; n=362 local control practices and n=65 distant control practices, n=7 intervention practices) assessed the addition of patient education to an existing healthcare professional targeted intervention on reducing antibiotic prescribing for children with pharyngitis (sore throat) aged from 0 to 17 years old. The patient education consisted of posting 'Be S.M.A.R.T. about antibiotics campaign materials to households, plus examination room posters, waiting room posters and leaflets. There was no effect of the patient education intervention on antibiotic prescribing: adjusted antibiotic prescription rates pre- and post-intervention: 38% to 39 % at the distant control practices, 39% to 37% at local control practices, and from 34% to 30% at the intervention practices (*P*=0.18 and *P*=0.48 for intervention practices compared with distant and local control practices, respectively).

One BA study[4] (+) (US; n=540 historic controls, n=180 intervention) found that waiting room posters placed in paediatric practices on 'a parent's guide to help understanding colds and viruses' had no effect on antibiotic prescribing for upper respiratory tract infections in children aged 6 months to 10 years old. The proportion of respiratory illness visits resulting in antibiotic prescriptions was 44.3%before the intervention and 48.3% after (*P*=0.79).

[1]Taylor et al. 2005 (++)
[2]Francis et al 2009 (+)
[3]Gonzales et al. 2005 (+)
4Ashe et al. 2006 (+)

The evidence is only partially applicable to the UK patient population as the majority of studies were conducted in the US.

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Evidence statement 2.2(1) Education interventions targeting antibiotic prescribing for adults' respiratory tract infections in primary care

There is inconsistent evidence from two US non-RCT studies (+)[1,2] concerning whether education interventions lead to a reduction in prescribing antibiotics for adults' respiratory tract infections within primary care.

One non-RCT[1] (+) (n=362 local control practices and n=65 distant control practices, n=7 intervention practices) assessed the addition of patient education to an existing healthcare professional targeted intervention on reducing antibiotic prescribing for adults with acute bronchitis aged from 18 to 64 years old. The patient education consisted of posting 'Be S.M.A.R.T. about antibiotics campaign materials to households, plus examination room posters, waiting room posters and leaflets. There was a significant decrease in antibiotic prescribing following the intervention: adjusted antibiotic prescription rates pre- and post-intervention: 50% to 44% at the distant control practices, 55% to 45% at local control practices, and from 60% to 36% at the intervention practices (P<0.002 and P=0.006 for intervention practices compared with distant and local control practices, respectively).

One non-RCT[1] (+) (n=51 control practices, n=4 intervention practices) assessed the same intervention as that described above[1], but with adults aged 65 to 85 years old with acute respiratory tract infections (ARIs). The educational intervention was not effective at reducing antibiotic prescription rates for ARIs: prescription rate decreased from 51% to 49% at control practices and from 45% to 40% at intervention practices (P=0.79 after adjusting for patient age, chronic obstructive pulmonary disease, specific ARI diagnosis, and practice-level clustering).

[1]Gonzales et al. 2005 (+)
[2]Gonzales et al. 2004 (+)

The evidence is only partially applicable to the UK patient population as both studies were conducted in the US.

Research question 2: Which educational interventions are effective and cost effective in changing the public's behaviour to prevent infection and reduce the spread of antimicrobial resistance?

Hand hygiene interventions measuring the incidence of infections

Evidence statement 2.1(2) Hand hygiene interventions delivered in day/child care centre populations to reduce the incidence or transmission of infections

There is moderate evidence from 3 studies (One non RCT[1] (+) one cluster RCT (++[2]) and one non-RCT(-[3])) that hand hygiene interventions targeting day/child care centre staff and/or children and/or their parents do not reduce the incidence of getting a respiratory or gastrointestinal illness but may reduce the onward transmission of a gastrointestinal illness to others.

One non-randomised study[1] (+) (Iceland; n=30 day care centres, 2,349 children aged 2 to 6 years old) found no difference in the incidence of febrile, respiratory, or gastrointestinal illnesses in day care centres involved in a hand and environmental

hygiene intervention (n =15) compared to control day care centres (n = 15). Crude and adjusted incidence rate ratios of the illnesses were not significantly different for any of the illnesses between baseline and intervention period. The intervention lasted for 1.5 years and consisted of regular hygiene education to staff and children; staff also received hand washing training, instruction on use of gloves, use of disposable nose wipes for children and washing of toys, furniture, floors, doorknobs, and toilets. Self-reported compliance with the hygiene intervention was high.

One cluster RCT[2] (++) (US; n=292 families with children aged 6 months to 5 years old attending 26 child care centres) assessed the effectiveness of a hand hygiene intervention in which families were provided with hand sanitizers and biweekly hand-hygiene educational materials for 5 months; control families received materials on good nutrition. The intervention did not change the incidence of getting an illness in the first place (primary illness incidence rate measured as number of primary illnesses per susceptible person-month for intervention vs control for gastro-intestinal illnesses: 0.06 vs 0.05; for respiratory illnesses: 0.37 vs 0.37). The intervention did significantly lower the onward transmission of gastrointestinal illnesses from one family member to another when compared to control families (IRR:0.41; 95% CI: 0.19–0.90; p=0.03). It did not reduce the onward transmission of respiratory illnesses (IRR: 0.97; 95% CI: 0.72-1.30; p=0.83).

One non-RCT[3] (-) (Sweden; n=6 day care centres with 292 children aged 1 to 5 years old) found that a hygiene education intervention did not have an effect on parent-reported sickness absence (10.5□8.6 days vs 11.2□7.4 days in intervention vs control respectively), incidence of respiratory illnesses (55.9% vs 61.6%) or gastroenteritis (17.7% vs 13.9%), doctor's consultations (47% vs 59%) or antibiotic prescriptions (38% vs 42% given antibiotics) in children. The intervention consisted of providing guidelines to staff on how to handle infections in children and reduce infection in day-care centres, providing liquid soap and paper towels (instead of terry towels and bars of soap); information posters were placed near entrances and parents were provided with verbal information in to meetings on infectious diseases and their spread, use of antibiotics and risk of antimicrobial resistance. Control day care centres received no intervention.

[1]Gudnason et al. 2013 (+)
[2]Sandora et al. 2005 (++)
[3]Hedin et al. 2006 (-)

The evidence is only partially applicable to the UK child and day care centre populations as none of the studies were undertaken in the UK – studies were undertaken in Iceland, Sweden and the US.

IRR: incidence rate ratio

Evidence statement 2.2(2) Hand hygiene interventions delivered in schools

There is weak evidence from one US non-RCT[1] (-) that regular hand hygiene education delivered in schools in combination with the provision of hand sanitizers and information posters (intervention) compared to the provision of hand sanitizers and information posters alone (control) may reduce the incidence of illnesses when contagious illnesses are at a high level. The study (n=773 students aged 6 to 14 years allocated to intervention or control by classroom in two schools) reported that the percentage of respiratory and gastrointestinal illness-related absent days was significantly lower in the

intervention group compared to the control group during flu season (October to December: 1.15% vs 1.57% respectively; *P*<0.001) but not across the whole academic year (October to May: 1.23% vs 1.26% respectively; *P*=NR).

[1]Lau et al. 2012 (-)

The evidence is only partially applicable to the UK as the study was conducted in the US.

Evidence statement 2.3(2) Web-based hand hygiene interventions aimed at adults

There is moderate evidence from one RCT[1] (++) (UK; n=20,066) that a bespoke web-based intervention reduces the incidence of respiratory illnesses. The intervention included prompt emails sent once a month to encourage participants to use the sessions, and to maintain hand washing. It was aimed at adults registered on participating GPs list. The intervention successfully reduced episodes of respiratory infections (p<0.0001), the total number of days of infection (p<0.001), transmission to other household members (p<0.001) and led to shorter duration of illness (p<0.001) in the 16 weeks following randomisation. The intervention also resulted in fewer consultations with either a GP or contact with health services for respiratory infection type symptoms at both 16 weeks (p=0.014) and 12 months (p=0.001) post intervention and a reduction in the number of antibiotic prescriptions at both 16 weeks (p=0.002) and 12 months (p<0.001).

[1]Little et al. *in press* (++)

The evidence is directly applicable to the UK adult population.

***Review 3*: A review of reviews of educational interventions designed to change the public's knowledge and behaviour in relation to antimicrobial use and antimicrobial resistance that target healthcare professionals and patients**

Evidence statement 3.1(1) – Knowledge and attitudes

Two reviews [1,2] found that multi-component interventions improve the public's knowledge of appropriate antimicrobial use (specifically in relation to antibiotics). One provided a narrative review[1] of public health campaigns and the other, a meta-analysis[2] of patient-only and combined patient and clinician targeted interventions, indicated that there was a statistically significant increase in knowledge and attitudes across these studies. It is not possible to conclude which components of an intervention are more effective than others.

1 Huttner 2010
2 Thoolen 2012

Evidence statement 3.2(1) – Antibiotic prescribing

There is strong evidence from eight reviews[1-8] that multi-component educational interventions that target both clinicians and patients/the public are effective at reducing antibiotic prescribing for self-limiting conditions. However the evidence concerning whether patient education, clinician education or a combination of both is superior in reducing antibiotic prescribing for self-limiting conditions is inconsistent.

One review[1] showed modest effects of public health campaigns on reducing antibiotic prescribing.

Three reviews[2-4] indicated that multi-component interventions including both clinician education and patient/public education are more effective at reducing inappropriate antibiotic prescribing than single-component interventions.

Two reviews[5,6] found that there were no significant differences in the effectiveness of single-component patient or clinician education only interventions compared to combined patient and clinician education interventions .

One review[7] concluded that while multi-component interventions were most effective, this was most likely due to the inclusion of physician education rather than patient education. And another review[8] concluded that inappropriate antibiotic use is most likely to be achieved through targeting healthcare professionals to delay or refuse antibiotics for self-limiting conditions rather than by educating patients or the public.

1 Huttner 2010
2 Arnold 2005,
3 Edeghere 2010,
4 Vodicka 2013
5 Ranji 2006
6 Ranji 2008
7 Van der Velden 2012
8 Thoolen 2012

Evidence statement 3.3(1) – Antibiotic resistance

Four reviews [1-4] reported on antibiotic resistance following educational interventions that reduced antibiotic prescribing/use. One review[1] found mixed effects on antibiotic resistance. One review[2] found no evidence of a change in antibiotic resistance, although few studies reported on this and follow-up periods were short; but an update of this work[3] found evidence of a reduction in the incidence of penicillin-resistant *S.pneumoniae* in one of three clinician and patient education intervention studies that assessed antimicrobial resistance. One review[4] indicated that public health campaigns may be associated with reductions in antimicrobial resistance, although some of the campaigns reported increases in antibiotic resistance over time (causality in either direction was not proven).

1 Arnold 2005,
2 Ranji 2006
3 Ranji 2008
4 Huttner 2010

Evidence statement 3.4(1) - Adverse effects

Three reviews [1-3] reported on adverse effects with educational interventions. Two reviews[1,2] found no evidence of adverse effects, however few studies reported on this and none were powered for rarer events such as hospitalisations. One review[3] found that, overall, reductions in antibiotic prescribing were not correlated with any adverse events but highlighted that an English study had found an increase in hospitalisations and mortality associated with community acquired pneumonia due to a decrease in antibiotic use over the time period.

1 Ranji 2008
2 Vodicka 2013
3 Huttner 2010