Research Article

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A Cross Sectional Study of Public Knowledge and Attitude towards Antibiotics in Putrajaya, Malaysia

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Abstract

Objective: The objective of the study was to assess public knowledge and attitudes regarding antibiotic utilization in Putrajaya, Malaysia.

Methods: A self-administered questionnaire survey was conducted among public attending a local hospital. The four-part questionnaire collected responses on demographic characteristics, recent use of antibiotics, knowledge and attitude statements. Cronbach's alpha for knowledge and attitude statements were 0.68 and 0.74 respectively. Only questionnaires with complete responses were analysed. General linear modelling was used to identify demographic characteristics which contributed significantly to knowledge and attitude. Multiple logistic regression was used to determine the adjusted odds ratios of obtaining an inappropriate response for each knowledge and attitude statement. The relationship between antibiotic knowledge and attitude was examined using Pearson's correlation and correlation between related statements was performed using the Chi-square test. In all statistical analyses, a p-value of < 0.05 was considered statistically significant.

Results: There was positive correlation ($p<0.001$) between mean knowledge (6.07±2.52) and attitude scores (5.59±1.67). Highest education level ($p<0.001$) and healthcare-related occupation ($p=0.001$) contributed significantly to knowledge. Gender ($p=0.010$), race ($p=0.005$), highest education level ($p<0.001$), employment status ($p=0.016$) and healthcare-related occupation ($p=0.005$) contributed significantly to attitude. The differences in score between demographic groups were small. Misconceptions that antibiotics would work on both bacterial and viral infections were reported. Approximately three quarters of respondents expected antibiotics for treatment of coughs and colds. Close to two thirds (60%) believed that taking antibiotics would improve recovery. Several demographic groups were identified as 'high risk' with respect to gaps in knowledge and attitude.

Conclusions: This study has identified important knowledge and attitude gaps as well as people 'at risk'. These findings would be useful in strategizing targeted antibiotic awareness campaigns and patient counselling.

Keywords: antibiotic, attitude, knowledge, Malaysia, public, survey

Introduction

Emergence of antibiotic resistance has become a global public health concern in recent decades. Studies in Europe [1,2] indicate that resistance against antibiotics increases with higher consumption, which could be driven by irrational use of antibiotics and insufficient patient education by prescribers. [3]

While antibiotic utilization in Malaysia (9.65 defined daily doses (DDD) / 1000 population / day) [4] is low compared to European countries such as Norway (16.16), Denmark (17.8), France (21.56) and Finland (30.85) [5], the country is not free from the issue of antibiotic resistance. In fact, in 2010, the National Surveillance on Antibiotic Resistance [6] reported an increase of antibiotic resistance among common strains of bacteria such as ***Staphylococcus aureus, Acinebacter*** and ***Haemophilus influenzae***.

According to the Malaysian National Medicine Use Survey (NMUS) 2007, antibiotics were the 11th most utilised therapeutic

group in Malaysia and accounted for the largest proportion of money spent in 2006 and 2007 [4]. The most widely used antibiotic class was the penicillin [4]. Several local studies reported upper respiratory tract infections as the most common infections to be prescribed antibiotics in hospitals (31%) [7] and primary care (50 – 55.2%) [8,9]. Inappropriate prescribing of antibiotics and poor patient knowledge were observed in many of these studies [7–10]. In another study [11], only 21.4% of survey respondents were able to understand antibiotic usage instructions on the labels. The only Malaysian study assessing public knowledge and attitude towards antibiotics was conducted in the northern state of Penang, and revealed a sizeable proportion of respondents having poor knowledge and attitude towards antibiotics [12].

The World Health Organization (WHO) issued a Global Strategy for Containment of Antimicrobial Resistance in 2001 which urged member countries to initiate awareness and educational campaigns for patients and general community on appropriate use of antibiotics to combat antibiotic resistance [13]. This was echoed by International Pharmaceutical Federation (FIP) in 2008 in its Statement of Policy on Control of Antimicrobial Drug Resistance [14] and WHO Regional Office for South-East Asia [15] in 2010. In line with these recommendations [13–15] and in view of the lack of evidence in Malaysia the study was designed and carried out among public members in Putrajaya, a federal government administrative city located about 25km south of Kuala Lumpur. In 2010, Putrajaya was home to an estimated 85,636 people. [16]

The objective of this study was to assess public knowledge and attitude regarding antibiotic utilization in Putrajaya, Malaysia. The study is registered in the National Medical Research Register (ID: NMRR-12-8-10849).

Methods

Questionnaire Development and Structure

A questionnaire was used to gather public responses. A four-part questionnaire was adapted and modified from previous studies [12, 17–19]. Part I recorded a total of 9 demographic characteristics and Part II documented respondents' recent antibiotics consumption (defined as antibiotic use within the past four weeks). Part III was made up of 12 knowledge statements covering five aspects including: identification of antibiotics, action of antibiotics, good bacteria, adverse effects of antibiotics and administration of antibiotics. Participants were asked to respond with either "Yes", "No" or "Not Sure". Part IV contained eight attitude statements and respondents were required to answer according to a 5-point Likert scale (1=strongly disagree; 2=disagree; 3=not sure; 4=agree and 5=strongly agree). Part IV was adopted wholly from a previous study [12].

The questionnaire was originally developed in English, which was then translated into Malay language (the national language of Malaysia). Face and content validation of the questionnaire was undertaken by a panel of senior hospital pharmacists. Feedback was gathered to improve the questionnaire presentation, clarity and congruency of meaning. Modifications were made and the questionnaire was pilot-tested among 30 respondents. Pilot testing was carried out based on the feedback from the first round and reliability testing was also conducted. Cronbach's alpha for Part III and Part IV of the questionnaire were 0.68 and 0.74 respectively.

Study Design and Administration of Questionnaire

The study was conducted over 6 weeks in February and March 2010 using the validated questionnaire. Respondents were attendees of the outpatient pharmacy department of Putrajaya Hospital. Sample size was determined using the Raosoft sample size calculator [20] for the population of 116,000 people attending Putrajaya Hospital annually. A sample size of 383 was required to provide a confidence level of 95%.

Along with a confidentiality statement and paragraph explaining the objectives of the study, 520 self-administered questionnaires were distributed to account for potential non-response. A convenience sampling method was adopted. The inclusion criteria were: (1) Adults aged 18 years and over; (2) able to read and understand Malay or English and (3) aware of the term 'Antibiotics'. Verbal consent was obtained from all study participants before administering the questionnaire. No personal identifiers were included in the form.

Statistical Analysis

Only fully completed questionnaires were included in the analysis. Numerical data were expressed as mean ± standard deviation. Respondents' age was categorised into four groups "18–30", "31-45", "46-60" and "61 and above". "Appropriate responses", defined as correct answers for Part III and positive attitude for Part IV were given 1 score as opposed to 0 score for "inappropriate responses", defined as either incorrect answers, negative attitude or "Not Sure".

All data were analysed using SPSS® version 20.0. Demographic characteristics, recent use of antibiotics, knowledge and attitude scores were summarised using descriptive statistics. The difference between mean scores was examined by using t-test or ANOVA where appropriate. Demographic characteristics which contributed significantly to knowledge and attitude were identified using a general linear model (GLM). The adjusted odds ratios (AORs) of obtaining an inappropriate response for each knowledge and attitude statement were determined using multiple logistic regressions. Pearson's correlation was used to examine the relationship between antibiotic knowledge and attitude. Correlation between related statements was performed using Chi-square test. In all statistical analyses, a p-value of < 0.05 was considered to be statistically significant.

Results

Out of 520 questionnaires distributed, 508 questionnaires were returned (97.7% response), of which 107 questionnaires were incomplete. The final sample included 401 questionnaires.

Respondents' demographic characteristics are summarised in Table 1. The mean age of the respondents was 41.1 ± 13.8 years old, with most falling within the 31-45 age group. Most respondents were Malay (77.1%), female (63.8%), had undertaken tertiary education (62.1%) and were wage-earners (64.6%). A minority of respondents worked in health-related occupation (11.0%), as did their family members (23.9%).

Only characteristics with significant difference ($p < 0.05$) in mean scores were included in the general linear model (Table 1). After adjustment, highest education level ($p<0.001$) and healthcare-related occupation ($p=0.001$) were found to contribute significantly to the mean knowledge score whereas gender ($p=0.010$), race ($p=0.005$), highest education level ($p<0.001$), employment status ($p=0.016$) and healthcare-related occupation ($p=0.005$) were found to contribute significantly to mean attitude score.

Sixty six respondents (16.5%) reported taking antibiotics within the past four weeks of the survey; most of whom obtained their medicines after consultation with doctors. Three admitted to purchasing antibiotics from retail pharmacy without prior consultation. The most common reason cited for taking antibiotics was respiratory tract infections (31.4%), which was defined as either cold, cough or flu, followed by fever (29.1%), others (12.8%), pain or inflammation (10.5%), skin problems or wounds (8.1%) and urinary tract infections (8.1%). Respondents who cited "Others" specified eye infection, ear infection, tooth infection or post-operative use as their reasons for consuming antibiotics.

The knowledge score ranged from 0 to 12 points, with a mean of 6.07 ± 2.52 and a median of 6.00. Highest inappropriate response was observed for statements on role of antibiotics. The majority of respondents did not know that antibiotics would not work against viral infections (83.0%) and most coughs and colds (82.0%). On the other hand, the majority (82.5%) seemed to be aware that antibiotics may cause allergic reactions; about half of them (52.1%) did not know antibiotics could also cause side effects. Knowledge on antibiotic resistance was also low (Table 2).

The statement "It is okay to stop taking antibiotics when symptoms are improving" was strongly associated with the statements "Antibiotics are the same as medications used to relieve pain and fever such as aspirin and paracetamol" ($p<0.001$) and "Taking less antibiotic than prescribed is more healthy than taking the full course prescribed." ($p<0.001$).

The attitude score ranged from 0 to 8 points, with a mean score of 5.59 ± 1.67 and a median of 6.00. The percentage of inappropriate responses for the eight attitude statements are summarised in Table 3.

Table 1: Respondents' demographic characteristics

Characteristics		Mean Knowledge Score ± S.D	*p value*	Mean Attitude Score ± S.D	*p value*
Gender	Female (n = 256)	6.31 ± 2.45	0.012	5.79 ± 1.53	0.002
	Male (n = 145)	5.64 ± 2.59		5.23 ± 1.84	
Age (years old)	> 60 (n = 37)	6.73 ± 2.92	0.329	6.27 ± 1.74	0.062
	46 – 60 (n = 107)	6.16 ± 2.37		5.61 ± 1.62	
	31 – 45 (n = 144)	5.96 ± 2.42		5.49 ± 1.73	
	18 – 30 (n = 113)	5.90 ± 2.64		5.47 ± 1.57	
Race	Malay (n = 309)	6.00 ± 2.46	0.353	5.46 ± 1.64	0.003
	Chinese (n = 46)	6.67 ± 2.44		6.39 ± 1.42	
	Indian (n = 31)	6.03 ± 2.83		5.81 ± 1.92	
	Others (n = 15)	5.67 ± 3.2		5.27 ± 1.67	
Highest Educat -ion Level	College / University (n = 249)	6.62 ± 2.41	0.000	5.86 ± 1.56	0.000
	Secondary School (n = 128)	5.21 ± 2.35		5.10 ± 1.72	
	Primary School (n = 17)	4.53 ± 2.53		5.35 ± 1.69	
	None (n = 7)	5.86 ± 3.98		5.29 ± 2.63	
Employ -ment Status	Employed for Wages (n = 259)	6.11 ± 2.48	0.643	5.61 ± 1.66	0.031
	Self employed (n = 29)	5.48 ± 2.69		4.79 ± 1.50	
	Housewife / Househusband (n = 32)	6.41 ± 2.30		5.88 ± 1.68	
	Retired / Unemployed (n = 60)	6.10 ± 2.73		5.85 ± 1.70	
	Student (n = 21)	5.76 ± 2.55		5.14 ± 1.62	
Is your occupation related to health-care?	Yes (n = 44)	7.34 ± 3.06	0.004	6.43 ± 1.42	0.000
	No (n = 357)	5.91 ± 2.41		5.48 ± 1.67	
Is your family's occupation related to health-care?	Yes (n = 96)	6.49 ± 2.47	0.058	5.86 ± 1.67	0.062
	No (n = 305)	5.93 ± 2.53		5.50 ± 1.66	
What is your most common location seeking health-care?	Govt. Clinic / Hospital (n = 289)	6.08 ± 2.51	0.268	5.56 ± 1.69	0.182
	Private Clinic / Hospital (n = 92)	5.85 ±2.64		5.51 ± 1.53	
	Pharmacy (n = 20)	6.85 ± 2.08		6.25 ±1.89	
	Others (n = 0)	-		-	
Do you have any chronic disease?	Yes (n = 142)	6.16 ± 2.58	0.582	5.73 ± 1.56	0.181
	No (n = 259)	6.02 ± 2.50		5.51 ± 1.72	

Table 2: Proportion of inappropriate responses for knowledge statements, compared to that for similar statements from other studies.

	No.	Statement	Current Study (%) N=401	Oh *et al* (%)[12] N=408	McNulty *et al* (%)[17] N=7120	Chen *et al* (%)[18] N=1024
Role of Antibiotics	1.	Antibiotics are medicines that can kill bacteria.	21.7	23.3	20.0*	-
	2.	Antibiotics can be used to treat viral infections.	83.0	86.6	± 53.0*	-
	3.	Antibiotics work on most colds & coughs.	82.0	-	38.0	-
Good Bacteria	4.	Antibiotics can kill bacteria that normally live on the skin and gut (digestion tract).	60.3	-	43.0*	-
	5.	Bacteria that normally live on the skin and in the gut are good for your health.	73.1	-	± 42.0	-
Idenfitication of Antibiotics	6.	Antibiotics are the same as medications used to relieve pain and fever such as aspirin and paracetamol (Panadol).	33.4	-	-	-
	7.	Penicillin is an antibiotic.	61.8	54.9	-	-
Adverse Effects	8.	Antibiotics may cause allergic reactions.	17.5	46.0	-	-
	9.	Antibiotics do not cause side effects.	52.1	54.4	-	-
	10.	Overuse of antibiotics can cause the antibiotics to lose effectiveness in long term.	32.2	40.9*	-	-
Administration of Antibiotics	11.	It is okay to stop taking an antibiotic when symptoms are improving.	41.9	28.9*	-	49.9*
	12.	Taking less antibiotic than prescribed is more healthy than taking the full course prescribed.	33.2	-	-	92.6*

* Statements were not exactly the same as that in this study.

Nearly half of the respondents (45.6%) would stop an antibiotic course when their symptoms improved. Meanwhile, seventeen percent of respondents reported sharing their antibiotics with family members and would store antibiotics at home for emergency use. A small percentage of respondents demonstrated little caution when consuming antibiotics. In particular, seven percent did not check expiry dates and fewer again (3.5%) reported not taking antibiotics according to labelled instructions. Strong association was observed between respondents who would expect an antibiotic prescription for the common cold and those who thought antibiotics were effective in treating coughs and colds ($p<0.001$).

Table 3: Proportion of inappropriate responses for attitude statements, compared to that for similar statements from other studies.

No.	Statement	Current Study (%) N=401	Oh *et al* (%)[12] N=408	Chen *et al*[18] (%) N=1204	Vanden Eng *et al* (%)[19] N=12755
1.	When I get cold, I will take antibiotics to help me get better more quickly.	61.8	46.8	-	36.9*
2.	I expect antibiotic to be prescribed by my doctor if I suffer from common cold symptoms.	73.8	57.8	24.9*	53.6*
3.	I normally stop taking an antibiotic when I start feeling better.	45.6	40.2	-	-
4.	If my family member is sick I usually will give my antibiotic to them.	17.0	11.8	13.1*	-
5.	I normally keep antibiotic stock at home in case of emergency.	17.0	19.9	-	-
6.	I will use leftover antibiotics for a respiratory illness (runny nose/ sore throat / flu).	14.7	11.5	-	-
7.	I will take antibiotic according to the instruction on the label.	3.5	6.9	4.5*	-
8.	I normally will look at the expiry date of antibiotic before taking it.	7.0	7.8	-	-

* Statements were not exactly the same as that in this study

Significant positive correlation was noted between respondents' antibiotic knowledge score and their attitude score (r = 0.462, p<0.001). The AORs for knowledge and attitude statements are found in Table 4 and 5 respectively, with demographic characteristics. People in younger age groups, with secondary education or lower and male were found to have higher odds of poor knowledge on adverse reactions, administration of antibiotics, and attitute statements (Table 4). Those in the younger age groups were more likely to report taking antibiotics to recover more quickly, to expect antibiotics for common cold and to stop antibiotics when symptoms improve. Respondents with primary and / or no education were those who reported less caution in using leftover antibiotics and not using antibiotics according to instructions on the label (Table 5).

Table 4: Factors associated with inappropriate response for each knowledge statements.

Statement		1	2	3	4	5	6	7	8	9	10	11	12
Gender	Female[a]	1	1	1	1	1	1	1	1	1	1	1	1
	Male	1.577	0.936	**1.787**	0.867	0.900	1.319	1.261	**2.381**	**1.704**	**1.712**	**2.120**	**1.820**
Age	More than 60[a]	1	1	1	1	1	1	1	1	1	1	1	1
	46 – 60	**3.247**	1.114	0.889	1.902	1.726	0.975	1.308	0.930	1.141	1.580	2.328	1.098
	31 – 45	2.489	1.940	1.662	1.597	**2.881**	1.018	0.941	2.648	1.207	2.454	**3.020**	2.269
	18 – 30	**2.837**	2.249	0.804	1.770	2.475	1.177	0.974	**5.071**	1.774	**4.346**	**2.976**	**2.566**
Race	Malay[a]	1	1	1	1	1	1	1	1	1	1	1	1
	Chinese	0.612	**1.327**	0.818	0.482	0.528	2.107	**5.734**	0.263	**0.153**	0.990	0.748	1.264
	Indian	1.519	0.934	1.165	0.957	1.265	1.108	1.054	0.712	**0.256**	1.402	0.850	0.900
	Others	0.510	1.392	**6.178**	2.897	0.629	0.849	0.658	0.674	0.353	1.325	0.298	0.517
Highest Education Level	University / College[a]	1	1	1	1	1	1	1	1	1	1	1	1
	Secondary	**3.076**	1.329	0.837	**4.322**	**2.107**	1.078	**1.832**	**2.168**	1.726	**2.044**	**3.405**	**3.140**
	Primary	**5.662**	2.594	1.497	1.574	1.071	0.938	1.040	2.847	2.701	**8.686**	**5.076**	**5.134**
	None	2.255	2.823	1.567	2.511	1.252	1.757	1.037	6.407	0.537	2.415	**5.991**	4.429
Employment Status	Employed for wages[a]	1	1	1	1	1	1	1	1	1	1	1	1
	Self-employed	1.943	1.121	0.920	1.014	1.725	0.870	0.944	0.436	1.010	1.495	1.835	1.261
	Housewife / House husband	0.630	1.200	0.285	0.522	1.214	0.782	1.417	0.891	**0.381**	0.749	**2.454**	0.614
	Retired / Unemployed	0.684	1.277	0.764	1.729	2.868	0.519	1.014	1.899	1.628	0.934	0.967	1.427
	Student	1.491	2.130	0.536	2.469	0.736	1.785	1.329	0.840	0.592	2.151	1.190	0.536
Is your occupation related to healthcare?	Yes[a]	1	1	1	1	1	1	1	1	1	1	1	1
	No	1.082	**3.076**	1.162	**5.341**	2.185	1.116	**2.072**	1.615	1.929	1.712	1.215	1.392
Is your family's occupation related to healthcare?	Yes[a]	1	1	1	1	1	1	1	1	1	1	1	1
	No	0.802	1.053	0.984	0.518	0.810	**1.644**	1.480	0.796	0.990	1.509	1.048	1.385
What is your most common location seeking healthcare?	Government Clinic / Hospital[a]	1	1	1	1	1	1	1	1	1	1	1	1
	Private Clinic / Hospital	1.139	1.062	1.553	0.696	1.178	**1.850**	0.979	0.901	0.660	0.801	0.816	1.600
	Pharmacy	0.519	1.018	0.963	**0.287**	5.233	1.644	0.361	0.000	0.616	0.705	0.681	0.465
Do you have any long term diseases?	Yes[a]	1	1	1	1	1	1	1	1	1	1	1	1
	No	0.867	0.991	0.826	1.670	0.992	1.324	1.103	0.950	0.645	0.746	1.471	1.098

[a]Reference group of the categorical variable.
Odds ratios were adjusted for all variables. The odds ratios were obtained by stepwise multiple logistic regression analysis. Statistically significant variables are in bold.

Table 5: Factors associated with inappropriate response for each attitude statement.

Statement		1	2	3	4	5	6	7	8
Gender	Female[a]	1	1	1	1	1	1	1	1
	Male	**1.777**	1.670	**1.753**	**2.012**	**2.162**	**2.507**	2.628	1.564
Age	More than 60[a]	1	1	1	1	1	1	1	1
	46 – 60	**2.862**	2.152	2.306	1.355	0.766	1.243	6.537	2.684
	31 – 45	**4.697**	**3.571**	**3.125**	2.523	1.623	3.185	5.006	0.702
	18 – 30	**5.466**	**4.484**	**3.620**	2.779	1.845	3.164	1.154	1.083
Race	Malay[a]	1	1	1	1	1	1	1	1
	Chinese	**0.203**	**0.313**	**0.300**	0.886	1.212	1.285	4.869	1.336
	Indian	0.523	**0.313**	0.759	0.675	1.026	1.323	2.021	1.238
	Others	0.942	0.759	0.617	1.619	2.760	1.365	0.000	2.558
Highest Education Level	University / College[a]	1	1	1	1	1	1	**1**	1
	Secondary	**1.855**	**3.385**	**3.218**	**1.981**	1.530	1.651	**4.487**	0.737
	Primary	1.356	1.472	2.404	2.109	1.677	1.607	**16.373**	0.828
	None	1.468	1.489	2.815	4.867	1.293	**12.012**	**26.687**	4.984
Employment Status	Employed for wages[a]	1	1	1	1	1	1	1	1
	Self-employed	**3.049**	2.698	1.914	0.866	1.385	1.880	3.442	2.371
	Housewife / House husband	2.215	1.043	0.894	0.730	0.602	0.446	1.299	0.196
	Retired / Unemployed	1.971	1.648	1.221	0.817	0.697	2.104	0.851	0.597
	Student	2.480	2.792	1.611	1.697	2.343	0.214	0.000	3.984
Is your occupation related to healthcare?	Yes[a]	1	1	1	1	1	1	1	1
	No	1.951	**3.014**	1.723	1.273	1.184	1.553	1.284e8	1.259e8
Is your family's occupation related to healthcare?	Yes[a]	1	1	1	1	1	1	1	1
	No	1.283	**1.854**	1.157	1.168	1.163	0.721	0.538	0.971
What is your most common location seeking healthcare?	Government Clinic / Hospital[a]	1	1	1	1	1	1	1	1
	Private Clinic / Hospital	0.741	0.842	1..126	1.120	0.739	0.755	1.231	2.068
	Pharmacy	0.454	0.360	0.389	0.489	0.416	0.610	6.301	2.584
Do you have any long term diseases?	Yes[a]	1	1	1	1	1	1	1	1
	No	0.744	0.690	1.285	1.815	1.450	1.455	1.214	1.265

[a]Reference group of the categorical variable.
Odds ratios were adjusted for all variables. The odds ratios were obtained by stepwise multiple logistic regression analysis. Statistically significant variables are in bold.

Discussion

Antibiotic Use

Only 16.5% of respondents reported using antibiotics within the past month which was lower than the 28.9% reported in the northern state of Penang [12]. However, the main indications reported in this survey and the Penang survey were similar, with respiratory tract infections and fever being the main ones. It was still possible for the public to obtain antibiotics without prescriptions even though this practice is illegal. (Table 1) Compared to 7.5% reported in Penang [12] and 9.0% reported in Hong Kong [21], the proportion of respondents who did so in this study was lower (4.5%).

The Knowledge and Attitude Gaps

The results suggest that misunderstandings about antibiotic use were prevalent, which may cause unneccessary risk of antibiotic-resistant infection. Confusion about the role of antibiotics in treating infections was the most critical, with more than 80% of respondents failing to identify that antibiotics do not eradicate viral infections. This is consistent with the study in Penang (86.6%) [12]. In contrast, the proportion was reported to be 53.0% in a UK study [17]. Thirty eight percent of respondents from the UK study [17] thought antibiotics would be effective for treating most coughs and colds, compared to 83.0% in this study. The significant correlations between knowledge statements 6, 11 and 12 indicate that the knowledge gap might not be totally random. Respondents might have mistaken antibiotics as equivalent to painkillers or antipyretics, leading them to assume that stopping antibiotics is okay, as they would do with painkillers and antipyretics with symptom improvement.

The prevalence of inappropriate attitudes was higher compared to previous work [12,17,18]. In particular, more respondents from this survey reported that they would take antibiotics to help them recover faster, would expect antibiotics to be prescribed by a doctor for the common cold, would stop antibiotics when they start to feel better, would share antibiotics with sick family members and would use left-over antibiotics for treating future respiratory illnesses (Table 3).

Factors that were expected to have huge impact on knowledge and attitude, such as higher education level, race and increased age showed only a maximum of 2.1 score difference. Education level has been reported as a factor significantly associated with both knowledge [12,21] and attitude [21] on antibiotics. A local study found ethnicity to contribute significantly to knowledge on antibiotics [12].

Respondents' knowledge of appropriate antibiotic use was found to correlate postively with attitude. Strong association was also observed between several knowledge and attitude statements. This was consistent with a study in Korea, where adequate knowledge of antibiotics was shown to be a predictor for appropriate attitudes toward antibiotics and their use where participants with adequate knowledge were 1.52 times more likely to demonstrate appropriate attitude [22].

The 'High Risk' Group

This survey identified demographic groups who were prone to misconceptions and efforts to reach these groups of people should be a part of future educational campaigns. For instance, respondents without tertiary education may benefit from education about antibiotics only being effective for bacterial infections and not viruses.

Targeted Antibiotic Campaign and Counselling

An antibiotic campaign was launched in 1999 in the UK targeting young women and mothers who had higher consultation rates than other patients [23]. Its success in raising awareness on antibiotic resistance and reducing expectations for antibiotics had led the campaign being repeated in 2002. In Malaysia, it would be worth considering such a campaign at least at a local level. The Know Your Medicine Campaign [24] launched jointly by the Ministry of Health and Consumers Association of Malaysia in 2007 was a positive start and demonstrated willingness on the part of policy-makers but also providers at grassroot levels to promote prudent medicine usage among the public.

Previous work has reported members of the public not identifying with bacterial resistance as a personal threat and feel they have no role in managing the risk associated with it [25]. Hence, a targeted antibiotic campaign should aim to make members of the public, particularly those from the 'high risk' groups identified in this study feel that they have an influence in overcoming antibiotic resistance. Successful implementation of a nationwide campaign could potentially lead to sustained reduction of antibiotic utilization and lower bacterial resistance [26,27]. On another level, healthcare professionals also have the responsibily of providing proper counselling to these "high risk" patients. Effective doctor-patient communication and patient empowerment have been shown to reduce antibiotic prescribing for coughs and colds in the primary care setting [28]. Besides the knowledge, instilling the right attitude should also be a priority as simply increasing public knowledge on antibiotics has been shown to cause higher incidences of self-medication [17].

Limitations

There are several limitations in this study. Similar to all self-administered public surveys, the accuracy of the results was heavily dependent on the honesty and understanding of the respondents. Selection bias might occur due to convenience sampling. As the study was conducted in a local hospital setting, the findings may not be generalised to the whole country or other sectors of health care. The survey methodology omitted respondents who could not understand English or Malay language and those who had no awareness of the term "antibiotic".

Conclusion

The study identified important knowledge and attitude gaps as well as people 'at risk'. Future antibiotic awareness campaigns and patient counselling should promote specific messages to public members from the 'high risk' groups, to fill up the knowledge and attitude gaps as an effort against antibiotic resistance.

Authors' Contributions

KK Lim had the original idea for the study. Both KK Lim and CC Teh designed the questionnaire and carried out the data collection. KK Lim carried out the data analysis and wrote the first draft of the paper. All authors contributed to the revision of the paper and approved the final version.

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Conflict of Interest

None.

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