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ORIGINAL ARTICLE

Antibiotics use for upper respiratory tract infections among children in rural Anhui: children's presentations, caregivers' management, and implications for public health policy

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Abstract

Children with upper respiratory tract infections (URTIs) are among the highest receivers of antibiotics. Using a retrospective cross-sectional study, we described clinical management in rural China of recent URTIs in children. We explored antibiotics using behaviors and associations of caregivers' variables and children's symptoms. Children with URTIs had a high consultation rate and a high prescription rate of antibiotics. For the children, some caregivers adopted, without rationale, 'self-medication' with antibiotics. Children with fever were more likely to be taken to a doctor; among those, children with particular symptoms were more likely to receive a prescription for antibiotics. Disseminating knowledge on antibiotics, and on interpretation and management of URTI symptoms will be important targets for caregiver and physician education and should become routine in training for physicians. Our findings also suggest the need to improve communication between doctors and caregivers, to strengthen regulation of drug sales, and to help caregivers learn when over-the-counter drug purchase without medical consultation is reasonable. These activities can help to improve health of a vast population of children in rural China.

Keywords Antibiotics · Rural population · Upper respiratory tract infections (URTIs) · Children · Self-medication

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Introduction

Upper Respiratory Tract Infections (URTIs) are the most common infectious diseases in children and one of the most common health problems encountered in primary care worldwide [1–3]. Evidence has shown that antibiotics are of little or no benefit in the treatment of URTIs [4, 5]; however, children with URTI are among the highest recipients of antibiotics over the world [6, 7]. Clear evidence links inappropriate use of antibiotics to the development of antibiotic resistance [8, 9]. These observations make management of antibiotics a public health concern of the highest order in China. Abuse of antibiotics also drives over-medication of children, increasing healthcare costs and generating side effects [10].

Recognition of the public health importance of managing antibiotics takes the form of policies or strategies for promoting rational use of antibiotics, a major focus recently for health service providers in China. Starting in 2011, China's central government implemented a Special Antimicrobials Use Rectification program nationally, including antimicrobial stewardship in hospitals, antimicrobial resistance (AMR) monitoring systems, and antimicrobial prescription limits [11]. After years of implementation of these initiatives, Li et al. [12] pointed out through a systematic review that an extremely high percentage of URTI patients in China continued to be prescribed antibiotics. Overuse remained especially problematic in lower-level hospitals. (See Box 1.)

For outpatient children with URTIs, Zhang et al. [13] and Yang et al. [14] identified a high rate of inappropriate use of antibiotics in primary care institutions. The literature implied that complicated factors associated with antibiotic overuse and control of medical institutions or professionals have meant that interventions targeting these measures alone cannot fulfill the expectations set out in China's initiatives.

Box 1: Definitions

Three levels of medical care facilities in China, differing by size and function: Primary hospital, township hospital, village clinic

Since 1989, China has classified hospitals in three levels by their size and function. The higher level indicates more sophisticated medical capability.

Tertiary hospitals (Class 3 hospitals) are the highest level of hospital in China and include national, provincial, municipal, and medical-school-affiliated hospitals. They serve multiple regions with over 500 ward beds.

Secondary hospitals (Class 2 hospitals) are those located at county and district levels which mainly provide medical services to local residents but also undertake some clinical practice teaching and medical research. They are regional hospitals which offer comprehensive medical and health services to multiple communities. Ward beds of secondary hospitals are between 100 and 499.

Primary hospitals (Class 1 hospitals) serve in a community and usually been called primary health care institutions (PHC). PHC include community health service centers or stations in urban areas, ***township health centers (also called***

township hospitals) and village clinics in rural areas. Compared with health centers, community health service stations, and village clinics are smaller in size. Only physicians have the right to prescribe in China. There are always physicians in each level of hospital or clinic. But the differences in health workforce between urban and rural areas are great. Doctors in Secondary or Tertiary hospitals have bachelor degrees or above. Usually village doctors only received medical training.

Township, administrative village, village

There are five levels of local government in China: the provincial, prefecture, county, township, and village. Rural areas in China have townships and villages.

Townships are similar to municipalities and communes in other countries and in turn may contain village committees and villages. Several neighboring villages can form a large **administrative village**.

Caregivers

Usually parents care for their own children. In rural China, working age residents move to cities in search of work and leave their children in the hometown. Those children are often cared for by their grandparents or other relatives. Thus, child caregivers are usually parents, grandparents, or other relatives.

Patient

'Patient' refers to those who believed that they have symptoms or have a sickness, not necessarily diagnosed by doctors.

Pharmacists

Pharmacists are health professionals who passed through National pharmacist qualification examination and legally received a license. They usually practice in department within a hospital or clinic that dispenses medicines to patients according to prescriptions by the clinicians working for the same hospital/clinic. Some large medicine shops in big cities also have a licensed pharmacist in store.

Sellers of Medicine (medicine salesman)

These people sell medicines to customers in a business medicine shop.

Many have assumed that parents' knowledge, attitude, practices (KAP) of how to manage symptoms play an important role in rational antibiotics use for childhood URTIs. These questions have been raised in developed counties from the beginning of 21st Century [15, 16]. Factors such as demographics and KAP of individuals have also attracted researchers' attention in China. Ding et al. [17] investigated socio-demographic associations and found that caregivers' age and education influence their behavior in using antibiotics. Yu et al. [18] suggested that caregivers' knowledge about appropriate use of antibiotics is low and that prevalence of caregivers medicating children with antibiotics without medical guidance is common. Thus, China needs interventions such as mass education for caregivers. Wei et al. [19, 20] presented an intervention package targeting both physicians and caregivers and demonstrated a substantial reduction of prescriptions for antibiotics for childhood URTIs in township hospitals. (See Box 1.) Together these studies showed that examining the ways that individuals seek and use medications can complement insights about

how to formulate antibiotic-related strategy and policy to improve population health, and ways to implement them more effectively.

Besides socio-demographic factors and individuals' KAP, the relationship between patients' complaints, symptoms, and antibiotic prescribing or use has also been discussed worldwide [21–23]. Interpretation of signs and symptoms influenced decision making by both physicians and patients. Some are interpreted to indicate inflammation and lead to treatment with antibiotics. These special concerns of both physicians and caregivers will be important when designing educational programs for medical professionals and for the general public, including caregivers.

Complaints and symptoms of URTI associated with individuals' seeking of medical attention or behaviors related to the use of antibiotics have not been assessed previously in the Chinese rural population.

When children were found to have URTI symptoms, decisions about whether to pursue professional medical service or instead to purchase medicines/antibiotics without a prescription, or use medicines/antibiotics already stored by the family, were made primarily by caregivers. (We use the term 'self-medication' to refer to the behavior of caregivers who either used left-over drugs stored at home to treat children or purchased medicine 'over-the-counter'—without prescription—and gave that to children in their care.) Information about where they took children, and what antibiotics children received based on actions by caregivers (including seeking professional consultation, buying medicine over-the-counter, or using medicine left by others or previous diseases) may help improve interventions. Ding [17] and Yu [18] focused on the usual antibiotic use behavior of caregivers'. Their findings did not fully answer the questions we designed this study to address.

The present study aims to follow the management process of children's one episode of URTI. It aims to gather quantitative data on and provide an overview of the full range of acts by caregivers as they manage children through their URTI illness experiences. Specifically it aims to depict the caregivers' behaviors: Did they visit a physician or choose medication themselves without prescription? What was their use of antibiotics for the children's latest URTI complaints? We explored the factors including socio-demographic characteristics, caregivers' KAP, as well as patients' signs and symptoms which may influence those behaviors. While focusing on families with primary care as the means, the study has the potential to improve the health of a vast population of children in rural China.

Methods

Using data extracted from incomplete service logs from primary care settings or from exit surveys may avoid recall bias but cannot capture other elements such as caregivers' self-medication behaviors. Thus, for this study, we adopted a community-based sample. We conducted a retrospective cross-sectional study using a structured questionnaire with face-to-face interviews at the respondents' homes in rural Anhui, China. We recruited eight postgraduate students from Anhui Medical University and trained them for half a day about how to identify the caregiver in households with children and how to administer the questionnaire.

Setting

Anhui Province, in middle China, has a population of 68.6 million, 57% of whom live in rural areas. Per capita Gross Domestic Product (GDP) and income in Anhui rank in the middle (14th) among all provinces in the nation.

Sampling, subjects, and definition of URTI symptoms

To identify sufficient numbers of cases ($n = 260$) of caregiver-medicating of children (that may have the lowest incidence among the four behavior outcomes) to allow multivariate ($n = 26$) analysis of influencing factors and based on estimates from pilot study of the behavior incidence at 30%, we estimated the total sample size as 867. Considering a 6% non-response rate, we calculated the total sample size to be 920.

We adopted a stratified-cluster randomized sampling method. In Step 1, we classified all the 55 counties in Anhui province into three regions: north (17 counties), middle (15), and south (22). In Step 2, we randomly selected 4 counties from each region, then 1 township from each of the selected counties and 1 administrative village from each of the townships. In total, we recruited 12 administrative villages as study sites. In Step 3, we randomly selected the first household to visit and then moved from there to visit a next family, passing by two households further along our route and entering the third, until the sample size reached the minimum of 77 respondents in each village. During the household visits, interviewers asked members of the household if the family had a child under 15-years of age living with them. If the answer was "yes," the interviewer invited the children's main caregiver to participate in the interview. Criteria for determining eligibility of caregivers, both men and women, were as follows. Each one:

(a) had registered rural residence and actually lived in the village sampled during this survey;
(b) was aged ≥ 22 years for men and ≥ 20 years for women (the legal age for marriage under the Chinese law);
(c) was willing to participate and able to answer the survey questions; and
(d) was the main caregiver of the children in the household.

"URTI symptoms" referred to symptoms developed by one of the children such as cough, fever, running noses, or others that caregivers believed, mentioned, or reported as "cold," "cough," or "respiratory infection." We developed a list of common symptoms of respiratory infections (see Fig. 1) to help the caregivers recall the child's latest symptoms over the past 12 months.

Questionnaire

Our study used a structured questionnaire (available from corresponding author) soliciting information about (a) demographic characteristics of caregivers; (b)

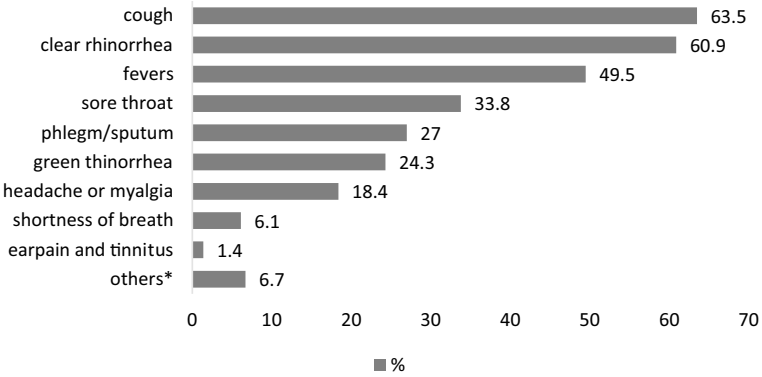

Fig. 1 URTI Symptoms of Children reported by caregivers. *Others included nasal congestion, diarrhea, vomit

caregivers' general knowledge (such as whether antibiotics kill viruses, whether unnecessary use of antibiotics make them ineffective), and their general behavior related to antibiotics (such as whether they have asked doctors to prescribe specific antibiotics, whether they feel satisfied without a prescription); (c) the recent experience with children's URTI symptoms (such as which symptoms emerged, whether to seek professional service or do they medicate the child without professional advice).

Data analysis

Data were double-entered using EPI DATA 3.1 and analyzed via SPSS 17.0. Descriptive analysis included characteristics of respondents, distribution of caregivers' knowledge and behaviors, and numbers and percentages of caregivers' coping behaviors (such as seeking professional consultation, using self-medication) for children's recently observed URTI symptoms. We conducted multivariable regression models to identify factors associated with caregivers' and children' behavior outcomes including "seeing a doctor," "being prescribed antibiotics," "adopting self-medication" (by the caregiver for the child), and "using antibiotics through self-medication."

For independent variables, we included all the potential items on the part of caregivers and children, including caregivers' demographic background, knowledge and behavior, the ages of children, and URTI symptoms (such as fever, sore throat).

Ethical considerations

The study was approved by the Ethical Committee of Anhui Medical University and the study team obtained informed consent from all participants. Participants were made aware that they could withdraw at any time.

Results

In total, interviewers identified 960 households with children under 15 years of age. They approached all caregivers and 925 of them completed the survey—a response rate of 96.4%. The demographics of children and their caregivers are provided in Table 1.

Symptoms and coping behaviors reported by caregivers

Caregivers reported a range of symptoms that they believed belonged to the URTIs (Fig. 1). The symptoms most frequently reported (defined as percentage of reported

Table 1 Characteristics of the study population

Characteristics	*n*	%
Age of caregivers(total respondents = 913)		
≤ 30	97	10.6
30–40	193	21.1
41–50	187	20.5
51–60	235	25.7
≥ 60	201	22.0
Sex of caregivers(total respondents = 921)		
Male	259	28.1
Female	662	71.9
Education of caregivers(total respondents = 922)		
0 years	262	28.4
1–6 years	262	28.4
7–9 years	319	34.6
≥ 10 years	79	8.6
Relationship with the child (total respondents = 925)		
Parents	415	44.9
Grandparents	499	53.9
Others[a]	11	1.2
Family size[b] (total respondents = 917)		
≤ 3	258	28.1
≥ 4	659	71.9
Age of children (total respondents = 925)		
< 1 year (infant)	26	2.8
1–6 years (preschool)	455	49.2
7–12 years (elementary)	329	35.6
13–15 years(junior)	115	12.4

[a]Others refers to relationships such as aunt/uncle and niece/nephew

[b]Family size refers to the number of family members living together including both adults and children

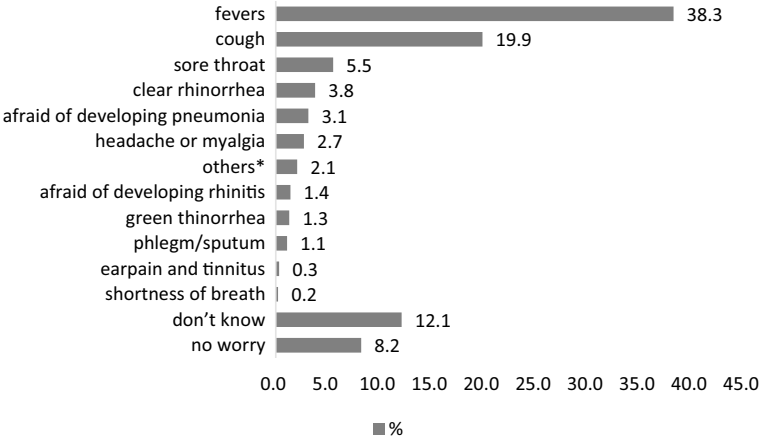

Fig. 2 The most worried URTI symptoms reported by caregivers. *Others included nasal congestion, diarrhea, vomit

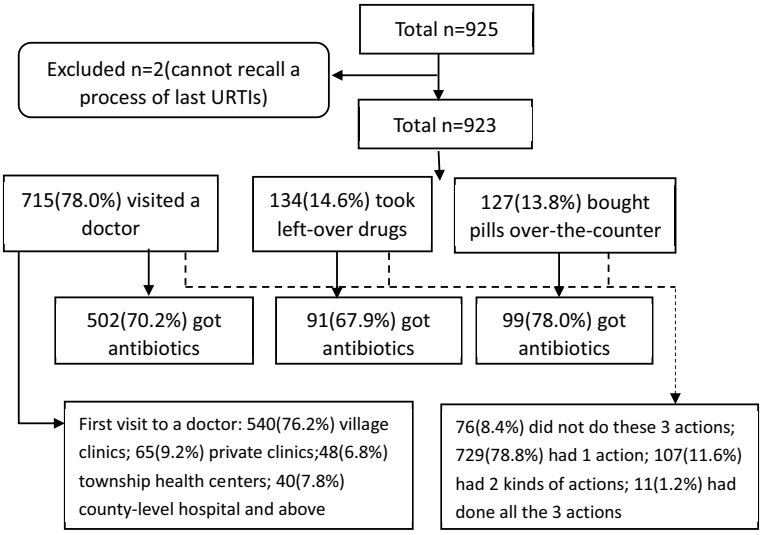

Fig. 3 Coping behaviors of caregivers for the children's latest URTI symptoms in the past year

above 30%) were cough (63.5%), clear rhinorrhea (60.9%), fever (49.5%), and sore throat (33.8%).

The top three URTI symptoms of concern to, and reported by caregivers, were fever (38.3%), cough (19.9%), and sore throat (5.5%), respectively (see Fig. 2). Among caregivers, 8.2% clearly stated having no worry about the children's URTI symptoms.

As demonstrated in Fig. 3, among 923 children with recent URTI symptoms, 78.0% reported visiting a physician, 14.6% reported taking drugs leftover and available at home, and 13.8% reported buying medicine over-the-counter. For these three coping actions, 11.6% of respondents reported using at least 2 of them with the children. Caregivers reported that their children received antibiotics with 70.2, 67.9, and 78.0% from seeing physician, using left-over medicine, or over-the-counter medicine, respectively. Among respondents who visited doctors, 76.2% went to village clinics first. Figure 4 showed self-reported medication in village clinics for the first visit. For medication, 86.4% medicated orally, 21.5% by injection, and 31.5% by intravenous infusion.

Knowledge and behaviors of caregivers

As shown in Table 2, 4.0% of caregivers believed that antibiotics can kill or control bacteria but not viruses. Thirteen percent (13.0%) could name at least one disadvantage of using antibiotics. Respectively, 21.7, 12.1, and 25.3% of caregivers believed that symptoms like the common cold, sore throat, and fever generally do not need antibiotic treatment. For behaviors, 25.5% of caregivers reported they had asked a doctor to prescribe antibiotics. Of those, 71.1% reported that seeking drugs without prescription was acceptable; 50.6% ceased the course of antibiotics course as soon as symptoms disappeared; and 41.0% reported they usually store antibiotics at home (from previous usage).

Professional service seeking and individual's associations

Presenting with a sore throat, phlegm/sputum, and fever, caused the most worry among caregivers. These were associated with increased likelihood of seeing a doctor. Respondents who stored antibiotics at home were less likely to see a doctor. Among those who saw a doctor, symptoms such as purulent nasal discharge, cough,

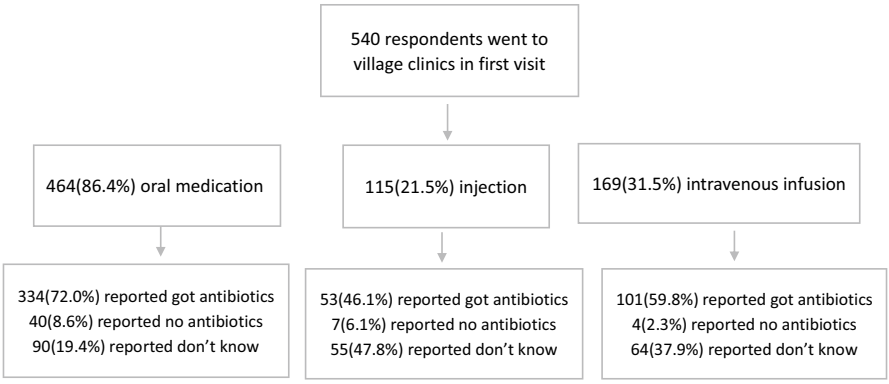

Fig. 4 Self-reported medication at village clinics regarding children's URTIs by caregivers

Table 2 Knowledge and behaviors related to antibiotic use of caregivers

Questions/behaviors	Answers	*n*	%
Knowledge			
Q1: Do antibiotics can kill or control bacteria meanwhile cannot kill or control virus?	Yes	37	4.0
	No/don't know	888	96.0
Q1.1: Can antibiotics kill or control virus?	Yes	334	36.6
	No	101	11.1
	Don't know	478	52.4
Q1.2: Can antibiotics kill or control bacteria?	Yes	371	40.9
	No	102	11.2
	Don't know	434	47.9
Q2: Can you name any dis-benefits of using antibiotics?	Name at least one	121	13.0
	Can't name	804	86.9
Q3: Does unnecessary use of antibiotics make them ineffective?	Yes	424	45.9
	No/don't know	499	54.1
Q4: Can you select at least one kind of symptoms do not need antibiotics in general?	Yes	376	40.8
	No	546	59.2
Q4.1: Are antibiotics needed for most common cold?	Yes	723	78.3
	No	200	21.7
Q4.2: Are antibiotics needed for most sore throat?	Yes	811	87.9
	No	112	12.1
Q4.3: Are antibiotics needed for fever?	Yes	689	74.7
	No	233	25.3
Behaviors			
B1: Have you ever ask doctor to prescribe specific antibiotics?	Yes	235	25.5
	No	687	74.5
B2: Accept leaving consultation without prescription	Yes	642	71.1
	No	261	28.9
B3: Stop taking drugs when symptom relieved?	Yes	468	50.6
	No	457	49.4
B4: Do you often spare some antibiotics at home?	Yes	378	41.0
	No	543	59.0

headache, or myalgia, along with believing antibiotics can kill or control bacteria, and storage of antibiotics at home made it more likely they would receive a doctor's prescription for antibiotics (Table 3).

'Self-medication' and individual associations

We defined self-medication as a caregiver behavior of giving left-over drugs to children or buying medicine over-the-counter to give to children in the study. Taken together, 228 (24.7%) of caregivers reported self-medication associated with a

Table 3 Associated actors of caregivers/children for seeing a doctor, prescribed antibiotics, using self-medication, and self-treatment with antibiotics regarding children's URTI symptoms; Multivariate logistic regression analysis; adjusted odds ratio (95% CI)

Factors of caregivers/children	Classification/category	Seeing a doctor $n=923$		Prescribed antibiotics $n=715$		Self-medication $n=923$		Self-treat with antibiotics $n=228$	
		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)	
Age group of caregivers	≤ 30 Ref.	–	–	–	–	–	–	–	–
	30–60							4.93	1.48–16.46
	≥ 61							6.85	1.37–34.20
Sex of caregivers	Male (1), female (2)	–	–	–	–	–	–	–	–
Education group of caregivers	0–6 years(1), ≥ 7 years(2)	–	–	–	–	–	–	–	–
Age group of the child	0–5 years(1), ≥ 5 years(2)	–	–	–	–	–	–	–	–
Family size	≤3(1), > 4(2)	–	–	–	–	–	–	2.60	1.06–6.37
Sore throat	Absent(0),present(1)	1.60	1.01–2.53	–	–	–	–	–	–
Clear nasal discharge	Absent(0),present(1)	–	–	–	–	–	–	2.97	1.23–7.17
Purulent nasal discharge	Absent(0),present(1)	–	–	2.13	1.17–3.88	–	–	–	–
Cough	absent(0),present(1)	–	–	3.50	2.14–5.70	–	–	–	–
Phlegm/sputum	Absent(0),present(1)	1.96	1.14–3.39	–	–	–	–	–	–
Shortness of breath	Absent(0),present(1)	–	–	–	–	–	–	–	–
Ear pain and tinnitus	Absent(0),present(1)	–	–	–	–	–	–	–	–
Headache or myalgia	Absent(0),present(1)	–	–	2.17	1.12–4.22	–	–	–	–
Fever	absent(0),present(1)	3.08	1.94–4.88	–	–	0.65	0.43–0.98	–	–
Other symptoms	absent(0),present(1)	–	–	–	–	–	–	–	–
Do antibiotics can kill or control bacteria?	No/not sure(0), yes(1)	–	–	2.81	1.68–4.69	–	–	–	–
Do antibiotics can kill or control virus?	No/not sure (0), yes (1)	–	–	–	–	1.57	1.04–2.36	–	–
Name any dis-benefits of using antibiotics	Cannot (0),can name one (1)	–	–	–	–	–	–	–	–
Believe unnecessary use of antibiotics make them ineffective	No (0), yes (1)	–	–	–	–	–	–	–	–

Table 3 (continued)

Factors of caregivers/children	Classification/category	Seeing a doctor $n=923$		Prescribed antibiotics $n=715$		Self-medication $n=923$		Self-treat with antibiotics $n=228$	
		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)		aOR (95% CI)	
Can you select at least one kind of symptoms that does not need antibiotics in general?	Cannot (0), can (1)	–	–	–	–	–	–	–	–
B1: Ask doctor to prescribe specific antibiotics	No (0), yes (1)	–	–	–	–	–	–	–	–
B2: Accept leaving consultation without prescription	No (0), yes (1)	–	–	–	–	–	–	–	–
B3: Stop taking drugs when symptom relieved	No (0), yes (1)	–	–	–	–	0.51	0.34–0.77	–	–
B4: Do you often spare some antibiotics in the home?	No (0), yes (1)	0.56	0.37–0.85	1.74	1.05–2.90	2.31	1.54–3.47	2.50	1.08–5.79
Had a most worried symptom	No (0), yes (1)	1.94	1.18–3.19	–	–	–	–	–	–

recent URTI symptoms. Of those, 167 (73.2%) self-medicated their children with antibiotics.

Factors such as believing antibiotics can kill or control a virus, or storing antibiotics at home, made it more likely a caregiver would adopt self-medication (Table 3). Children who presented with fever, caregivers who stopped taking drugs when symptoms had been relieved, were less likely to medicate children without guidance from a medical professional. Four factors increased the possibility of using antibiotics when self-medicating children: caregivers in older age groups, children who presented with clear rhinorrhea, more than 4 family members living in the household, and spare left-over antibiotics at home.

Discussion

The present study observed a high consultation rate, as well as a high prescription rate for antibiotics. This differs markedly from a sample of British adults, where only of 19.7% of responders who had recent RTI (including URTI) symptoms visited a general practitioner's (GP) surgery [24]. Caregivers took most of the children in our study with URTI symptoms (78.0%) to visit a doctor. Easy access to village clinics, where making an appointment was not necessary, or a caregiver's special concerns about a child, may contribute to the high consultation rate. Among those who visited a doctor, the majority (70.2%) of caregivers recalled that their doctors gave them antibiotics. Because these were self-reported results, and some patients did not know whether or not they were prescribed an antibiotic, the true proportion of study respondents having used antibiotics is probably higher than reported. China initiated a Special Antimicrobials Use Rectification program in 2011 and demonstrated reduced antibiotics usage for tertiary hospitals [25]. But the findings suggested an urgent need for policies and interventions focused primarily on promoting rational antibiotics use in rural communities, especially in village clinics.

High rates of consulting a physician give these medical professionals an opportunity to play an important role in improving knowledge and in changing beliefs of caregivers. Aside from dissemination of knowledge about management of childhood infections, shared-decision making between physicians and caregivers may facilitate evidence-based or delayed antibiotics prescription [26]. Thus, strategies for promoting effective communication with caregivers on proper use of antibiotics should be included in physician training.

Our findings also confirmed that self-medication was an important way in which caregivers and children in rural areas gain access to antibiotics. Using left-over antibiotics from previous illnesses is likely to indicate over prescription by clinicians and poor compliance by patients. It may result from dispensing of medicine in fixed-count packages. China's Food and Drug Administration released a regulation entitled Provisions for Supervision of Drug Distribution that forbids sale of antibiotics without a prescription [27]. Even so, individuals in most rural areas continue to have easy access to antibiotics. We believe that future strategies about the harms of antibiotics abuse plus strengthening enforcement of the regulation should include both education for caregivers and for those who sell medicines at pharmacies.

Multivariate regression suggested that caregivers who had a habit of storing antibiotics at home preferred self-medication, and specifically, using antibiotics—rather than consulting a doctor. Once such a person went to a doctor, he or she had a greater chance of obtaining a prescription for antibiotics than those caregivers who did not store antibiotics at home. These results indicate a need to regulate and guide families about what they keep in the family medicine cabinet—through advice of a family physician, a pharmacist (see Box 1), or through public education. Pharmacists who commonly practice in hospitals and some big medicine shops at present, can and should in the future serve in a wider variety of settings including communities.

Findings of the study also suggest an important direction for future research. The following factors need to be considered in future studies: residents' self-medication or storing antibiotics at home; and other factors that could contribute to these two behaviors, such as individuals' distance to a medical service, financial status, or attitudes toward self-medication; what the role of pharmacists and sellers of medicines should be, etc.

The present study indicated that caregivers in rural area had extremely poor knowledge about antibiotics; this may contribute to overuse of antibiotics including overuse for children. Among respondents, 89.0% hold an inaccurate belief about whether antibiotics can cure infections caused by a virus. This percentage is much higher than that from a pan-European study where the average percentage of respondents giving an incorrect answer was 54% [28] and a Swedish population study with an incorrect answer rate of 21.0% [29]. It is also a higher rate than in a previous study of Chinese parents attending vaccination clinics (79%) [18] where 74.7% to 87.9% of participating caregivers believed that symptoms like a common cold, sore throat, or fever should be treated with antibiotics. A survey in England with 1767 participants found that 24% of respondents believed antibiotics to be effective treatment for most coughs and colds [24].

Regression analysis demonstrated that those who believed that antibiotics would be an effective treatment for a virus were more likely to adopt self-medication. Where there was clear nasal discharge, caregivers tended to decide on their own to use antibiotics. It will be useful to consider an educational campaign to disseminate basic information about antibiotics and to address misconceptions about how families should best manage symptoms (when antibiotics are not an appropriate treatment).

Elder groups of caregivers have increased the likelihood of self-treatment with antibiotics. Their lower level of education and poor knowledge about antibiotics may contribute to this. Compared to younger caregivers, the older ones usually have limited access to information disseminated through books, journals, internet, or among a circle of friends communicating on the internet. When promoting an educational campaign in a rural area, special attention should be given to elder groups, bearing in mind their lower educational level and limited sources of knowledge.

Our findings also suggested that clinical features influenced physicians to prescribe antibiotics. This might be explained by physicians assessing the likelihood of a bacterial versus viral infection based on clinical observations. Purulent nasal discharge appears to be a strong predictor for prescribing antibiotics; this is confirmed by our findings and by studies of different ethnic populations [23, 30]. Purulence

occurs primarily when inflammatory cells or sloughed mucosal epithelial cells are present; this can result from either viral or bacterial infection [31]. Thus, mucus alone is not a predictor of bacterial infection that would lead to prescription of antibiotics. Our study did not include detailed information such as interaction between symptoms or duration of complaints. Thus, it is difficult to conclude whether antibiotics are over-prescribed for any one individual. The high antibiotic prescription rate, combined with the associated symptoms still point to the need to understand physicians' prescription behavior and to train them how to manage those symptoms appropriately in rural areas.

Strengths and limitations

Compared with studies based on hospital-based data, our study provides more detail by tracking the entire process and collecting data from the community using recent URTI management experiences to provide a representative sample and avoid selecting bias. Our study had a high response rate—96.4%. As to limitations, the data are based on self-reports from caregivers that may produce recall bias. Although Anhui is a typical agriculture and labor exporting province and its social, cultural, and economic background can be regarded as an epitome of the middle-east of China, one still needs to be cautious about generalizing these findings to other areas.

Conclusion

The findings showed inappropriate antibiotics prescription from physicians and self-medication with antibiotics by caregivers in rural China. There is urgent need to assess and intervene in rural communities to improve rational use of antibiotics. Consultation gives primary care physicians the opportunity to disseminate knowledge and promote shared-decision making. Effective communication with patients or caregivers should be included in physician training. Physicians could then help to improve caregivers' extremely poor knowledge about antibiotics and lack of common sense on how to manage children's URTI symptoms. A complementary educational campaign for caregivers is also needed. It should include symptom-based information to address caregivers' concerns. Such education will need to be delivered by those who understand the science and can effectively address the use of left-over drugs in family medicine cabinets. Additionally, the need to regulate self-medication among caregivers is urgent. Doing so will require strengthening the enforcement of drug sale regulations.

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