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Brief Report

Factors associated with preventive behaviors in the overuse and misuse of antibiotics in Korean nursing students

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This study was performed to investigate the factors associated with preventive behaviors in the overuse and misuse of antibiotics in Korean nursing students. Knowledge was found to be an important variable in eliciting preventive behaviors in antibiotic overuse and misuse; however, information in one's family or personal medical history negatively affected such behaviors. Preventive behaviors in the overuse and misuse of antibiotics are important for nursing students, as future health professionals.

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Antibiotics are powerful drugs in the treatment of bacterial infections, but their overuse and misuse have contributed to bacterial resistance, thereby decreasing their effect and resulting in higher medical costs, prolonged hospital stays, and increased mortality.¹ According to the World Health Organization, antibiotic resistance owing to the overuse and misuse of antibiotics is a serious public health problem worldwide.^{2,3} In particular, South Korea has the third highest antibiotic consumption rate among Organisation for Economic Cooperation and Development countries. A study reported that low knowledge and recognition were 2 causes of high antibiotic resistance in Korea⁴; others reported inappropriate prescriptions and frequent and unnecessary use of antibiotics in respiratory tract infections, including the common cold.^{2,5} Several studies showed that knowledge and attitude are factors influencing desirable behaviors.^{6,7} In particular, nursing students, as pre-nurses, can affect others and mediate their own behavior through knowledge and accurate risk perception.⁸ Therefore, we investigated the factors associated with preventive behaviors in antibiotic overuse and misuse in Korean nursing students.

METHODS

The study was conducted in March 2017, and the participants comprised 303 nursing students. The sample size was calculated using

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G*Power 3.1 (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). After excluding inappropriate responses, the data of 295 participants were analyzed. The study was approved by the institutional review board of Gachon University (1044396-201704-HR-070-01).

Using questionnaires comprising 9 and 13 questions, respectively, data were collected on general characteristics and knowledge and preventive behavior in antibiotic overuse and misuse. We developed a scale for knowledge and preventive behaviors related to antibiotic overuse and misuse based on research by Kim⁹ and Lee,¹⁰ with a Cronbach α of .71 and .62, respectively. The content validity index was rated by 2 practitioners in pharmacology or infection prevention. Statistical analyses were performed using SPSS Statistics 23 (IBM, Armonk, NY). Significance was defined as $P < .05$.

RESULTS

Of the 295 participants, 68.8% were freshmen and sophomores who did not take a pharmacology class (68.8%) and received no clinical training (70.2%), and 31.2% were juniors and seniors. Overall, 48.8% lived with their parents, 24.4% had a family history of chronic disease, and 25.1% had a personal history of disease. The participants accumulated medication-related information through medical staff (45%); textbooks or medical texts (8.4%); the media (5.1%); the Internet (35.8%); and surrounding people, including family (5.1%) and others (0.6%). There were significant differences in the level of knowledge related to antibiotic overuse and misuse according to grade ($P < .001$), pharmacology course ($P < .001$), clinical training ($P < .001$), whether or not participants lived with their parents ($P = .036$), personal medical history related to thyroid disease ($P = .005$), and medication-related information from textbooks and medical texts ($P = .040$). Furthermore, preventive behaviors were significantly

Table 1
Knowledge and preventive behaviors related to the overuse and misuse of antibiotics

	Items	Answer/preventive behavior (%)	
Knowledge	It is always helpful to take antibiotics during a cold (F).	38.0	
	It is better to swallow antibiotics with saliva, not water, because it makes the concentration of the medication thicker (F).	69.2	
	Antibiotics should be taken with other medications to promote their efficacy (F).	68.5	
	In general, the safest way to store antibiotics is to put them in the refrigerator (F).	45.1	
	When symptoms are severe, simultaneously taking 2 doses of medication is helpful (F).	87.1	
	It is safe to use prophylactic antibiotics to prevent antibiotic resistance (F).	71.2	
	Antibiotics that were prescribed in the past but not used can later be used for the same symptoms (F).	66.4	
	If symptoms improve, antibiotic resistance can be reduced by stopping the consumption of the prescribed antibiotics (F).	42.7	
	If the number of antibiotic-resistant bacteria is high, even simple surgery can be dangerous (T).	61.0	
	Preventive behaviors	As symptoms become more severe, I increase the dose and frequency of medication by myself (F).	79.0
		As symptoms improve, I reduce the frequency or stop the dose by myself (F).	34.9
		I have reduced or stopped the usage of a drug because of the overuse and misuse of antibiotics and the risk of resistant bacteria (F).	72.9
		I have stopped taking a drug because of severe side effects without informing the doctor or pharmacist (F).	88.1
		I have forgotten to take medicine (F).	16.9
When I have the same symptoms, I reuse previous medication (including cold medicine, pain killers, laxatives, ointments, and eye drops) by myself without a prescription (F).		21.4	
I have used prescription drugs (hospital) and nonprescription drugs (from pharmacies, convenience stores, etc) together (F).		69.8	
I have used prescription drugs (hospital) and nonprescription drugs (from pharmacies, convenience stores, etc) together (F).		25.8	
I have simultaneously used a prescription drug and medication that was given by someone other than a doctor (F).		85.1	
I have simultaneously used a prescription drug, nonprescription drug, and medication given by someone other than a doctor (F).		90.2	
I have taken over 3 drugs simultaneously (F).		91.2	
I have drunk or smoked while taking medication (F).		73.2	
I have used medication (including ointments, eye drops, and artificial tears) that has been in the refrigerator for a long time (F).		73.6	

F, false; T, true.

Table 2
Linear regression analysis for predicting preventive behaviors in the overuse and misuse of antibiotics (n = 295)

Variables	B	SEM	β	t	F	Adjusted R ²
Constant	0.659	0.036		18.241 [†]	6.001 [†]	0.064
Knowledge related to the overuse and misuse of antibiotics	0.076	0.038	0.113	1.993*		
Medication-related information sources (family, friend, neighbor)	-0.100	0.040	-0.144	-2.521*		
Personal medical history (respiratory disease)	-0.091	0.039	-0.134	-2.342*		
Family history of chronic disease	-0.049	0.023	-0.123	-2.150*		

* $P < .05$.

[†] $P < .001$.

different according to family history of chronic disease ($P = .015$), personal medical history ($P < .001$), and information accumulated through family, friends, and neighbors ($P = .004$).

The mean correct answer rate was 61.0% for knowledge related to antibiotic overuse and misuse and 63.2% for preventive behaviors (Table 1). To determine the variables that influence preventive behaviors related to antibiotic overuse and misuse, linear regression analysis was conducted, the results of which are shown in Table 2. Knowledge, medication-related information accumulated through family, friends, and neighbors, personal medical history, especially respiratory disease, and family history of chronic disease accounted for 6.4% of the total variability in preventive behaviors in antibiotic overuse and misuse. Preventive behaviors were closely associated with knowledge ($\beta = .113$, $P = .047$). Moreover, medication-related information accumulated through family, friends, and neighbors ($\beta = -.144$, $P = .012$), personal medical history, especially respiratory disease ($\beta = -.134$, $P = .020$), and family history of chronic disease ($\beta = -.123$, $P = .032$) negatively affected preventive behaviors in antibiotic overuse and misuse in nursing students.

DISCUSSION

This study demonstrated that knowledge, medication information acquired from family, friends, and neighbors, personal medical history, and family history of chronic disease were significant variables affecting behaviors related to antibiotic use in Korean nursing students. The Knowledge, Attitudes, and Practices survey model can demonstrate changes in behavior; thus, knowledge associated with antibiotic overuse and misuse was expected to influence medication-taking behaviors.¹¹ In this study, knowledge was affected by grade, pharmacology course, and clinical training. Nursing education, including basic nursing courses and clinical practice, influences personal medication use as well as the preparation to be a skilled nurse.¹² Furthermore, it eventually influences patient education regarding appropriate medication use.

However, medication information acquired from family, friends, and neighbors, personal medical history, especially respiratory disease, and family history of chronic disease negatively affected preventive behaviors in antibiotic overuse and misuse. Generally, family, friends, and neighbors provide emotional support and are an important source of information and advice.^{13,14} However, they can sometimes provide misinformation, consequently leading to incorrect behaviors. In this study, supportive relationships affected only behavior, not knowledge. This could be because most of the participants were young students who rely on classes, texts, and other

information sources. Additionally, information and experiences related to family and personal medical history were found to result in negative behaviors. Both of these are considered causes related to the higher rate of antibiotic overuse and misuse in Korea, where one has a strong attachment to one's family.

CONCLUSIONS

A correct understanding of antibiotic overuse and misuse is crucial for health care providers and the public. In particular, nursing students can affect others, including family and friends, as well as mediate their own behavior through knowledge and accurate risk perception. Moreover, as future nurses, they will play a pivotal role in patient education.⁸ Studies have demonstrated the importance of the role of nursing and medical students in suppressing antibiotic resistance.^{15,16} However, this research has limitations, in that the factors discussed showed low explanatory power.

Therefore, it is necessary to develop various research tools and conduct more studies to examine the factors affecting preventive behaviors in antibiotic overuse and misuse. It is also necessary to develop and apply specific and effective education programs to improve nursing students' knowledge related to antibiotic use. In particular, intensive management related to antibiotic use is required for those with respiratory disease and a family history of chronic disease and for medication information accumulated through family, friends, and neighbors.

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