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Pathways of healthcare and antibiotics use following reported gastrointestinal illness: a cross-sectional study in rural Anhui, China

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ABSTRACT

Objective To document the factors, and their pathways, that influence healthcare and antibiotics use following reported gastrointestinal illnesses in Anhui province, China.

Study design This study uses cross-sectional design, descriptive statistical analysis, pathway mapping and multivariate logistic regression modelling.

Setting Households in 12 villages in Anhui province, China.

Participants A total of 3659 residents who: (1) held a registered rural residence and were actually living in the sampled villages when this study was conducted; (2) were aged 18 years and older and (3) were willing to participate and able to answer the survey questions.

Outcome measures Planned and measured variables included the occurrence of gastrointestinal illness, professional care seeking and antibiotic use due to the illness and factors influencing these measures.

Results Of the 3659 informants, 29.0% reported gastrointestinal illness episodes in the past year. Of these episodes, 50.2% led to professional care seeking and 65.4% of antibiotic use. Multivariate logistic modelling identifies that: (1) reported gastrointestinal illnesses were more frequent in north compared with middle (OR 0.569, 95% CI 0.472 to 0.686) and south (OR 0.588, 95% CI 0.492 to 0.702) Anhui, and were positively associated with age (B=0.123, p<0.05), knowledge concerning (B=0.248, p<0.05) and practice of (B=0.184, p<0.05) prevention; (2) seeking professional care and antibiotic use following the illness was linked to the severity of symptoms and geographical locations, rather than to specific pathogenic features.

Conclusions Reported gastrointestinal illnesses are quite prevalent in the sample population and a large proportion of these have resulted in professional care and antibiotics use. The factors associated with the reported illnesses and pathways of healthcare and antibiotic use, as identified in this study, should inform future research and intervention efforts.

INTRODUCTION

Reported gastrointestinal illnesses (RGIs), or symptoms perceived by patients that seemingly have an origin from the gastrointestinal tract, comprise a wide range of diseases and conditions including bacterial and viral infections (eg, campylobacter infection, clostridium difficile infection, rotavirus infection, norovirus infection and adenovirus), inflammation (eg, ileitis, colitis and appendicitis), cancer (eg, oesophageal cancer, stomach cancer and colorectal cancer) and functional disorders (eg, functional dyspepsia, irritable bowel syndrome and chronic functional abdominal pain). Although the prevalence of gastrointestinal diseases/conditions varies depending on the definition and diagnosis criteria, they had been well recognised as a major cause of morbidity and mortality worldwide.[1–3] WHO reported that, in 2016, 'diarrhoeal disease' was the ninth most common cause of mortality from infectious diseases worldwide, accounting for some 1.4 million deaths.[1] El-Serag and Talley performed a meta-analysis of the literature published between 1976 and 2000 that identified the frequency of 'dyspepsia' to be 10%–40%[2]; while the findings from Oshima and Miwa review identified dyspepsia in 5.3%–20.4% of

the general population.[3] The two billion estimated cases of 'gastroenteritis' in 2015 resulted in 1.3 million deaths globally, mostly affecting children and those in the developing world.[4 5]

RGIs are economically costly conditions resulting in loss of time from work, medication use, repeated physician visits and hospitalisations and inappropriate diagnostic procedures.[6–12] In addition, RGIs are closely linked to antibiotics use and resistance, which has been recognised as one of the most serious public health issues worldwide.[5 13–16]

Causes of gastrointestinal illnesses are complex, comprising virus (eg, rotavirus, norovirus and calicivirus), bacteria (eg, *Escherichia coli*, salmonella and shigella), parasites (eg, whipworm, amoebic dysentery and giardiasis) and chemicals (eg, alcohol, salicylic acid and medicine), as well as psychological and behavioural factors (eg, stress, handwashing and intake of un-clean water).[17–21] The symptoms of gastrointestinal illnesses also vary greatly ranging from diarrhoea, vomiting, purulent or bloody stool to abdominal pain, gastric discomfort, anorexia and dehydration, among other symptoms. Most of these symptoms are non-specific with one symptom often being attributable to multiple causes and vice versa. Therefore, the diagnosis of gastrointestinal illnesses, in the absence of adequate lab tests and/or sophisticated examinations, is extremely difficult. Thus, all of these factors pose huge challenges for a majority of patients and primary care givers, who have minimal access to laboratory tests and other auxiliary examinations in deciding the type of intervention that is needed or should be provided. These issues of uncertainty suggest a clear need for more research that investigates the factors and the pathways influencing healthcare and antibiotics use following RGIs.

Data concerning the prevalence of RGIs and related service seeking among the Chinese is scarce. Limited studies have demonstrated that there are marked differences in the prevalence of RGIs among different populations and that there is a high probability for using antibiotics for RGIs in a variety of healthcare settings. According to our previous study in rural Anhui, China, 27.8% residents with symptomatic gastrointestinal infections sought professional healthcare and 81.7% of the patients with RGIs used antibiotics.[22] Despite the fact that a majority of RGIs are viral in origin, prescribing antibiotics for RGIs remains a common practice.[23] Studies exploring the reasons for patient's overall healthcare-seeking activities and the prevalence of antibiotic prescribing in China are generally lacking. Few publications focus on factors affecting service seeking and antibiotics use following symptomatic RGIs in China.

METHODS
Study setting, period and population
The study employed a stratified-clustered randomised sampling in recruiting both site villages and resident informants. The selection proceeded in four steps. Step

1: all the 61 counties in Anhui province were divided into north, middle and south regions. Step 2: four counties were randomly selected from each of the three regions, in addition to one township from each of the counties and one administrative village from each of the township sites. Step 3: one household from the village was randomly selected, from the list of all households within the village, as the starting household before 320 households—that were geographically closest to the starting household—were selected. Step 4: one household member from each of the households was randomly selected according to preset eligibility criteria, including those who: (1) had registered rural residence and were actually living in the sampled villages when the study was conducted; (2) were aged 18 years or older and (3) were willing to participate and able to answer the survey questions. Data collection took place in the field from 30 April to 12 May 2016.

Measurements and variables
The study used a structured questionnaire consisting of questions concerning four categories of variables: (1) social demographics (eg, age, gender and education); (2) the most recent episode of RGIs, including specific symptoms experienced; (3) responses to the RGIs, including taking leftover medicines, buying Over-the-counter (OTC) medicines from retail pharmacies (hereafter referred to as buying medicine) and seeking treatment from clinics; (4) the specific antibiotics obtained from clinics and retail pharmacies; and (5) knowledge concerning, and practice of, RGIs prevention (for details of the questionnaire and values assigned to the question items, please see online supplementary appendix 1). The questionnaire was adapted from our previous studies and was pilot tested before this study.[22]

In China, a 'pharmacy' generally refers to a department within a hospital or clinic that dispenses medicines to patients according to prescriptions by the clinicians working for the same hospital or clinic, while a 'retail pharmacy' is a private retail business that sells medicines to customers with or without prescriptions from clinicians. Almost all retail pharmacies in China sell both OTC and non-OTC medicines, including antibiotics. Although non-OTC medicines may be displayed in separate cabinets, in practice they may be purchased directly without prescription, and Chinese customers generally do not distinguish between these two types of medicines.

Data collection and analysis
Data were collected by face-to-face structured interviews using the aforementioned questionnaire. The interview was performed by trained medical graduates in a quiet location within the households of informants. Measures taken to ensure data quality included: (1) training and examination of the filed data collector and (2) daily checks by a quality supervisor of all the questionnaires completed during the day.

The data collected were doubled entered using EPI DATA V.3.1 and analysed using SPSS V.10.01.

Gastrointestinal illness used an operational definition. Regardless of the informant's actual health condition, any 'yes' answer to the question 'have you experienced any gastrointestinal illness in the past year?' was treated as an RGIs episode. Similarly, use of professional healthcare and/or antibiotics was also identified by the informant's self-report.

Data analysis included pathway mapping and multivariate logistic regression modelling. For the pathway mapping, we first classified our informants into different groups according to their RGIs status and responses following the RGIs and then mapped them onto a dendrogram illustrating all potential pathways, as well as the flow of responses along the diagram. Regarding the logistic regression modelling, we developed a range of models using RGIs, visit to clinics, practice of traditional care, use of prescribed antibiotics at clinics and use of leftover or purchased antibiotics, as the dependent variables respectively. For each of these dependent variables, we built two models by entering different sets of independent variables. All the models used the same confounder variables, including sociodemographics and geographical regions. But the models differed in exposure variables. For example, the model 1 of visit to clinics used the number of symptoms as the exposure variable; while model 2 of visit to clinics used specific symptoms (eg, diarrhoea, vomiting, purulent/bloody stool) as the exposure variables. Cases with missing data were excluded from the data analyses.

Patient and public involvement

Development of the research questions and outcome measures were informed by qualitative interviews and pilot tests with a purposively selected sample of rural residents within the study site communities in Anhui province.

RESULTS

### Demographic characteristics of informants

In total, the study approached 3840 informants and 3659 of them completed the interview, representing a response rate of 95.3% (table 1). The majority of informants were females (67.0%). The mean age of informants was 50.74 years (SD=12.88 years). Approximately one-third of informants reported no education, which corroborated with an illiteracy rate of 31.2%. Specifically, informants with primary school education accounted for about 29.1% of the sample; while those with 7 or more years of education accounted for 39.6%.

Response pathways following RGIs

Among the 3659 informants, 1060 (29.0%) reported an experience of gastrointestinal illnesses in the past year before the survey (figure 1). Of those with RGIs, 50.2% sought care from clinics, 22.6% used leftover or purchased medicine and 14.3% practised traditional care. The most frequently practised traditional care was abdominal message (65.1%), followed by absinthe-bath/prepared with Hb. artemesia (35.5%), folk soups (16.4%)

Table 1 Sociodemographics of informants

	Total (N/%)	Age group (years)			P value
		18–45 (N/%)	46–55 (N/%)	≥56 (N/%)	
Gender					
Male	1210 (33.0)	376 (32.0)	328 (29.3)	505 (37.1)	0.000
Female	2449 (67.0)	799 (68.0)	793 (70.7)	857 (62.9)	
Education					
0 years	1140 (31.2)	78 (6.6)	283 (25.3)	779 (57.3)	0.000
1–6 years	1064 (29.1)	284 (24.2)	405 (36.2)	375 (27.6)	
≥7 years	1449 (39.6)	812 (69.2)	431 (38.5)	206 (15.1)	
Missing	6 (0.2)				
Family size					
1–2	1110 (30.3)	167 (14.3)	320 (28.6)	623 (45.9)	0.000
3–4	1448 (39.6)	631 (53.9)	442 (39.5)	375 (27.6)	
≥5	1089 (29.8)	373 (31.9)	356 (31.8)	360 (26.5)	
Missing	12 (0.3)				
Region					
North	903 (24.7)	253 (21.5)	274 (24.4)	376 (27.6)	0.000
Middle	1211 (33.1)	362 (30.8)	375 (33.5)	474 (34.8)	
South	1545 (42.2)	560 (47.7)	472 (42.1)	513 (37.6)	
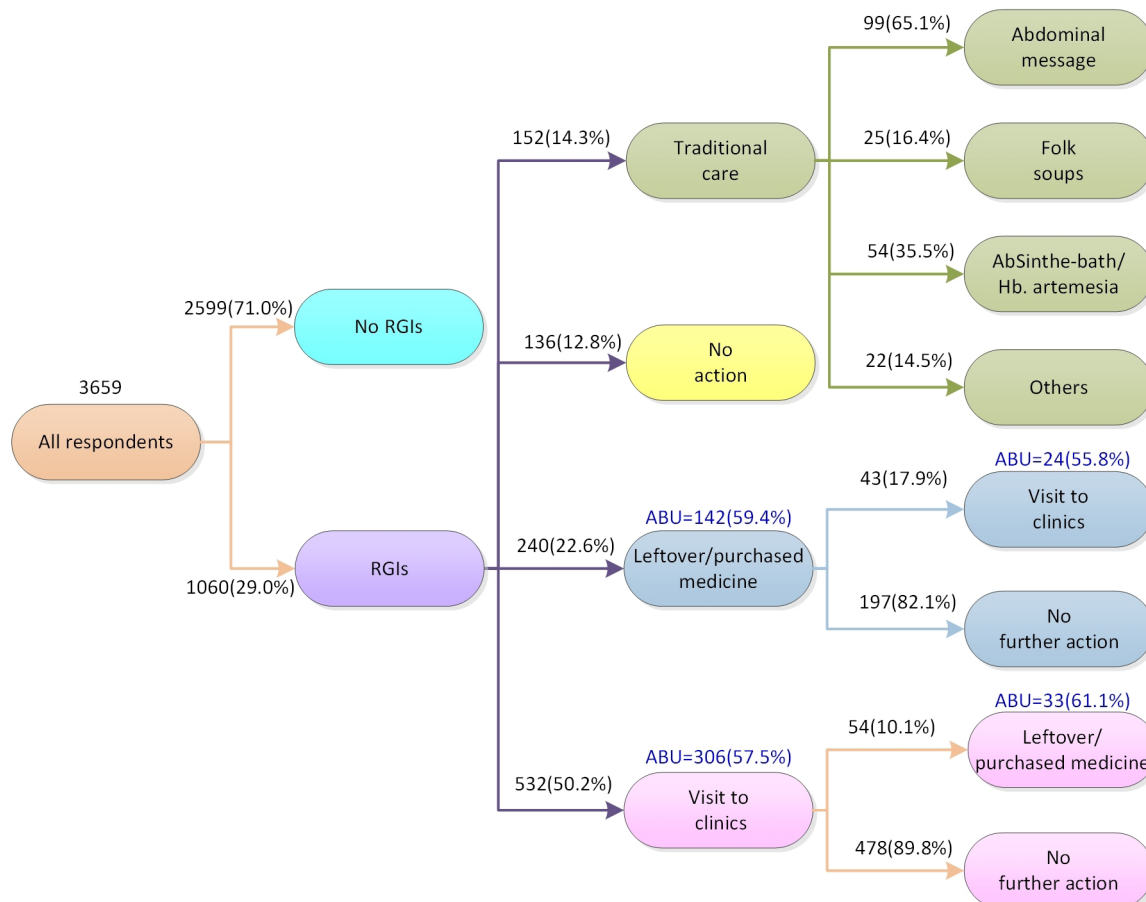
Figure 1 Healthcare and antibiotics use (ABU) following reported gastrointestinal symptoms. RGIs, reported gastrointestinal illnesses.

and other traditional methods (14.5%). Antibiotics were used by 57.5% of those who had visited clinics and 59.4% of the sample used leftover medicines or medicines purchased in a retail pharmacy.

Variables associated with reported RGIs

The study established two multivariate logistic regression models of RGIs (table 2). The first model includes sex, age group, education and geographical region as the independent variables. It reveals that RGIs were positively linked with age group (OR 1.123, 95% CI1.012 to 1.247). The likelihood of RGIs varied geographically, and was substantially lower in the villages of middle (OR 0.569, 95% CI 0.472 to 0.686) and south rural Anhui province (OR 0.588, 95% CI 0.492 to 0.702), than in the north of rural Anhui. Compared with model 1, model 2 introduces two additional independent variables; (1) the knowledge about RGIs prevention and (2) the practice of RGIs prevention. Model 2 demonstrates a positive correlation between RGIs and the knowledge about RGIs prevention (OR 1.282, 95% CI 1.136 to 1.446) and practice of RGIs prevention (OR 1.202, 95% CI 1.005 to 1.438); while the type of correlations between RGIs and other variables and their significance remained unchanged as illustrated in model 1.

Variables associated with health care seeking

The study also produced two multivariate logistic regression models of three healthcare-seeking behaviours, including visits to clinics, traditional care and leftover/purchased medicine (table 3). Sex did not demonstrate statistically significant associations with any of the behaviours in either model 1 or 2. Age group was positively linked with visit to clinics, but negatively linked to traditional care. Education group was significantly associated with use of leftover/purchased medicine in both models 1 and 2. Compared with north rural Anhui, informants with RGIs in the south were more likely to seek healthcare from clinics (OR 1.282) and those in the middle and south were less likely to use leftover and/or purchased medicines (OR 0.671 and OR 0.673). There was a strong correlation between informant visits to clinics and the number of RGIs symptoms. The correlation coefficient between visit to clinics and number of symptoms, in model 1, was 0.181. In other words, the group with the largest number of symptoms (six or greater) was 3.065 times more likely to visit clinics compared with the group with only one symptom. In model 2, the ORs for visiting clinics due to specific symptoms range from 0.447 (0.327 to 0.612) for diarrhoea to 3.047 (1.708 to 5.434) for purulent and/or bloody stool. The ORs for five out of the eight

Table 2 Multivariate logistic regression models of reported gastrointestinal illnesses (RGIs)

Independent variables	B	OR	95% CI
Model 1			
Sex	−0.084	0.919	0.782 to 1.081
Age group	0.116	1.123	1.012 to 1.247
Education	0.089	1.093	0.982 to 1.217
Geographical region			
Middle versus north Anhui	−0.563	0.569	0.472 to 0.686
South versus north Anhui	−0.532	0.588	0.492 to 0.702
Constant	−0.785	0.456	
Model 2			
Sex	−0.074	0.929	0.789 to 1.093
Age group	0.123	1.131	1.018 to 1.256
Education	0.053	1.054	0.945 to 1.176
Geographical region			
Middle versus north Anhui	−0.587	0.556	0.461 to 0.671
South versus north Anhui	−0.538	0.584	0.489 to 0.698
Score of knowledge concerning RGIs prevention	0.248	1.282	1.136 to 1.446
Score of practice of RGIs prevention	0.184	1.202	1.005 to 1.438
Constant	−0.074	0.227	

Sex: 1=male, 2=female; age group: 1=18–45, 2=46–55, 3≥56; education: 1=0 years, 2=1–6 years, 3=≥7 years; score of knowledge concerning RGIs prevention=sum of correct answers to the question items regarding knowledge concerning RGIs prevention, and score of practice of RGIs prevention=sum of correct answers to the question items regarding practice of RGIs prevention (please refer to online supplementary appendix 1 for details).
RGIs, reported gastrointestinal illnesses.

symptoms were statistically significant except for abdominal pain, dehydration and other symptoms. Diarrhoea was only positively linked with the use of traditional care. In comparison, both use of traditional care and leftover/purchased medicine does not exhibit clear relationships with either the number of symptoms, or the specific symptoms, except in the case of diarrhoea. Lastly, age group was negatively correlated to use of traditional care, and the residents in south and middle Anhui were more likely to use leftover/purchased medicines than those in north Anhui.

Variables associated with antibiotics use

Looking at the multivariate models of antibiotics use, social demographics and knowledge about antibiotics does not reveal any statistically significant correlations with antibiotics use in either model 1 or 2 (table 4). Antibiotics were prescribed more frequently for RGIs informants at clinics in the north than in either middle or south rural Anhui (OR=1.977 to 2.351). Informants with more symptoms were more likely to be prescribed antibiotics at clinics (OR 1.498, 95% CI 1.273 to 1.763) than those with fewer symptoms. For specific symptoms, only two out of eight symptoms demonstrated statistically significant

associations. Informants with abdominal pain (OR 1.546, 95% CI 1.013 to 2.359) and anorexia (OR 1.765, 95% CI 1.203 to 2.589) demonstrated greater chances of having antibiotics prescribed at clinics than those reporting other symptoms. By comparison, no specific symptoms were found to have statistically significant associations with use of leftover/purchased antibiotics.

DISCUSSION
Key findings

This study has provided useful data to better understand healthcare seeking and antibiotic use following RGIs among residents in rural Anhui, China. It produces an edendrogram of the flow of behavioural responses following RGIs and reveals frequent RGIs episodes and that a high percentage of these episodes had led to seeking antibiotics and healthcare interventions from clinics. The multivariate logistic modelling identifies that: (1) RGIs were more frequent in north compared with middle and south Anhui, and were positively associated with age, knowledge concerning and practice of prevention; (2) seeking professional care and antibiotic use following the illness was linked to the severity of symptoms and geographical locations, rather than to specific pathogenic features.

Implications in context of other research and for policy

For the prevalence of RGIs, it is difficult to compare the result from our study population with that from other countries, since different studies used different disease definitions and diagnostic criteria. However, our findings are consistent with other research in identifying that RGIs cause a significant burden on healthcare systems and play an important role in antibiotics use. While for the dendrogram derived from this study, it provides an illustrative depiction of the flow of behavioural responses following RGIs and thereby aids in identifying potential alternatives for diverting unnecessary healthcare and antibiotics use. Specific implications of the dendrogram include: (1) self-medication merits adequate attention in future interventions since it formed an important path of responses within the dendrogram, and specifically involved frequent antibiotic use; (2) educating patient with RGIs to use traditional care may prove to be an effective way for reducing unnecessary use of both antibiotics and professional care, particularly in terms of substituting self-medication; (3) doctors should be made fully aware that they need to ask whether their patients with RGIs have used leftover/purchased antibiotics and other medicines before the consultation. Additionally, doctors need to educate their patients not to practice self-medication after a visit.

Our finding that older informants were more likely to report RGIs may be attributable to: (1) the increase of gastrointestinal disorders as age increases and (2) the fact that older residents tend to be more sensitive to RGIs.[3 24] The elevated chances of experiencing RGIs by informants

Table 3 Multivariate logistic regression models of care seeking following reported gastrointestinal illnesses (RGIs)

Independent variables	Visit to clinics (yes=532, no=528)			Traditional care (yes=152, no=908)			Leftover/purchased medicine (yes=240, no=820)		
	B	OR	95% CI	B	OR	95% CI	B	OR	95% CI
Model 1									
Sex	0.160	1.173	0.886 to 1.553	0.193	1.213	0.814 to 1.806	−0.293	0.746	0.541 to 1.027
Age group	0.270	1.310	1.094 to 1.570	−0.406	0.666	0.516 to 0.861	0.079	1.082	0.878 to 1.335
Education	−0.239	0.787	0.653 to 0.949	−0.042	0.959	0.733 to 1.253	0.338	1.403	1.124 to 1.751
Geographical region									
Middle versus north	0.547	1.728	1.255 to 2.381	0.447	1.563	0.961 to 2.543	−0.398	0.671	0.464 to 0.972
South versus north	0.248	1.282	0.950 to 1.730	0.722	2.058	1.316 to 3.219	−0.460	0.631	0.446 to 0.894
No of symptoms	0.181	1.199	1.073 to 1.340	−0.010	0.990	0.846 to 1.157	0.024	1.024	0.899 to 1.167
Constant	−1.024	0.359		−1.621	0.198		−1.424	0.241	
Model 2									
Sex	0.121	1.129	0.840 to 1.516	0.238	1.269	0.840 to 1.916	−0.287	0.750	0.542 to 1.039
Age group	0.200	1.222	1.011 to 1.476	−0.328	0.720	0.553 to 0.938	0.098	1.103	0.891 to 1.365
Education	−0.206	0.814	0.670 to 0.988	−0.102	0.903	0.684 to 1.192	0.335	1.398	1.116 to 1.750
Geographical region									
Middle versus north	0.581	1.789	1.273 to 2.513	0.499	1.648	0.999 to 2.718	−0.437	0.646	0.442 to 0.944
South versus north	0.372	1.451	1.055 to 1.994	0.663	1.940	1.229 to 3.064	−0.507	0.602	0.423 to 0.857
Specific symptom									
Diarrhoea	−0.805	0.447	0.327 to 0.612	0.840	2.316	1.460 to 3.675	0.232	1.261	0.878 to 1.812
Vomiting	0.646	1.907	1.288 to 2.825	−0.623	0.536	0.275 to 1.047	−0.219	0.803	0.510 to 1.264
Purulent/bloody stool	1.114	3.047	1.708 to 5.434	−0.534	0.586	0.241 to 1.426	−0.674	0.510	0.256 to 1.016
Dehydration	0.200	1.221	0.771 to 1.934	−0.596	0.551	0.271 to 1.123	0.309	1.361	0.822 to 2.256
Abdominal pain	0.198	1.219	0.907 to 1.638	0.112	1.119	0.750 to 1.669	−0.036	0.964	0.691 to 1.347
Gastric discomfort	0.336	1.399	1.043 to 1.878	−0.293	0.746	0.504 to 1.104	0.143	1.153	0.821 to 1.621
Anorexia	0.345	1.413	1.073 to 1.860	−0.100	0.905	0.616 to 1.328	−0.003	0.997	0.726 to 1.369
Other symptoms	0.066	1.068	0.722 to 1.578	0.105	1.110	0.642 to 1.920	0.131	1.140	0.733 to 1.774
Constant	−0.705	0.494		−2.001	0.135		−1.561	0.210	

Sex: 1=male, 2=female; age group: 1=18–45, 2=46–55, 3≥56; education: 1=0 years, 2=1–6 years, 3=≥7 years.

in the north, compared with those in the middle and south of Anhui may be mainly due to specific differences in economic and dietary conditions. The north of Anhui is the least developed area in the whole province.[25] Diet in north Anhui features high amounts of salt and low quantities of fruit and vegetables. Clean water supply and other hygienic conditions are also more problematic in north Anhui, compared with the middle and south.[25] The positive correlation of RGIs to the knowledge about, and practice of, RGIs prevention (table 2, model 2) may not necessarily mean that knowledge about prevention and practice of prevention places individuals at risk. Being a retrospective study, the knowledge about, and practice of, RGIs prevention reflect the informants' status when this study was conducted, rather than before the occurrence of the RGI episode under concern. Therefore, it was possible that past RGI episodes had, to some extent, driven the informants to both learn and practice prevention.

Regarding the models of healthcare seeking that follow RGIs, older informants tended to choose professional rather than traditional care. This may be explained by the informants' severity of, and intolerance to RGIs. On the one hand, older informants may have experienced more severe RGIs due to poorer health conditions. On the other, older informants may believe that they are more vulnerable than younger patients and therefore cannot risk delay in seeking adequate help.[26] The spatial difference (more visits to clinics but less use of leftover/purchased medicines in the middle than in the south and north of Anhui) may reflect the combined effects of physical and financial access to healthcare.[27] The middle region (where the capital city of the province is located) is the most affluent area in Anhui; while the south is a mountainous area that may prohibit easy physical access to healthcare; though possessing better economic conditions than the north.[25] Overall, our findings suggest that RGIs symptoms are important determinants of healthcare

Table 4 Multivariate logistic regression models of antibiotics use following reported gastrointestinal illnesses (RGIs)

Independent variables	Prescribed antibiotics at clinics (yes=306, no=226)			Leftover/purchased antibiotics (yes=142, no=98)		
	B	OR	95% CI	B	OR	95% CI
Model 1						
Sex	0.149	1.160	0.764 to 1.761	0.482	1.619	0.926 to 2.831
Age group	0.239	1.270	0.975 to 1.653	−0.004	0.996	0.675 to 1.471
Education	0.184	1.203	0.920 to 1.572	−0.114	0.892	0.594 to 1.339
Geographical region						
Middle versus north Anhui	0.682	1.977	1.253 to 3.120	−0.079	0.924	0.469 to 1.821
South versus north Anhui	0.855	2.351	1.486 to 3.720	0.313	1.368	0.716 to 2.614
No of symptoms	0.404	1.498	1.273 to 1.763	0.202	1.224	0.967 to 1.551
Score of knowledge about antibiotics	−0.232	0.793	0.585 to 1.074	−0.355	0.701	0.461 to 1.067
Constant	−1.930	0.145		0.099	1.105	
Model 2						
Sex	0.130	1.139	0.748 to 1.735	0.467	1.595	0.894 to 2.846
Age group	0.201	1.222	0.936 to 1.596	0.010	1.010	0.679 to 1.502
Education	0.141	1.152	0.879 to 1.509	−0.143	0.866	0.569 to 1.320
Geographical region						
Middle versus north Anhui	0.692	1.998	1.248 to 3.198	0.011	1.011	0.496 to 2.062
South versus north Anhui	0.855	2.351	1.475 to 3.747	0.400	1.492	0.758 to 2.935
Specific symptom						
Diarrhoea	0.211	1.235	0.792 to 1.926	0.167	1.181	0.605 to 2.305
Vomiting	0.223	1.250	0.776 to 2.015	0.815	2.259	0.889 to 5.742
Purulent/bloody stool	0.321	1.378	0.718 to 2.645	−0.136	0.873	0.218 to 3.496
Dehydration	0.035	1.036	0.559 to 1.921	−0.109	0.897	0.354 to 2.271
Abdominal pain	0.436	1.546	1.013 to 2.359	0.115	1.122	0.613 to 2.053
Gastric discomfort	−0.148	0.862	0.562 to 1.323	−0.268	0.765	0.406 to 1.442
Anorexia	0.568	1.765	1.203 to 2.589	0.428	1.534	0.851 to 2.763
Other symptoms	−0.150	0.861	0.515 to 1.441	0.262	1.300	0.547 to 3.088
Score of knowledge about antibiotics	−0.200	0.819	0.603 to 1.112	−0.372	0.689	0.445 to 1.067
Constant	−1.334	0.263		0.340	1.405	

Sex: 1=male, 2=female; age group: 1=18–45, 2=46–55, 3≥56; education: 1=0 years, 2=1–6 years, 3=≥7 years; score of knowledge about antibiotics=sum of correct answers to the question items regarding knowledge about antibiotics (please refer to online supplementary appendix 1 for details).

seeking. A larger number of symptoms experienced tended to drive informants from informal to professional care. In terms of specific symptoms, informants with purulent/bloody stool (followed by informants experiencing vomiting, gastric discomfort and anorexia) were more likely to seek healthcare than informants with other symptoms. For informants, a larger number of symptoms may indicate severer illness and pain or discomfort. Such perceptions may be the main reason why the number of symptoms described by informants was positively correlated with their seeking professional healthcare interventions. The correlation between the number of symptoms and healthcare seeking may also suggest that what the informants sought from clinicians were cures

for their symptoms or illness, but not necessarily specific treatments, such as antibiotics. This observation is consistent with the correlations between professional healthcare seeking and specific symptoms. Blood in stool, vomiting, gastric discomfort and anorexia are all non-specific symptoms. So, the magnitude of the correlation coefficients of these symptoms with professional healthcare seeking can be best explained by their perceived significance to informants' health or well-being. In other words, why bloody stool illustrated a greater coefficient than vomiting may be because informants perceive bleeding as more threatening than vomiting.

In our models of antibiotics use, the chance of prescribing antibiotics at clinics in north Anhui was 1.996

and 2.321 times greater than that in the middle and south of the province. This geographical disparity merits further research and it is justified only if the proportion of patients to clinics with RGIs caused by bacteria infection in the north is some twofold that in the middle and south. The positive correlation between antibiotic use and the number of reported symptoms also merits further scrutiny since the number of symptoms is, as mentioned above, more indicative of the severity of RGIs than of a bacterial aetiology. A greater number of symptoms may lead doctors to perceive stronger patient pressure for more and quicker cures, and for preventing complications. In examining specific symptoms, antibiotics use was not correlated with purulent/bloody stool, but with abdominal pain and anorexia. Both abdominal pain and anorexia are non-specific symptoms; while purulent stool may be more likely caused by a bacterial infection. These findings again suggest that the use of antibiotics lacked clear indications.

Study limitations

This study has a number of limitations. First, it relies on subjective perceptions and self-reports. For example, informants can be unreliable in accurately reporting gastrointestinal symptoms, healthcare seeking and antibiotic use. They may also have inherent tendencies to respond in ways that render them healthier (eg, being less likely to RGI episodes and/or symptoms) or otherwise conform to social norms (eg, being more likely to engage in handwashing and other prevention behaviours). Second, given the broad symptom-based definition of RGIs used in the study, seasonal and other influences on symptom occurrence may have affected the estimation of frequency of symptoms. Third, the over-representation of females may raise concerns about selection biases. However, our analysis revealed no significant differences by sex in terms of symptom-related healthcare seeking and use of antibiotics.

CONCLUSION

RGIs are quite prevalent in the sample population and a large proportion of the illnesses have resulted in professional care and antibiotics use. Age, knowledge and prevention behaviours are all correlated with RGIs and subsequent antibiotic and other healthcare utilisation. Both traditional care and non-action form integral parts along the pathways of informants' responses to RGIs. Symptoms drive patients to seek professional healthcare for the non-specific need of curing the illnesses, but are often given unnecessary specific treatments, such as antibiotics, due to misperceptions. These findings should be of concern for addressing issues of overuse and unnecessary use of healthcare and antibiotics and inform future research and intervention efforts in this area of analysis.

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