

# Determinants of Antibiotics Misuse by the Parents in Children: A Survey From Northern Region of Saudi Arabia

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## Abstract

**Objectives:** To investigate knowledge, beliefs and practices associated with parental antibiotic misuse.

**Methods:** This cross sectional study was conducted among the parents visited 4 major shopping malls (selling medicines) of Tabuk, Saudi Arabia from June to December 2015. Self-prescription of antibiotics for a child in the past year was defined as antibiotic misuse was noted.

**Results:** From 610 parents (60.5% mothers and 39.5% fathers) 11.6% reported self-prescription. Responded parents differed by age, education, number of children and profession. Parents responded that antibiotics should be used for runny nose, sore throat, cough and fever (50%); to reduce symptom severity and duration (57.7%), should be stopped on clinical improvement (28.7%), are effective in viral infections (68.6%) and if used by the other family members should be given to the children (20.1%). Determinants of misuse in a multivariable model, were income, number of kid, type of infection treated last year, knowledge of diseases requiring antibiotics, or being unsure, using same antibiotics used by the other family person, unsure of such use and adjusting for the type of responding parent. Logistic regression model shows that those who incorrectly had knowledge that any type of infection with fever needs to be treated by antibiotics had twice the odds of misusing antibiotic (AOR: 2.17, 95%CI: 1.19-3.96), Parents who believed that it was acceptable to administer the same antibiotics to their children that were used for a similar illness by any other family member in the past; had thrice the Odds of using non-prescribed antibiotics (AOR=3.01, 95% CI=1.77-5.37). Similarly, those who were not sure about the use of prior antibiotics by any other family member were also three times more likely to misuse antibiotics (AOR:3.00,95%CI/:1.00-9.01). Parents reporting monthly income of less than SAR 5000 had twice the Odds of misusing anti biotics (OR:2.00,95% CI:1.05-3.83).

**Conclusion:** Parents having low income, more than two kids below 12 years age, low education level, inappropriate beliefs and practices are vulnerable for misusing antibiotics in their children.

**Key words:** Antibiotic misuse, parents.

## Introduction

Misuse of antibiotic treatment potentially implies non-compliance with recommended and prescribed therapy. The concept of noncompliance involves practices including self-prescription, incomplete treatment, missing the doses, taking sub optimal

doses and reuse of left over antibiotics.<sup>1</sup> Antibiotic misuse is a worldwide problem and results in the rapid development of antibiotic resistance, increased health care cost, increased failure of treatment, frequent and prolonged hospitalization, more outpatient and ER visits. A large systemic review from various regions and countries; reporting a mean compliance with antibiotic treatment of 60.2%, and use of left over antibiotics of 28.6%.<sup>1</sup> Self-medication is considered as the use of drugs in treating self-diagnosed illnesses or symptoms and the intermittent or continuous use of prescription drugs to treat chronic diseases or recurrent symptoms; antibiotic storage at home predicts self-medication.<sup>2</sup> Antibiotics are the most important medication and their misuse is mainly for the viral respiratory tract infections, with a parental

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belief for reduction in the severity of symptoms.<sup>3</sup> Regional studies showed a lot of fluctuations in the prevalence of antibiotic misuse.<sup>2,4,5</sup> A study in Syria found that 57% of individuals were following someone other than a physician or using an old prescription and 50% were holding antibiotics after improvement in symptoms.<sup>4</sup> In United Arab Emirates, self-use of antibiotics was practiced by 34% of parents in children. Major predictors of antibiotic misuse were storing antibiotics at home and ease of obtaining antibiotics. Another study from Jordan reported 39.5% of self-medication for antibiotics. Main reasons were found to be the previous experience and socioeconomic factors, low income and education.<sup>5</sup> Common misconceptions regarding antibiotic misuse include the ability to treat symptoms of flu, sore throat, runny nose, fever and any other common infections frequently caused by viruses.<sup>2-5</sup> A recent survey of mothers (N=209) of children with respiratory tract infection (RTI) from Jeddah, Saudi Arabia reports 16.1% of mothers used non-prescribed antibiotics.<sup>6</sup> One of the previous studies of the kingdom of Saudi Arabia showed that RTIs were the most common infections requiring antibiotics in children.<sup>7</sup> There is insufficient data from

Saudi Arabia assessing antibiotic misuse, knowledge, parental beliefs and practices related to it. One cross-sectional study assesses awareness, attitudes and practices related to precautionary measures for H1N1 influenza, in 2009 during the H1N1 pandemic. It showed in spite of high level of concern in population there was a low compliance for precautionary measures, low level of knowledge and education were significant predictors of low compliance.<sup>8</sup> Similarly there is a need to explore common misconceptions and attitudes towards antibiotic use to help unwanted sequelae associated with antibiotic misuse, but first these misconceptions and attitudes need to be identified and quantified. Thus, our aim was to assess the extent and determinants of antibiotic misuse by parents by surveying them in public places such as malls located in Tabuk, northern region of Saudi Arabia.

### Materials and methods

This cross-sectional study was conducted from June 2014 to December 2014 at 4 major shopping malls (selling medicines) of Tabuk, Saudi Arabia. The survey was conducted at evening between 6 to 10 pm, four days a week including week ends. These times ensure the most access to potential study participants. Study participants included parents of children aged between 1 to 12 years whether native Saudis or expatriates. Surveys of knowledge, beliefs and practices in Saudi Arabia utilized settings such as shopping malls as families from all cadres of the society visit there. A

platform was created for conducting the study by trained data collectors who administered the survey after taking informed consent from the parents. While Parents were completing the forms children were provided with the coloring materials and other recreational activities to occupy them.

The questionnaire was developed from the validated questionnaires reviewed from the literature<sup>5,9,10</sup> and after pilot testing the structure was modified in local settings in English and Arabic. The first part of the questionnaire included demographic characteristics of respondents, socioeconomic and educational status, followed by the questions that tested the knowledge, beliefs and practices related towards the use of antibiotics. Parent's gender, educational level, profession, monthly income, marital status and nationality were inquired. Knowledge questions in terms of using antibiotics and their effectiveness against signs and symptoms were noted. Beliefs and practices related to duration of use and reuse of antibiotics for various signs and symptoms were inquired. Structured questions for beliefs and practices were ascertained.

Multivariable analysis using Multiple logistic regression modeling was performed to determine the socio-demographics including knowledge, beliefs and practice variables with antibiotic misuse or self-prescription of antibiotics for their children. Based on the reported studies<sup>2,4-6</sup> prevalence of antibiotic misuse over a large range sample size was calculated 610 to capture Antibiotic misuse. This sample size was estimated with the power of 80% and significance level set at alpha of 0.05.

Proportions were calculated and subgroup analyses were based on respondent's information for prescribed or non-prescribed use of antibiotics for their child in past year. Non-prescribed use of antibiotics was defined as antibiotics prescribed by oneself or by someone other than the physician. Chi Square was used as a statistical test of significance with a  $p < 0.05$  considered significant for comparing determinants of non-prescribed use of antibiotics between prescribed users and self-medicated users. Odds ratios and 95% confidence intervals were calculated to evaluate the relationship between socio-demographic variables and antibiotic self-prescription (misuse) as an outcome variable. Multiple logistic regression modeling was performed to determine the relationship of socio-demographic, knowledge, beliefs and practices associated with the use of non-physician prescribed antibiotics, and adjusted Odds ratios (AOR) were calculated. Determinants were adjusted for the differences between respondents (mothers and fathers for age, education, and occupation). Pearson Chi-Square of goodness of

fit test was carried out to assess the predictive accuracy of the model; using algorithmic approach.

The study was planned according to ethical principles for autonomy, safeguarding participant interest, taking informed consent, and maintaining anonymity and privacy of study participants. The study was according to the principals of Helsinki's declaration, and was approved by institutional Review Board of King Khalid Civilian Hospital, Tabuk and KSA.

### Results

A total of 631 parents participated in the study, among them 3.3% (21/631) of parents reported that they did not use antibiotics for their children in last one year; hence 610 parents were included for the analysis. Among them 539 (88.4%) mentioned that antibiotic was prescribed by a physician and 71 (11.6%) mentioned they self-prescribed antibiotics. Among the respondents, the age ranged between less than 25 years (5.6%) to e" 55 years (3.3%) in age; 60.5%

were mothers, 82.6% were Saudi nationals, 42% had more than two children of less than 12 years of age. Fifteen percent parents had monthly income less than SAR 5000, and 17 % reported monthly income of more than SAR 15000. Overall, the knowledge of parents demonstrated that 57.7% parents were of the opinion that antibiotics limit trend severity and symptoms of common cold, 68.6% thought that antibiotics are effective against viruses and 50% of the respondents said that any type of infection can be treated by the antibiotics. Of the parents who used antibiotic in the past one year for their children, 25% did not complete the required course of antibiotics. Regarding beliefs 50% of parents agreed that if a child has runny nose, cough, sore throat or fever, antibiotics should be given, 28.7% agreed to stop the course of antibiotics if the symptoms start improving; 55% said that usually doctors give the same antibiotics upon consultation, but 66.2% were of the opinion that an antibiotic will not be effective in a community setting if it is over used (Table-I).

**Table-I**

*Demographic characteristics, socioeconomic and educational status and knowledge, beliefs and practices related towards the use of antibiotics of respondents*

		%
Age	<25 years	5.6
	25-55 years	91.1
	>55 years	3.3
Respondent	Mother	60.5
	Father	39.5
Nationality	Saudi nationals	82.6
	Other than Saudi	17.4
Number of children	1-2 children	58
	>2 children	42
Monthly income	<5000 SAR	15
	5000-15000 SAR	68
	>15000 SAR	17
Antibiotics limit trend severity and symptoms of common cold	Yes	57.7
	No	42.3
Antibiotics are effective against viruses	Yes	68.6
	No	71.4
Any type of infection can be treated by the antibiotics	Yes	50
	No	50
Completed the required course of antibiotics	Yes	75
	No	25
In runny nose, cough, sore throat or fever, antibiotics should be given	Yes	50
	No	50
Agreed to stop the course of antibiotics if the symptoms start improving	Yes	28.7%
	No	71.3
Agreed that doctors give the same antibiotics upon consultation	Yes	55
	No	45
Antibiotic will not be effective in a community setting if it is overused	Yes	66.2
	No	33.8

Table II displays the subgroup of the study participants by physician or self-prescribed group. Variables with  $p < 0.25$  are shown in the table 2, as these were considered in the model building. Overall, socio demographic characteristics did not differ significantly between the two groups except that parents with more than 2 children less than 12 years of age, tended to self-prescribe antibiotics compared to those with one

to two children (table III). This analyses significantly differed by knowledge based on the antibiotic use for bacterial versus other infections, infections associated with fever, use of specific antibiotic if it was used by a family member in the past for similar illness in children, and type of infection that was reported to be treated(t). Those who reportedly suffered bronchitis or pneumonia tended to use physician- prescribed antibiotics.

**Table-II**

*Knowledge, beliefs, practices and socio-demographic characteristics by antibiotic self-prescription in study participants*

Characteristics	Self-prescribed (n=71)%	Physician Prescribed (n=539)%	P- value
Relationship with child			
Mother	46.5	38.6	0.24
Father	53.5	61.4	
Number of Family members			
Less than 5	30.0	39.7	0.19
More than or equal to 5	69.0	60.3	
Number of children			
one to two	46.5	59.4	0.04
more than 2	53.5	40.6	
Marital Status			
Married	93.0	96.3	0.19
Widow/Divorced	7.0	3.7	
Monthly income (Saudi Riyals)			
Monthly income <5000	23.9	13.7	0.03
Higher income > 5000	76.1	86.3	
Education			
Less than or equal to High School	40.8	13.6	0.24
Grater than High School	59.2	86.4	
Any infection with fever need to be treated byAntibiotics			
Incorrect response	69.0	48.1	0.004
Correct response	25.4	43.8	
Dont Know	5.6	8.1	
Antibiotics are effective against viruses			
Incorrect response	64.8	69.1	0.14
Correct response	21.1	23.7	
Dont Know	14.1	7.2	
Antibiotic used by other family members forSimilar illness can be given to a child			
Incorrect response	40.8	18.5	<0.001
Correct response	52.1	78.3	
Dont Know	7.1	3.2	
Did you complete the full course of antibiotics when used last time			
Yes	70.0	78.2	0.16
No	24.3	19.4	
Do not remember	5.7	2.4	

The logistic regression model displayed in Table III shows that those who incorrectly had knowledge that any type of infection with fever needs to be treated by antibiotics had twice the odds of misusing antibiotic (AOR: 2.17, 95%CL: 1.19-3.96), or who did not know (AOR: 1.15, 95%CL: 0.35-3.78) compared to parents with correct knowledge. Parents who believed that it was acceptable to administer the same antibiotics to their children that were used for a similar illness by any other family member in the past; had thrice the Odds of using non-prescribed antibiotics compared to those who did not keep such a belief (AOR=3.01, 95% CI=1.77-5.37). Similarly, those who were not sure about the use of prior antibiotics by any other family member were also three times more likely to misuse antibiotics compared to those who would not treat the child with the same antibiotic used by any other family member with the similar illness (AOR:3.00,95%CI/:1.00-9.01). Patients who reported

that their children suffered with infections other than pneumonia/bronchitis misused antibiotics twice as much as compared to those children had pneumonia and bronchitis (AOR:2.21,95%CI:1.134.34). Parents with more than two children of less than 12 years of age misuse antibiotics (AOR: 1.68, 95%CI: 0.992.85) as compared to those who had only one or two children. Parents reporting monthly income of less than SAR 5000 had twice the Odds of misusing (OR:2.00,95% CI:1.05-3.83) compared to those with monthly income of and more than SAR 5000. The model was adjusted for demographic differences (age, education and profession) between responding mothers and fathers (Table-II). The model likelihood ratio had Chi-Square:44.33, with DF=8, and  $P < 0.001$  (Nagelkerke-R square=13.9%). Due to small number of covariates' fulfilling the asymptotic assumption criteria; the calculated Pearson Chi-Square goodness of fit test was insignificant ( $P=0.256$ ).

**Table-III**  
*Determinants of antibiotic misuse by parents: Logistic regression model*

Variables in model	Beta (SE)	Wald Statistics	P-Value	AOR	95% Confidence Interval
<b>Any infection with fever is to be treated by Antibiotics</b>					
Incorrect response	0.77 (0.31)	6.34	0.012	2.17	1.19-3.96
Correct response (Reference)		6.87	0.032	1.00	
Did not know	0.14 (0.60)	0.06	0.813	1.15	0.35-3.78
<b>Antibiotic used by other family members for Similar illness can be given to a child</b>					
Incorrect response	1.13 (0.28)	15.75	<0.001	3.01	1.77-5.37
Correct response (Reference)		17.16	<0.001	1.00	
Did not know	1.01 (0.56)	3.83	0.050	3.00	1.00-9.01
<b>Infection type perceived to be treated with Antibiotics in a child in past year</b>					
Other infections	0.79 (0.34)	5.30	0.021	2.21	1.13-4.34
Pneumonia/Bronchitis (Reference)				1.00	
<b>Number of children</b>					
Parents with >2 children of <12 years	0.52 (0.27)	3.67	0.055	1.68	0.99-2.85
Parents with <2 children of <12 years				1.00	
<b>Monthly income (Saudi Riyals)</b>					
Low <5000	0.70 (0.33)	4.43	0.035	2.00	1.05-3.83
High >5000				1.00	
<b>Relationship of respondents with child</b>					
Father	-0.30 (0.27)	1.22	0.269	0.74	0.44-1.26
Mother				1.00	
<b>Constant</b>	-4.69 (0.91)	26.42	0.000		

Person Chi square goodness of fit test (87.87; df 80, with  $p=0.256$ );  $R^2$  13.9% AOR- adjusted odds ratios Table-III

## Discussion

Antibiotic misuse is evidently associated with misconception on the use of antibiotics and their indications. In Saudi Arabia, antibiotics can be purchased from the pharmacy without prescription, however, antibiotics use without prescription was only 11.6% (95% CI : 9.10005-14.205) of the study participants. This rate is lower than reported from UAE (36%) Syria (57%), Jordan (39.5%) and Greece (22.70%).<sup>2,4,5,11</sup> But much closer to USA (12% in sub urban area), Hong Kong (9%) and UK (5%). Possibility of an inherent bias cannot be ruled out as sample selection may have occurred from a distinguished section of the population who belonged to the group who did not misuse antibiotics. However, estimates were similar in the 4 selected diverse shopping malls that differed by reported monthly income ( $p < 0.002$ ), and we feel confident that various strata of the population by socioeconomic status were captured in our sample. Moreover, survey of mothers of children with RTI, from Tabuk reported 16.1% of antibiotics misuse<sup>6</sup>, that further supports our estimate. Socio-demographic characteristics such as age<sup>2,5,11-13</sup>, gender<sup>4,10,12</sup>, education<sup>2,4,5,10-12</sup>. Income levels<sup>4,5,10,13</sup> and geographical locations, have been associated antibiotic misuse. Younger<sup>4,12,13</sup>, and middle<sup>5</sup>, age groups have been associated with antibiotics misuse, males<sup>4,10</sup> have been invariably related with misuse practice whereas younger females<sup>12</sup>, have been associated with storing of antibiotics. Both low<sup>4</sup>, and high<sup>5,10</sup> income levels are reported to be associated with antibiotic misuse. Such reports reflect cultural variation, cohort effects, and sampling variation! For example, high education is associated with misuse in relatively developed settings such as UAE<sup>2</sup>, Jordan<sup>5</sup>, Hong Kong<sup>10</sup>, and Greece<sup>11</sup>, however, antibiotic misuse was least in Hong Kong (9%), midlevel in Greece (22.7%) and highest in Jordan(39.5%), but low level of education were associated with misuse in Syria that reported highest level of misuse(57%).<sup>4</sup> In our study, the participating mothers (58.7%) were younger and less educated than participating fathers; in a sub group analysis less educated fathers had higher odds of antibiotic misuse than educated fathers (OR2.68, 95% CI =1.19-6.05); such an association was not significant in mothers (OR 0.82, 95% CI 0.38-1.75); likewise, mothers from another study carried out in Saudi Arabia were reluctant to self-medicate their children due to adverse effects on immunity.<sup>6</sup> More fathers were in health care related

profession than mothers, and mothers were less likely to misuse antibiotics as compared to fathers; however these results were not significant; though there are reports that parents in non-health care professions misused antibiotics more than parents in health related professions.<sup>13</sup> Parents with more children showed association with antibiotic misuse in Greece<sup>11</sup>, and our study showed somewhat similar association.

Our study had higher percentages for inadequate knowledge, and beliefs compared to those reported from Hong Kong with whom our rate of misuse was closer than other studies<sup>10,12</sup>, nevertheless, practice of stopping antibiotics earlier (25%) when symptoms improve in our study were better than the reported estimate of 50% from Greece.<sup>11</sup>

Symptoms of RTI are known to be associated with self-prescribed antibiotics, and parental pressure upon doctors to prescribe antibiotics.<sup>12</sup> Our results showed that parental misuse was more for infections other than pneumonia or bronchitis, including common respiratory infections. Similarly history of successful treatment by antibiotics in a family member is vulnerable to increase misuse and storage of leftover antibiotics. In our study 34% disagreed that the repeated use of a specific antibiotic in the community may make it less effective in the future. This indicates a low awareness for the development of bacterial resistance. Such an issue is reported from a study that 28% were unaware of the dangers associated with antibiotic misuse<sup>10</sup>, education about the appropriate usage of antibiotics and the issue of bacterial resistance should be introduced to the public. Failure to complete therapy, ignoring and skipping dosage, reusing leftover antibiotic and self-medication can have detrimental effects both at the individual and community level with development of resistance, low potency, diagnostic errors, and therapeutic problem.<sup>1,3</sup>

A notable point is that our study participants (28%) did not know that an antibiotic should be used for a certain period of time. Another issue lies in the understanding of antibiotic function: only 38.5% understood that antibiotics are used to treat bacterial infection, while the remaining respondents had mixed answers and believed for its use in viral infections too. The correct use of antibiotics and discontinuation of treatment is of concern, as a good number of respondents did not have enough information to enable them to use antibiotics safely.

Our results are consistent for; parents with more than one child of less than 12 years of age and association with antibiotic misuse<sup>11</sup> and for reported misuse in single parents<sup>2</sup>, but for latter association our results insignificantly showed the same relation as single, widowed, separated individuals, but sparse data could have shown a chance relationship. The relationship between socio-demographic strata and antibiotic misuse cannot be overlooked anywhere; hence our results have important implications to educate all but especially vulnerable subgroups of populations. Further using self-reporting of antibiotic misuse and compliance has been criticized<sup>1</sup>, therefore, home visit approach is recommended to detect errors in medications for children.<sup>14</sup> In Europe, antibiotic misuse is considered as major threat for development of resistance, hence national level awareness initiatives engaging political, media, and other stakeholders are targeting primary care providers.<sup>15</sup> Equally important is resistance against other medications such as anti-malarial medicines, that are being misused at high levels (44.3% for anti-malarial drugs 48% antibiotics).<sup>17</sup> Furthermore, a study from India reports that environmental factors, such as climate, availability of health care systems due to poor environmental conditions are also responsible for misuse of antibiotics thus leading to development of resistance in antibacterial medicines.<sup>18</sup> It further recommends dissemination of information and education with enforcement of legislation for antibiotic dispensing.<sup>18</sup> Another interesting fact is the availability of health insurance that is reported to be associated with low antibiotic misuse with better knowledge, beliefs and practices.<sup>19</sup> In Saudi Arabia, health care is available with a better health care insured for the population and where antibiotic misuse is lower as in developed settings; the knowledge beliefs and practices need to be enhanced. Our study had several strengths, first, use of parents (mothers and fathers) as a target population to obtain direct information on knowledge, beliefs and practices. Second, a large sample size to capture various strata of target population including parent's gender, education and income level, and other unknown factors that could affect the knowledge, beliefs and practices related to antibiotic misuse. Thirdly, utilization of referenced questions contributed to obtain meaningful data and reliable results.

The study faced some limitations; firstly the participants were selected from those visiting

particular shopping malls leading to selection bias; hence, representativeness of target population may have been affected. In addition, data were collected on weekdays as well as on weekends at the time when most of families visit these malls. In Saudi Arabia, visiting shopping malls is a popular recreational activity; as only families are allowed on weekends and other times inside malls. Moreover, culturally it is not considered appropriate to visit homes and studies are conducted in shopping malls; by setting up a stall; and campaign related to health.

The fact that few non Saudis visited malls could be due to the summer vacation months when many expatriates leave for their home towns; may also be the reason for low misuse of antibiotics; as study from UAE argued that the high percentage of misuse was due to the presence of expatriate population. Secondly, a limitation could arise from the participants not understanding the question; and attempting to respond; further some questionnaires were administered with the help of data collectors. Looking at the educational level of participants; there were 1.7% (n=11) without any education and 4.6% with primary education only (n=29); hence it is assumed that assistance was mandatory for some of them. We did not keep a log of this information and had we carried out that, may have evaluated this through sub-group analyses.

### Conclusion

This study determined a reasonable estimate of antibiotic misuse with identification of socio-demographic determinants of low income, and having more children was related to moderate knowledge deficits, inappropriate beliefs and practices in parents.

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