

# Behavior, attitudes and knowledge about antibiotic usage among residents of Changhua, Taiwan

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This study surveyed the behavior, attitudes, and knowledge about antibiotic usage among residents of Changhua County, Taiwan. A questionnaire designed to evaluate general knowledge and attitudes towards antibiotic usage was administered to a total of 1024 adults. The male-to-female ratio was 0.75. All of the 1024 adults were aware of the term "antibiotics". Only 39.2% of subjects had knowledge about basic antibiotic terminology, 69.7% expected that physicians should educate people about antibiotics. There were 7 main findings of this study: (1) 52.7% of subjects considered that physicians advice about the need for compliance was poor; (2) 15.3% of subjects always requested an antibiotics prescription when they suffered from flu-like symptoms; (3) 49.8% failed to comply with prescribed antibiotic regimens; (4) 53.1% of subjects were not aware that antibiotic syrup should be stored in the refrigerator; (5) 27.1% of subjects lacked knowledge about how to deal with the misuse of antibiotics; (6) 9.3% of pregnant and breast-feeding subjects did not have adequate knowledge of the safety of using antibiotics during pregnancy; and (7) 30% of subjects did not know how to obtain information about antibiotic usage. Residents of Changhua County had inadequate or incorrect knowledge about antibiotic usage. The findings of this study imply the need for programs to promote greater education about antibiotics usage in the general population of Taiwan.

**Key words:** Anti-infective agents, attitude, cognition, health care surveys, questionnaires

The usage of antibiotics has been increasing and is associated with the emergence of bacterial resistance to antibiotics [1]. Previous studies in Taiwan showed that the prevalence rates of antibiotic resistance in many different bacteria were much higher than those of western countries [2,3]. In Taiwan, more than 50% of *Haemophilus influenzae* clinical isolates collected from medical centers were ampicillin-resistant [2,4]. Chang et al reported that the introduction of the National Health Insurance program in Taiwan brought about a major change in antibiotic use patterns in public hospitals [5]. They emphasized the need not only to educate physicians to prescribe antibiotics according to guidelines, but also to educate patients about antibiotics [5]. Ho et al found that antibiotics were used excessively in number and

duration in Taiwan [6]. The microbiologic work-up had little effect on the indication for treatment and choice of antibiotics. Organisms responsible for community-acquired pneumonia in Taiwan differed markedly from western countries in that only 3.3% of cases were caused by *Streptococcus pneumoniae* [6].

Increasing prescription of antibiotics, particularly those prescribed due to patients' requests, contributes to rising drug costs and increasing antibiotic resistance of pathogens in the community [7-10]. Epidemiologic data on knowledge, attitudes and behavior about antibiotics are limited in Taiwan. A previous study [4] found marked differences in these parameters between residents of rural and urban areas. Lack of adequate explanation and education about antibiotic usage by prescribing physicians were common deficiencies. The purpose of this study was to explore the cognition, attitude and behavior of adults over 20 years old living in Changhua County.

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## Materials and Methods

There were a total of 1,300,700 residents in Changhua County at the time of this study. Adults aged over 20 years who were not under supervision or treatment for underlying disease were interviewed using a questionnaire developed by an expert committee, which included physicians, pharmacists, statisticians, and sociologists. In this study, cognition refers to the processes whereby knowledge is acquired and used. Attitude was defined as the relatively stable organization of beliefs, feelings, and behavior tendencies directed toward something or someone. Behavior referred to observable actions or responses in both humans and animals. The experts committee defined the terms for the cognition, attitude and behavior of correct antibiotic usage and constructed the concept frame. Based on these definitions and consensus achieved in discussions, a confidential questionnaire was designed for administration by trained research assistants. These assistants visited all of the designated areas of Changhua County and administered the questionnaire to all residents aged at least 20 years old who gave informed verbal consent to participate in the study. According to the population numbers and geographic distribution, Changhua County is divided into 4 areas, including Changhua area, Lugan area, Pagua area, and Erlin area. The research assistants collected the data and discussed their findings with the expert committee. The findings of preliminary analysis by the committee were analyzed weekly in order to decrease bias. Data were analyzed with Statistical Package for the Social Sciences (SPSS) version 10.0 software. The number of patients participating in this observational study was determined by evaluating the statistical power needed for a separate randomized study in which patients participated. A  $p$  value  $\leq 0.05$  was considered statistically significant.

## Results

A total of 1024 adults were enrolled in equal numbers from the different regions of Changhua County. The demographic characteristics of the 1024 subjects are shown in Table 1. The completion rate of the questionnaire was 80%. All 1024 adults had heard of the term "antibiotics"; 50.6% believed that antibiotics were the same as anti-inflammatory agents; and 44.6% believed that antibiotics were the same as antipyretic agents. Only 39.2% of subjects had correct knowledge of specific terminology about antibiotics, and 67.7%

**Table 1.** Demographic characteristics of the subjects

Demographic characteristic (n = 1024)	n (%)
Location	
Changhua area	227 (22.2)
Lugan area	238 (23.2)
Pagua area	277 (27.1)
Erlin area	282 (27.5)
Gender	
Male	437 (42.7)
Female	587 (57.3)
Age (years)	
<30	254 (25.1)
30-49	549 (54.4)
$\geq 50$	207 (20.5)
Education group	
Less than junior high school	78 (7.6)
Junior high school	77 (7.5)
Senior high school	398 (38.9)
Above college	471 (46.0)
Occupation	
Related to medicine	79 (7.8)
Not related to medicine	738 (72.6)
None	200 (19.7)
Most common location seeking care	
Hospital	758 (74.4)
Clinic	556 (54.6)
Traditional medicine	410 (40.2)
Folk medicine	53 (5.2)
Others	15 (1.5)
Previous hospitalization	
Yes, no operation	390 (38.2)
Yes, and operation	326 (31.9)
No	516 (50.5)

expected physicians to take responsibility to educate patients about prescribed antibiotics.

Data on behavior concerning correct usage of antibiotics are shown in Table 2. Among the 1024 subjects with complete data, 52.7% reported that they would not follow an antibiotic prescription; 48.9% would not visit for follow-up examination after therapy; 15.3% would request antibiotics if they had any flu-like symptoms. Only 14.7% of subjects reported that they would take antibiotics before a meal. Concerning storage, 46.9% reported they would not store antibiotic syrup in the refrigerator. If subjects took the wrong antibiotics, 27.1% reported that they would not be concerned about it. 90.7% of women reported that they would not take antibiotics if pregnant.

Data on attitudes about correct usage of antibiotics are shown in Table 3. Among the 1024 subjects, 87.7% indicated that they would follow an antibiotic prescription, and 54.1% would return to the outpatient

**Table 2.** Behavior toward antibiotic use in adult residents of Changhua County

Behavior (n = 1024)	n (%)
Taking antibiotics	
Follow the physician's instruction	482 (47.2)
Stop without consultation	441 (43.2)
Decrease the dosage without consultation	92 (9.0)
Irregularly take the medicine	7 (0.7)
Return for more antibiotics after finishing the prescription	
No	508 (49.8)
Yes	512 (50.2)
If ill with flu-like symptoms and the doctor does not prescribe antibiotics, what would you do?	
Visit another doctor for antibiotics	67 (6.5)
Buy antibiotics elsewhere	27 (2.6)
Not be concerned	772 (75.5)
Request that the doctor prescribe antibiotics	157 (15.3)
If you had pneumonia and your doctor did not prescribe antibiotics, what would you do?	
Visit another doctor for antibiotics	112 (10.9)
Buy antibiotics elsewhere	14 (1.4)
Not be concerned	450 (44.0)
Ask the doctor to prescribe antibiotics	447 (43.7)
How would you take antibiotics?	
With water	997 (97.6)
With tea	3 (0.3)
Directly	8 (0.8)
Other methods	14 (1.4)
Would you take antibiotics before meals?	
No	867 (85.3)
Yes	150 (14.7)
Do you store antibiotics in a place with exposure to the sun?	
No	1001 (98.3)
Yes	17 (1.7)
Do you keep antibiotic syrup in the refrigerator?	
No	475 (46.9)
Yes	538 (53.1)
If you took the wrong antibiotics, what would you do?	
Induce vomiting	188 (18.5)
Visit the doctor immediately	742 (72.9)
Not be concerned	88 (8.6)
If you are pregnant, should you take antibiotics?	
No	917 (90.7)
Yes	94 (9.3)
If your family is sick, do you give your family members your antibiotics?	
No	887 (86.9)
Yes	134 (13.1)
If you experienced adverse effects from taking antibiotics, what would you do?	
Stop taking the antibiotics	57 (5.6)
Visit the doctor immediately	959 (93.8)
Not be concerned	6 (0.6)

department after finishing the prescription. 75.1% of subjects expected a prescription containing antibiotics; 53.3% of subjects expected a prescription containing antibiotics if they developed pneumonia. 79.4% of subjects reported that they would feel dissatisfaction if doctors prescribed antibiotics without explanation.

Data on subjects' awareness of correct usage of antibiotics are shown in Table 4. Among the 1024 subjects, 96.7% knew that prescriptions should be completed; 49.9% reported that they would stop use of antibiotics if their condition improved; and 58.4% would return for a follow-up visit. 67.4% of subjects thought

**Table 3.** Attitudes toward antibiotic use in residents of Changhua County

Attitude (n = 1024)	n (%)
Would you follow the physician's directions about antibiotic use?	
No	121 (12.3)
Yes	863 (87.7)
Would you visit for follow-up after taking antibiotics?	
No	451 (45.9)
Yes	532 (54.1)
If you had the flu-like symptoms, would you prefer a prescription containing antibiotics?	
No	768 (75.1)
Yes	254 (24.9)
If you had pneumonia, would you prefer a prescription containing antibiotics?	
No	472 (46.5)
Yes	544 (53.5)
If your doctor prescribed antibiotics but did not explain the reason, would you be satisfied?	
No	808 (79.4)
Yes	209 (20.6)

it unnecessary to take the antibiotics if they had flu-like symptoms; 63.2% of adults thought that pneumonia should be treated with antibiotics; 87.8% considered it necessary to take antibiotics with water; 95.5% considered that patients should follow the prescription; 80.8% did not know that antibiotics should not be stored in an area with sun exposure; 85.1% knew that antibiotics had adverse effects; 89.7% knew that they could consult pharmacists and doctors about the use of antibiotics; 40.8% thought it harmful to follow the doctors' prescriptions to take antibiotics; and 92.6% thought that taking less antibiotics than prescribed would be safer.

## Discussion

This prospective study surveyed knowledge, attitudes and behavior about antibiotic use among residents of Changhua County. A high rate of questionnaire completion (80%) was achieved. The reasons why non-responders declined to participate remain unclear. A good cross-section of general practitioners participated, but the study was not designed to explore variations in prescribing patterns. Subjects were asked to complete the questionnaire after they gave informed consent to participate in the study. We emphasized that we were interested to learn about their knowledge, attitudes and behavior relating to correct use of antibiotics.

All subjects reported that they were familiar with the term "antibiotics", but only 39.2% had correct knowledge about the use of antibiotics. 50.6% of subjects were unable to differentiate antibiotics from anti-inflammatory agents. Our results suggest

that programs to educate the populace are needed to prevent misuse of antibiotics; 69.7% of subjects thought that physicians should educate them about antibiotic-related information when they are prescribed, and 54.5% thought that pharmacists should educate them.

52.7% of subjects reported that they would not follow physicians' advice about antibiotics. Not only did these subjects react against taking medicine, but their compliance with prescribed regimens was also negatively influenced by traditional folk medicine ideas. Traditional folk medicine is widely practiced in Changhua county of Taiwan and folk therapy is often considered superior to western medicine.

In this study, 15.3% of subjects reported that they would request antibiotics if they had flu-like symptoms. Several previous studies found that patient pressure was the most frequently cited reason for the prescription of antibiotics [11-14]. Pressure from patients to prescribe antibiotics, particularly for flu-like symptoms, has been identified as the most common reason for doctors' discomfort with prescribing decisions [12]. General practitioners may overestimate patients' expectations [15]. Armstrong et al found general practitioners used less information in decisions about management than about diagnosis and also when deciding to prescribe antibiotics [16]. This may be counterproductive as inappropriate prescription of antibiotics may encourage the patient to relate the natural recovery of a commonly self-limiting lower respiratory tract illness to the effect of medication, engendering a cycle of repeat consultations for minor respiratory symptoms [17]. Prescribing antibiotics for the treatment of flu-like symptoms enhances belief that antibiotics are effective

**Table 4.** Knowledge about antibiotics in residents of Changhua County

Cognition (n = 1024)	n (%)
Have you heard of "ANTIBIOTICS" before?	
No	0 (0.0)
Yes	1024 (100.0)
Do you think antibiotics are the same as anti-inflammatory agents?	
No	505 (49.4)
Yes	517 (50.6)
Did you think antibiotics are the same as antipyretics?	
No	566 (55.4)
Yes	456 (44.6)
Who should provide education about antibiotics?	
Physicians	713 (69.7)
Pharmacists	558 (54.5)
Nurses	351 (34.3)
Public health officers	510 (49.9)
Teachers	360 (35.2)
Major caregiver	159 (15.5)
Mass media	634 (62.0)
Others	22 (2.2)
Should patients follow the physician's directions when taking antibiotics?	
No	35 (3.4)
Yes	988 (96.6)
Is it okay to stop taking an antibiotic regimen if your symptoms are improving?	
No	513 (50.1)
Yes	510 (49.9)
Should patients return for follow-up visit after taking antibiotics?	
No	425 (41.6)
Yes	597 (58.4)
Should flu-like symptoms always be treated with antibiotics?	
No	688 (67.4)
Yes	333 (32.6)
Should pneumonia always be treated with antibiotics?	
No	376 (36.8)
Yes	646 (63.2)
Should antibiotics be taken with water?	
No	124 (12.2)
Yes	892 (87.8)
Would you take antibiotics according to the instructions on the package?	
No	46 (4.5)
Yes	977 (95.5)
Should exposure of antibiotics to sunlight be avoided	
No	827 (80.8)
Yes	196 (19.2)
Did you know some antibiotics have "teratogenic effects"?	
No	838 (82.0)
Yes	184 (18.0)
Do some antibiotics cause adverse effects?	
No	152 (14.9)
Yes	870 (85.1)
Did you know that you can consult physicians and pharmacists about the use of antibiotics?	
No	105 (10.3)
Yes	916 (89.7)
Do you think that it's harmful to follow physicians' directions when taking antibiotics?	
No	606 (59.2)
Yes	417 (40.8)
Do you think that taking less antibiotics than prescribed is more healthy?	
No	76 (7.4)
Yes	947 (92.6)



and raises antibiotic consumption [18]. Doctors seem aware of this dilemma and are willing to identify inappropriate use of antibiotics for lower respiratory tract illness, but the practice nevertheless continues. This suggests considerable scope for reducing antibiotic use, which seems of little benefit for upper respiratory infection [18]. The lack of an alternative management strategy and the practice of making prescribing decisions without seeking either markers of infection or specific pathogens, however, suggest that antibiotics will probably continue to be prescribed far more frequently than necessary.

Unnecessary prescription of antibiotics was reduced by the implementation of the National Health Insurance program in Taiwan, which brought about a major change in antibiotic use patterns in public hospitals [1]. Educating general practitioners can reduce antibiotic use [19] and educating patients has been shown to reduce re-visits due to failed therapy in some western countries [20]. The initial investment of explanation may prove worthwhile [21]. In this study, 20.6% of residents reported previous dissatisfaction with their management, and they re-visited physicians twice as often as the satisfied group. Dissatisfaction was common in residents who requested antibiotics but did not receive them, although as a group those given antibiotics indicated that they would be less likely to present for follow-up. These findings further indicate the need for education of the general population about antibiotics.

Regarding basic knowledge about antibiotic usage, 97.6% of subjects indicated that they would take antibiotics with water, 0.3% with tea, 0.8% by direct swallowing, and 1.4% by other ways. Only 14.7% of subjects indicated that they would take antibiotics before a meal. Thus, programs to educate people to take antibiotics according to the recommended methods are needed. Concerning the storage of antibiotics, 98.3% of subjects indicated that they would store antibiotics in a cool place, and 46.9% would not store antibiotic syrup in the refrigerator. Thus, patients need to be educated about the need to refrigerate antibiotic syrup.

We conclude that Changhua County residents lack adequate knowledge in the following 7 aspects of correct antibiotic usage: (1) compliance with physicians' directions; (2) inappropriate requests for an antibiotic prescription for flu-like symptoms; (3) compliance with antibiotics regimens; (4) lack of knowledge that antibiotic syrup should be stored in the refrigerator; (5) lack of knowledge about proper ways to deal

with ingestion of incorrect antibiotics; (6) pregnant and breast-feeding subjects did not have adequate knowledge of the safety of antibiotics; and (7) lack of knowledge of consultative channels about information related to antibiotic usage. Programs are needed to improve education about correct antibiotic usage in the general population.

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## References

1. Kunin CM. Resistance to antimicrobial drugs: a worldwide calamity. *Ann Intern Med* 1993;118:557-61.
2. Chang SC, Hsieh WC. Current status of bacterial antibiotic resistance in Taiwan. *J Infect Dis Soc ROC* 1996;7:83-8.
3. Chang SC, Hsieh WC, Luh KT. Resistance to antimicrobial agents of common bacteria isolated from Taiwan. *Int J Antimicrob Agents* 1994;4:143-6.
4. Chang SC, Hsieh WC, Liu CY, and the Antibiotic Resistance Study Group of Infectious Disease Society of Republic of China. High prevalence of antibiotic resistance of common pathogenic bacteria in Taiwan. *Diagn Microbiol Infect Dis* 2000;36:107-12.
5. Chang SC, Chen YC, Hu YP. Antibiotic use in public hospitals in Taiwan after the implementation of national health insurance. *J Formos Med Assoc* 2001;100:155-61.
6. Ho M, Chang FY, Yin HC, Ben RJ, Chang LY, Chen PY, et al. Antibiotic usage in community-acquired infection in hospitals in Taiwan. *J Formos Med Assoc* 2002;101:34-42.
7. Hsueh PR, Teng LJ, Wu TL, Yang D, Huang WK, Shyr JM, et al. Telithromycin- and fluoroquinolone-resistant *Streptococcus pneumoniae* in Taiwan with high prevalence of resistance to macrolides and beta-lactams: SMART program 2001 data. *Antimicrob Agents Chemother* 2003;47:2145-51.
8. Shieh HL, Lin MC, Hu YPO. Policy and strategy of controlling antibiotic use—an integrated action plan for overcoming antimicrobial resistance. *J Intern Med Taiwan* 2001;12:1-13.
9. Chang SC, Shiu MN, Chen TJ. Antibiotic usage in primary care units in Taiwan after the institution of national health insurance. *Diagn Microbiol Infect Dis* 2001;40:137-43.
10. Chang SC, Chang HJ, Lai MS. Antibiotic usage in primary care units in Taiwan. *Int J Antimicrob Agents* 1999;11:23-30.
11. Webb S, Lloyd M. Prescribing and referral in general practice: a study of patients' expectations and doctors' actions. *Br J Gen Pract* 1994;44:165-9.
12. Bradley CP. Uncomfortable prescribing decisions: a critical incident study. *BMJ* 1992;304:294-6.

13. Virji A, Britten N. A study of the relationship between patients' attitudes and doctors' prescribing. *Fam Pract* 1991;8:314-9.
14. Macfarlane JT, Holmes WF, Macfarlane RM, Lewis S. Contemporary use of antibiotics in 1089 adults presenting with acute lower respiratory tract illness in primary care in the UK: implications for developing management guidelines. *Respir Med* 1997;91:427-34.
15. Britten N. Patients' demands for prescriptions in primary care. Patients cannot take all the blame for overprescribing. *BMJ* 1995;310:1084-5.
16. Armstrong D, Reyburn H, Jones R. A study of general practitioners' reasons for changing their prescribing behaviour. *BMJ* 1996;312:949-52.
17. Brain DJG. Papers that have changed my practice. Diagnostic behaviour and prescribing. *BMJ* 1983;287:1269-70.
18. Orr PH, Scherer K, Macdonald A, Moffatt MEK. Randomized placebo-controlled trials of antibiotics for acute bronchitis: a critical review of the literature. *J Fam Pract* 1993;36:507-12.
19. Mölsted S, Ekedahl A, Hovelius B, Thimansson H. Antibiotics prescription in primary care: a 5-year follow-up of an educational programme. *Fam Pract* 1994;11:282-6.
20. Macfarlane J, Holmes WF, Macfarlane RM. Reducing reconsultations for acute lower respiratory tract illness with an information leaflet: a randomized controlled study of patients in primary care. *Br J Gen Pract* 1997;47:719-22.
21. Howie JGR, Porter AMD, Heaney DJ, Hopton JL. Long to short consultation ratio: a proxy measure of quality of care for general practice. *Br J Gen Pract* 1991;41:48-54.