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Parental awareness and management of antibiotic side effects and allergies in children and young people: a UK survey

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Background and objectives: Antibiotic use in children and young people is common, however, the associated short- and long-term effects are often unknown. Inappropriate prescribing and misdiagnosed allergies contribute to antimicrobial resistance (AMR) and poorer health outcomes. To explore parental awareness, experiences and management of antibiotic side effects and allergies in children and young people, to inform strategies for improved antimicrobial stewardship and communication.

Materials and methods: An online survey was conducted in April 2024 with 1205 UK parents of children aged 16 years or under. The survey assessed experiences of side effects, knowledge of antibiotic risks, and allergy management. Descriptive statistics and chi-squared tests were used to analyse responses, with weighting applied to ensure representativeness of the UK population.

Results: Among respondents, 64% ($n=770$) reported their child had taken oral antibiotics, with 9% ($n=72$) reporting side effects and 7% ($n=53$) reporting allergies. Skin infections were the most common antibiotic indication that led to side effects (23%, $n=16$). Skin irritation was the most frequently reported side effect (26%, $n=19$) and allergic reaction (58%, $n=30$). Side effects often disrupted daily activities and led to 64% ($n=46$) stopping the antibiotic course early, of which 24% ($n=11$) did so without professional advice. Following their experience, many parents would seek professional advice on side effects (64%, $n=46$) and allergic reactions (76%, $n=40$) for future infections in their children.

Conclusions: Improved communication can facilitate appropriate recognition, assessment and management of antibiotic adverse reactions in children and young people, potentially reducing incorrect penicillin allergy labelling.

Introduction

Antimicrobial resistance (AMR) is a global concern, projected to become one of the leading causes of mortality by 2050, with an estimated economic impact of up to $100 trillion.[1] In 2019, the UK introduced a National Action Plan (NAP) aimed at reducing antibiotic-resistant infections in England by 10% by 2025.[2] However, between 2018 and 2023, there was a reported 12.8% increase in estimated antibiotic-resistant infections in England, and a 25.4% increase in rates of reported bacteraemia in those aged up to 17 years.[3] An updated NAP was published in 2024, focused on improving antimicrobial use and increasing public engagement on the risks of exposure.[4]

Antibiotics are frequently prescribed to children and young people, accounting for ~12% of all UK antibiotic prescriptions.[5] Many of these prescriptions are unnecessary,[6,7] probably exacerbated by perceived parental expectation for antibiotics, which poses a barrier to appropriate prescribing.[8] Children may be unable to describe symptoms, making it difficult for parents to gauge the severity of their illness. Consequently, parents are more likely to seek professional reassurance for their children than for themselves.[9–11]

Adverse reactions are common in children and young people taking antibiotics.[12,13] A national cohort study in Wales found that adverse reactions occurred after roughly one in five paediatric antibiotic prescriptions, with the highest risks among younger, lower-weight, and more deprived children.[14] Antibiotic allergies are often overestimated in children and young people. Although ~6%–8% of the English population carry a penicillin allergy label, research shows that about 90% of these labels are incorrect.[15–17] This is often due to misdiagnoses of side effects or symptoms, or because individuals outgrow the allergy over

time. Incorrect allergy labelling often prevents patients from receiving first-line antibiotic treatment for their condition, particularly for children and young people where penicillins are first-line options for most childhood infections. As a result, non-penicillin antibiotics are often prescribed, which increases the risk of adverse reactions and AMR.[15,16,18]

Adverse reactions can be problematic for patients taking antibiotics[19] and can reduce adherence to prescribed courses,[20] potentially worsening treatment outcomes and contributing to AMR. Contact rates with general practice (GP) and urgent care have steadily increased in children and young people,[21] therefore understanding how parents respond when their child experiences adverse reactions is essential for improving prescribing practices and communication. Parental awareness of the risks associated with antibiotic use and inaccurate allergy labels remains low,[11,22] highlighting the need for improved education and communication around antibiotic prescribing and allergy assessment.

This study aims to explore parents' accounts of their child's experiences of side effects and purported allergic reactions following antibiotic use, and the actions they take in response. Findings will help inform strategies to support families, improve antimicrobial stewardship and reduce unnecessary prescribing or misuse of antibiotics.

Materials and methods

The UK Health Security Agency (UKHSA) commissioned Ipsos MORI, an independent market research company, to carry out an online Omnibus survey. Eligible participants were parents and guardians across the UK with a child aged 16 years or under living at home with them. The survey was adapted from a study previously conducted among adults who had experienced side effects to antibiotics[20] and comprised three sections: (i) experience of side effects during antibiotic use; (ii) knowledge of and attitudes towards side effects to antibiotics and (iii) allergies to antibiotics. Each section contained a combination of single choice, multiple choice and free text questions. No prompts or guidance was given to direct respondents to what a side effect or allergy was. The list of side effects used as options in the survey was obtained from a review of common adverse reactions experienced from oral antibiotics regularly used in community settings.[23]

The survey was conducted in April 2024 to gather insights from parents whose children had previously experienced adverse reactions from antibiotics. 'Side effects' was used as an overarching term for adverse reactions in the survey as this was considered to be language understood by respondents. Participants were recruited by Ipsos through their online panels designed to be representative of the population, with weighting applied for Government Office Region, working status, education, ethnicity and gender within age groups.

All parents with a child aged up to and including 16 years living at home with them were asked an initial question about whether their child or children had ever taken oral antibiotics, defined as antibiotics that come in capsule or tablet forms. For those whose child or children had taken these antibiotics, and who had multiple children aged up to 16 living at home with them, the participant was directed to randomly select one child to answer the remaining survey questions about (the child with the most recent birthday). The study did not seek direct input from children and young people regarding their experiences.

Deprivation was measured using the Index of Multiple Deprivation (IMD), in which a multifactor scoring system is applied to small geographical areas in England.[24] People living in each area are allocated into five equal groups based on their relative level of deprivation. Quintile 1 (Q1) represents the most deprived 20% of areas, and Quintile 5 (Q5) the least deprived 20%.

Survey responses were analysed to produce descriptive statistics and visual presentation of the data. Pearson's chi-squared test, corrected for survey design, tested for differences in proportions across levels of categorical variables. Demographic data are presented both unweighted and weighted to reflect the sample composition, while all further analyses were conducted using weighted data to ensure representativeness of the UK population.

Results

The survey was completed by 1205 parents from separate households, of which 6% (72/1205) reported that their child had previously experienced side effects to antibiotics. The demographic characteristics of the total survey sample, and the sample whose children had experienced side effects, are shown in Table S1 (available as Supplementary data at *JAC-AMR* Online).

Antibiotic use

Among all parents in the survey, 64% (770/1205) reported that their child had ever been given oral antibiotics, while 33% (395/1205) had not and 2% (40/1205) did not recall. Of those who had received antibiotics, 64% (491/770) said their child had taken them in the past year, whereas for 30% (234/770) it had been longer than 1 year since last taking them. Children aged up to 10 years of age were significantly more likely to have taken antibiotics in the past year (77%, 324/422) compared with those aged 11 to 16 years (48%, 168/347; $P<0.05$). In addition, children and young people in IMD Q1 were significantly more likely to have taken antibiotics in the past year (73%, 119/163) compared with those in IMD Q4 (58%, 88/153; $P<0.05$) and Q5 (54%, 67/123; $P<0.05$).

Experience of side effects

Among parents of children who had ever been given oral antibiotics, 9% (72/770) reported that their child had experienced side effects from taking antibiotics. The most commonly reported side effect was a skin rash/itchy skin. Of these, 83% (60/72) said their child's last experience of side effects occurred within the past year. It took >5 days for 28% (20/72) of these parents to notice their child's side effects, while 25% (18/72) noticed within 3–5 days, 32% (23/72) within 1–2 days and 15% (11/72) on the day the antibiotics were taken. Figure 1 shows the side effects reported by parents that their children had experienced.

On the most recent occasion when a child experienced side effects, the antibiotics were mostly taken for a skin infection (23%, 16/72). Other common indications included a cough (13%, 9/72), earache or ear infection (12%, 9/72) and sore throat (12%, 8/72). Around one in five (19%, 14/72) reported side effects to antibiotics prescribed for flu or the common cold, which antibiotics are not effective for. Almost half of the parents whose child who had experienced side effects (44%, 31/72) could not remember which antibiotic was prescribed for their child.

Most parents whose child had experienced side effects were aware of this possibility beforehand (87%, 62/72). When asked where they received this information, respondents could select multiple sources of information and the most common sources were advice from a healthcare professional during consultation (41%, 26/62), information provided by a healthcare professional when collecting the antibiotics (34%, 21/62) and reading the

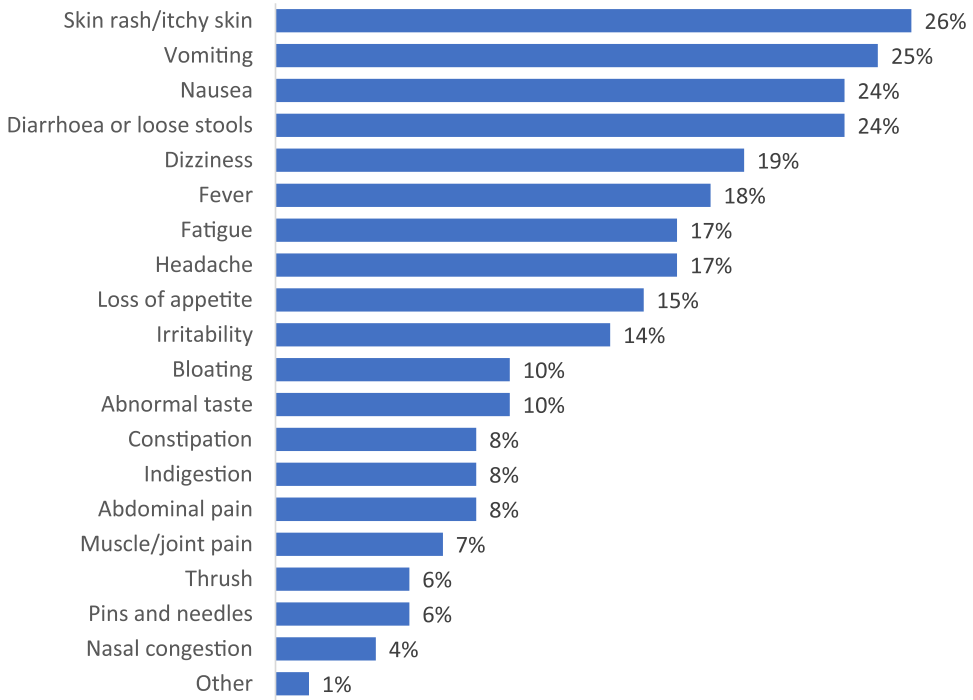

Figure 1. Side effects experienced by children and young people in response to taking antibiotics, as reported by their parents ($n = 72$).

patient information leaflet supplied with the medication (34%, 21/62). Additional sources included friends and family (28%, 18/62) and online searches (13%, 8/62).

The Yellow Card Scheme is the UK's voluntary system for reporting information on suspected adverse reactions to medicines, allowing these to be monitored. Just under half of parents whose child had experienced side effects were fully aware of the Yellow Card Scheme before participating in the survey (44%, 32/72). An additional 35% (25/72) were aware but did not know exactly what it was, while 21% (15/72) were not aware of it at all before the survey. Among those who were aware of the Yellow Card Scheme, 52% (29/57) had used it to report their child's side effects.

Impact of side effects

The reported impact of the side effects on the child varied. Of those whose child had experienced side effects, 39% (28/72) reported that the most recent side effects were mild and did not interfere with daily activities. A similar proportion (44%, 32/72) said their child's side effects were moderate, preventing the child from doing some activities. Around one in five parents (17%, 12/72) reported that their child experienced severe side effects that prevented them from doing most activities. Figure 2 shows how parents would act in future cases regarding antibiotics as a result of their child's experience with side effects.

When side effects were noticed, most parents acted on this with only 13% (9/72) stating that their child continued with their usual routine. The actions taken by parents in response to the antibiotic side effects that their child experienced are shown in Figure 3.

Parents were asked whether their child finished the antibiotic course from which they experienced side effects. Overall, 64% (46/72) said their child stopped taking the antibiotics, while 33% (24/72) said their child completed the full course and 3% (2/72) did not recall. Among those who had stopped taking the antibiotics, 48% (22/46) did so on the advice from a healthcare professional, 24% (11/46) made this decision themselves and 22% (10/46) followed advice from a friend or family member.

Antibiotic allergies

All parents whose child had ever taken antibiotics were asked if they were aware of an allergy that their child has to antibiotics. Of these, 7% (53/770) reported an allergy, while 2% (13/770) were unsure. Of those reporting an allergy, 79% (41/53) reported that this had been confirmed by a healthcare professional. The most common class of antibiotic that children and young people were allergic to were penicillins, identified by 53% of parents (28/53). In addition, 25% of parents (13/53) reported that their child was allergic to glycopeptides and 21% (11/53) to monobactams. The most reported allergic reaction was an itchy skin rash, reported by 57% of parents (30/53). Other reactions included red or patchy skin (43%, 23/53), fever (40%, 21/53), swelling of the face or neck (32%, 17/53) and difficulty breathing (26%, 14/53). Among the 72 parents who reported side effects in their child, 44% (32/72) also reported an allergy. Of those whose child had taken antibiotics, 83% (641/770) reported no associated adverse reaction.

Parents whose child had experienced an allergic reaction to antibiotics were asked about the actions they took the last time this occurred. Over half of parents (57%, 30/53) said they stopped their child from taking the antibiotic, and most (87%, 26/30) received alternative antibiotics to treat the condition. Figure 4

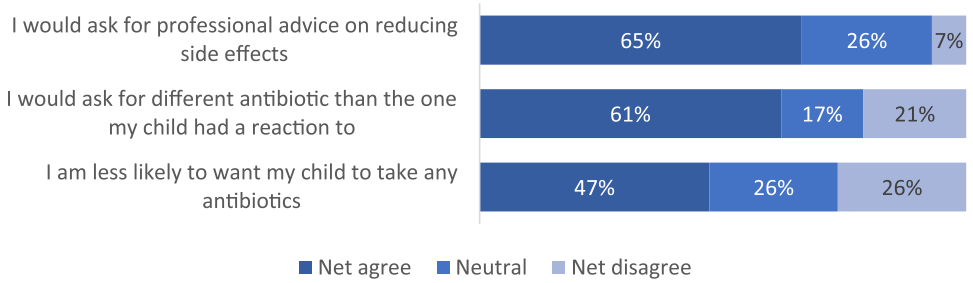

Figure 2. Parents' agreement to statements regarding their future use of antibiotics for their children following their child's experience with side effects ($n = 72$).

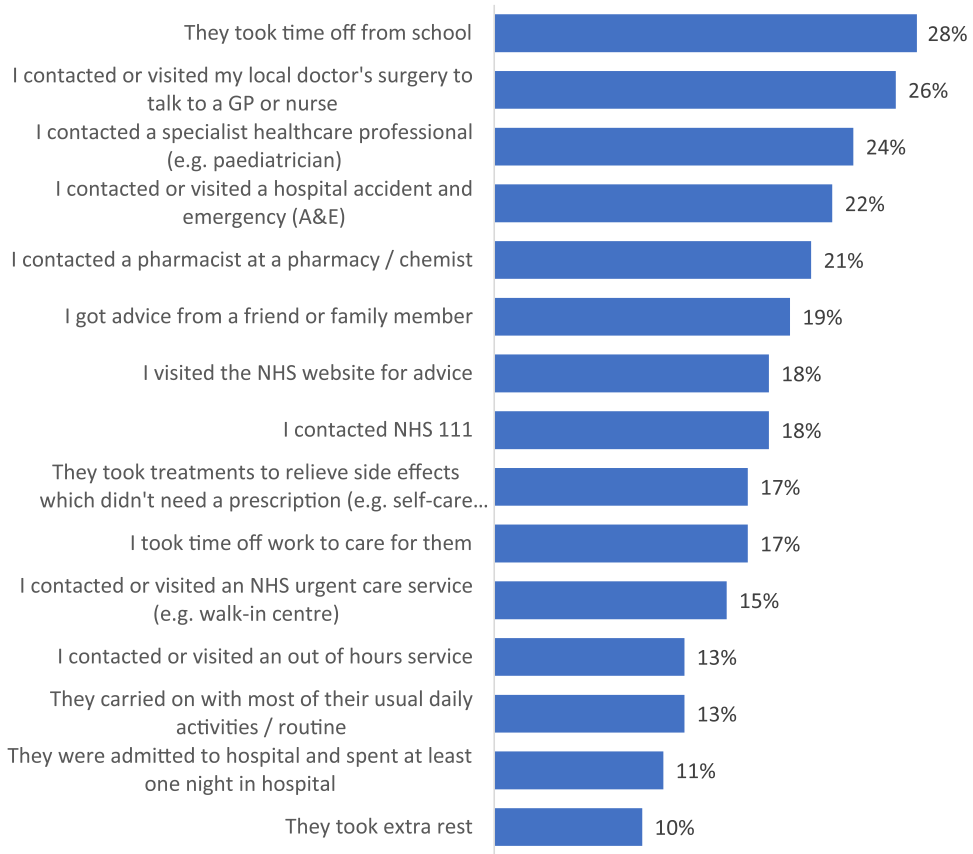

Figure 3. Actions taken by parents or their child in response to their child's side effects ($n = 72$).

shows how parents would act in future cases regarding antibiotics following their child's experience with allergic reactions.

Discussion

This study surveyed parents of children and young people aged 16 years and under to explore their experiences with adverse reactions related to antibiotics, and how these experiences influenced their attitudes and behaviours towards future antibiotic use. Antibiotics are commonly prescribed for children and young people, and 64% of surveyed parents reported that their child had been prescribed antibiotics at some point. Among those whose children had taken antibiotics, 9% reported side effects, typically dermatological or gastrointestinal although there was wide variation in manifestation, 7% reported an allergic reaction, with penicillin being the most common allergen. No adverse reaction was reported in 83% of children who took antibiotics.

The frequency of adverse reaction to antibiotic therapy has been previously assessed in hospitalized children in the UK, where a higher rate of adverse reactions (21%) was reported, with the likelihood increasing by 7% for each additional day of therapy.[25] However, this study was led by clinicians and did not assess parent or guardian perspectives. Research in outpatient settings has also highlighted the link between inappropriate antibiotic

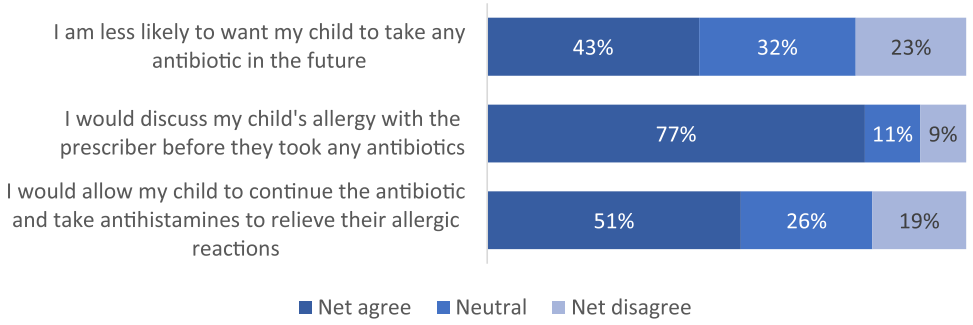

Figure 4. Parents' agreement to statements regarding their future use of antibiotics for their children following their child's experience with allergic reactions ($n=53$).

prescribing to adverse drug reactions and increased healthcare costs.[26] In addition, broad-spectrum antibiotics have been associated with gastrointestinal and skin-related adverse reactions in children, with diarrhoea being particularly common.[27,28]

Younger children and those in IMD Q1 were more likely to have been prescribed antibiotics within the past year. These groups have previously been reported to be at higher risk of developing adverse reactions than older and children from less deprived areas,[29] and it could be proposed this could be due to increased exposure to risk factors.[7] However, while many studies have found that GP practices in more deprived areas tend to prescribe antibiotics at higher rates,[30] GP attendance can be lower in these populations,[31] potentially influencing access to antibiotics and reporting of adverse reactions. In addition, penicillin allergy has been found to be significantly less prevalent in more deprived areas.[15] Further research is needed to explore how deprivation interacts with prescribing quality, allergy labelling and reporting of antibiotic adverse reactions in paediatric populations.

Skin rashes and itchy skin were the most frequently reported side effects, and the most common manifestations in those reporting an allergic reaction. Compared with a previous survey with adults,[20] children and young people in this survey were prescribed a higher proportion of antibiotics for skin infections (23% compared with 7%). Children and young people may experience rashes caused by viral infections, which parents in the survey may have misreported as a skin infection, potentially over-reporting skin infections as the underlying problem.

Many parents who reported a side effect also reported an allergic reaction in their child, suggesting uncertainty in distinguishing between the two. Also, 20% of parents reported that their child's allergy diagnosis had not been confirmed by a healthcare professional, implying self-diagnoses, which has not been reported before and warrants investigation. Differentiating between true allergic reactions and side effects or symptoms of underlying infections is essential to ensure accurate medical records and appropriate future treatment. Incorrect penicillin allergy labelling can increase the risk of AMR,[15,32] therefore children and young people with suspected antibiotic allergies should undergo further assessment to confirm the diagnosis and prevent unnecessary avoidance of first-line treatment.

Over half of surveyed parents described their child's side effects as moderate or severe, significantly disrupting daily activities, with some requiring urgent medical attention. The impact of side effects also extended beyond health. Many parents reported withdrawing their child from school to recover from side effects, potentially impairing academic learning, development and performance.[33] In addition, some parents took time off work or purchased costly remedies to manage their child's side effects, highlighting wider impacts of antibiotic use. Parents reported a broad range of help-seeking when side effects occurred, with emergency settings being visited more than community pharmacies. This dispersion suggests uncertainty about appropriate triage and highlights the opportunity to strengthen pharmacist-led advice and safety-netting to reduce avoidable urgent care use and school absence. Stopping the course following the side effects was common, with many doing so without professional advice. This emphasizes the importance of prior guidance on which side effects require reassessment and which should be continued if able to.

In this survey, 19% of children who experienced side effects were reported by parents to have been prescribed antibiotics for viral infections. This may reflect inappropriate prescribing or an error in recall, as indications were not clinically verified, however, supports the need for clearer communication and safety-netting around viral infections. Awareness of antibiotic risks was higher among parents than adults prescribed antibiotics for themselves.[20] Parents often view their children, especially younger children, as more physically vulnerable to side effects due to their developing immune system,[10] and often take a more active involvement in health-related decisions for their child as a result.[34,35] While most parents were aware of potential side effects before their child took antibiotics, 13% were unaware. Despite this, almost half of parents whose child experienced side effects said they were less likely to want antibiotics in the future, and two-thirds indicated they would initiate discussions with healthcare providers in future cases, suggesting that the full potential impact of side effects may not have been fully understood beforehand. Over half of parents whose child experienced an allergic reaction said they would allow their child to continue taking the antibiotic alongside antihistamines. While this may be appropriate in low-risk cases with mild allergic reactions,[36] this decision would need to be made by a healthcare professional following assessment. These findings highlight the need for clearer communication from prescribers to improve parental understanding and support informed decision-making in the management of adverse reactions.

Although prescribers often perceive parental expectations for antibiotics, research shows that most parents prefer to avoid them when possible.[37] Overuse and misuse of antibiotics not only contributes to AMR, but also exposes children and young people to avoidable side effects. Healthcare professionals play a crucial role in supporting informed antibiotic use by anticipating parental concerns and proactively discussing potential side effects before prescribing. Clear, empathetic communication during consultations can help set realistic expectations, reduce anxiety, and empower parents to make shared decisions about their child's treatment.[38] This approach aligns with the UK's AMR NAP, which includes an objective to empower and engage the public on the risks of antimicrobial exposure,[2] and may contribute to reducing unnecessary prescribing driven by perceived parental pressure.[8]

Limitations

The list of potential side effects in the questionnaire, although based on previously published work, included findings that may be symptoms of the index infection rather than a side effect, such as fever or rashes. As it is clear that respondents may not have been able to separate adverse reactions from signs or symptoms of the index infection, it might be possible to improve future questionnaires to distinguish new symptoms that develop while on treatment from symptoms that prompted presentation to a healthcare professional in the first place.

Owing to the small number of respondents whose child experienced side effects, the sample size for analysing these parents' experiences in recognizing and managing their child's side effects was limited. Consequently, we were unable to conduct further analyses by demographic characteristics or cross-analyses of survey responses. Future research may consider surveying only parents who have had experience with antibiotic side effects in their children. This approach could help to further explore the factors that influence their attitudes and behaviours in response to these side effects.

Another limitation is that the survey focused specifically on oral antibiotics in capsule or tablet form. As a result, the study likely under-represents children under 5 years of age and those receiving antibiotics via alternative routes, such as liquid oral formulations and enteral tube and intravenous administration. Future research should examine these formulations to capture the full range of adverse reactions associated with paediatric antibiotic use.

All data were self-reported by parents without clinical verification, which may be subject to recall bias or inaccuracies. Parents may have misremembered the cause, timing or severity of the antibiotic use and associated reactions, particularly if the events occurred over 1 year ago. This particularly reduces the reliability of the antibiotic indications and whether they were prescribed appropriately or not.

The timing of the survey coincided with an outbreak of scarlet fever and invasive Group A streptococcal (iGAS),[39] which can present with a rash or redness of the skin.[40] This may have led to misreporting by parents associating visible symptoms with skin infections, adding to the confusion in distinguishing between side effects, allergic reactions and symptoms of the underlying illness.

Conclusions

This study found that 9% of children who took antibiotics experienced parent reported side effects and 7% were described as an allergic reaction. More side effects were reported in younger children and those from more deprived areas. Results suggest some parents are self-diagnosing allergies, which is worrying and requires further investigation. Providing clear information during consultations can facilitate appropriate recognition, assessment and management of antibiotic adverse reactions, potentially reducing incorrect penicillin allergy labelling in children and young people. Reducing antibiotic prescriptions in children can reduce avoidable and potentially severe adverse reactions and can help to establish healthy habits from a young age.

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Transparency declarations

The authors affirms that this manuscript is an honest, accurate, and transparent account of the study being reported. No important aspects of the study have been omitted. The authors declare no conflicts of interest.

Supplementary data

Table S1 is available as Supplementary data at *JAC-AMR* Online.

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