

## A Literature Review on Antibiotic Use Behaviors Comparative Analysis

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### บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่เกี่ยวข้องกับพฤติกรรมการใช้ยาปฏิชีวนะ โดยยาปฏิชีวนะเป็นรูปแบบการรักษาชนิดหนึ่งที่สามารถรักษาโรคติดต่อที่มีสาเหตุจากเชื้อจุลินทรีย์ได้ ในปัจจุบันสถานการณ์ของเชื้อดื้อยาปฏิชีวนะได้เป็นปัญหาในระดับโลกที่ต้องการการแก้ไขอย่างเร่งด่วนเนื่องจากส่งผลกระทบต่อทั้งด้านเศรษฐกิจและสังคม การศึกษานี้จึงมุ่งที่จะวิเคราะห์ปัจจัยที่เกี่ยวข้องกับการเกิดพฤติกรรมการใช้ยาปฏิชีวนะเพื่อหวังว่าจะสามารถนำไปต่อยอดในการแก้ปัญหาเชื้อดื้อยาได้ งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาปัจจัยที่ส่งผลกระทบต่อพฤติกรรมการใช้ยาปฏิชีวนะของประชากรในประเทศและสภาพสังคมประชากรศาสตร์ที่แตกต่างกัน ซึ่งจะวิเคราะห์เอกสารและงานวิจัยที่เกี่ยวข้อง ที่อ้างอิงจาก Knowledge, Attitude and Practices (KAP), Perceived Behavioral Control (PBC) และ Theory of Planned Behavior (TPB) models ผลการศึกษาพบว่า พฤติกรรมการใช้ยาปฏิชีวนะมักเกี่ยวข้องกับความรู้ส่วนบุคคลในเรื่องดังกล่าว ความตระหนักถึงปัญหาเชื้อดื้อยา ทศนคติต่อเรื่องเชื้อดื้อยา และปัจจัยทางด้านประชากรศาสตร์ต่างๆ เช่น เพศ อายุ สถานะทางสังคม ระดับการศึกษา รายได้ และอาชีพ เป็นต้น นอกจากนี้สวัสดิการสังคมต่างๆ อาจมีผลกระทบต่อพฤติกรรมการใช้ยาปฏิชีวนะ เนื่องจากกลุ่มบุคคลที่รายได้ต่ำและมีความต้องการใช้จ่าย หากเจ็บป่วยอาจจะมีแนวโน้มที่จะรับประทานยาปฏิชีวนะด้วยตนเองแทนที่จะไปพบแพทย์ เพื่อที่จะหายป่วยและสามารถกลับไปทำงานได้ รวมถึงมาตรการหรือกฎหมายของภาครัฐที่กำกับไม่ให้บุคคลทั่วไปสามารถซื้อยาปฏิชีวนะรับประทานได้เองอาจมีส่วนช่วยในการบรรเทาปัญหาเชื้อดื้อยาได้ สามารถสรุปได้ว่า ปัจจัยที่เกี่ยวข้องกับพฤติกรรมการใช้ยาปฏิชีวนะสามารถแบ่งได้ออกเป็นสองระดับ ได้แก่ ระดับบุคคล ซึ่งรวมถึง ความรู้ ความตระหนัก ทศนคติต่อเรื่องเชื้อดื้อยา และระดับสังคมหรือระดับชาติ ได้แก่ มาตรการต่างๆที่เกี่ยวข้องกับการควบคุมปัญหาเชื้อดื้อยาในสังคม ซึ่งในการจัดการกับปัญหาดังกล่าว มีความจำเป็นที่ต้องพิจารณาทั้งสองระดับไปควบคู่กัน

**คำสำคัญ:** เชื้อดื้อยา, การใช้ยาปฏิชีวนะ

## Abstract

The purpose of this study was to focus on the factors influencing public antibiotic use behaviors. Antibiotics could be possibly perceived as a form of medication with the potential to treat contagious diseases caused by microorganisms. In the current period, the crisis with regard to inappropriate antibiotic use behavior has become one of the world's most critical health predicaments, with immensely negative consequences on global economic and social contexts. This research may give an idea about the variables regarding the problems which might consequently lead to achieving decent solutions. The objective to study and analyze factors affecting antibiotic use behaviors of different demographic groups in different countries. The methods to study and analyze previous studies regarding antibiotic use based on Knowledge, Attitude and Practices (KAP), Perceived Behavioral Control (PBC) as well as Theory of Planned Behavior (TPB) models. The results of the behavior with regard to antibiotic resistance was generally found to be associated with involving personal knowledge. Nevertheless, other variables including awareness, attitude towards antibiotic resistance prevention as well as some demographic factors such as gender, ages, socioeconomic status, education level, income and profession genre could also be found to have a correlation with regards to antibiotic use behavior in some pieces of studied research. Furthermore, some welfare policies could additionally contribute to public antibiotic use behavior as poor individuals' financial situations affected the tendency of favoring self-medication using antibiotics. Additionally, some imposed federal regulations controlling antibiotic prescriptions might play an important role in alleviating the problem.

The drivers could be observed in two scales: individual and national scale. Individual scale refers to personal antibiotics use of the citizens influenced by knowledge, awareness, attitudes etc. while national scale could represent the enforced federal regulations and laws regarding antibiotic use management. In order to tackle the issue, these two contexts should be cooperatively considered.

**Keyword:** Drug resistance, Antibiotic use behavior

## Introduction

Antibiotics can be defined as medicine used to treat infectious diseases delivered by bacteria and other microorganisms.<sup>(1)</sup> Since the discovery of the first commercialized antibiotic, penicillin, in 1928, many antibiotics have been discovered.<sup>(2)</sup> Beginning of the twentieth century, antibiotics are considered crucial in combating many

pandemics.<sup>(3)</sup> Mass production of antibiotics has existed for more than 60 years in medicine and agriculture, which has considerably benefited public health and productivity in farming.<sup>(4)</sup> Antibiotics help prevent and treat infections received after surgeries and chemotherapy treatment. Another benefit of antibiotics is to help extend the

life expectancy. Shortly after penicillin discovery, penicillin resistance became a consequential medical problem.<sup>(5)</sup> Antibiotic use is the main cause which leads to antibiotic resistance. The overuse of antibiotics accelerates the antibiotic resistance, since more surviving bacteria multiply and become resistant to the antibiotics.<sup>(6)</sup> Inappropriate prescribing, extensive use in agriculture is also considered some antibiotic resistance causes.<sup>(5)</sup>

Antibiotic resistance is considered one of the world's biggest current health crises. In the U.S. alone, around or more than 2.8 million people suffer from antibiotic-resistance infection and more than 35,000 people die each year.<sup>(2)</sup> Currently, utmost priority pathogens with the greatest threat to public health are *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Enterobacteriaceae*, *Enterococcus faecium*, *Staphylococcus aureus* in order.<sup>(7)</sup>

In Thailand, each year, at least 88,000 antibiotic resistance cases were reported and 40.0% died. Approximately more than 40,000 million Thai baht or 0.6% of the country's GDP were spent to solve the issue. Moreover, the cost of antibiotics was extremely high with 17,000 million Thai baht in 2012. One of the approaches for this issue was a 5-year national strategic plan launched in 2016 (NSP-AMR:2017–2021) which aimed at reducing misuse of antibiotics by raising awareness among the Thai population. Overall achievements of the 5-year national strategic plan were 50% reduction of antimicrobial resistance (AMR) morbidity, 20% reduction of antimicrobial

consumption in humans, 30% reduction of antimicrobial consumption in animals, 20% increase in public knowledge on AMR and awareness of appropriate use of antimicrobials, and improvement of the capacity of the national AMR management system to level 4. Additional achievements were improvement of public health and safety, increase of prosperity and sustaining national development.<sup>(8)</sup>

Lack of understanding and knowledge about antibiotics primarily accounted for antibiotic misuse in Thailand, especially in remote areas.<sup>(9)</sup> There was a significant information gap among the general populace in Thailand.<sup>(10)</sup>

Knowledge about antibiotics use for Upper Respiratory Infection was inappropriate among the majority of the Grade 12 students and high vocational students in the study area. Moreover, more than 90% of the study subjects had taken antibiotics for less than 10 days, while 50% of them took antibiotics for less than 5 days.<sup>(11)</sup>

## Instrument

### *Material and Methods*

This study did documentary research by studying previous research conducted in geographic locations including in Asia, America, Europe, Australia which included both developed and developing countries. In addition, knowledge, attitudes, beliefs regarding antibiotic use, based on Perceived behavioral control, The theory of Knowledge, Attitude and Practices and Theory of Planned Behavior were also considered in this study. The study focused on a variety

of research with various groups of participants in terms of age, profession including health-care related professions, socioeconomic status and education level. The main resources were from Springer, ACS Publications, National Center for Biotechnology Information, BMC, PLOS One, Oxford University Press (OUP), The Strengthening Partnerships, Results, and Innovations in Nutrition Globally project (SPRING), ScienceDirect, National Library of Medicine, Clinical Microbiology and Infection and Journal of The Royal Thai Army Nurses.

### What is Drug resistance

Drug resistance is the condition in which the reaction of cancer cells or microorganisms towards a drug which used to be effective against them is not present anymore.<sup>(12)</sup> Drug resistance could be contributed by natural causes or humans involving causes. Mutations and selective pressures which the latter refers to after being treated with a certain drug, survive microbes with the ability to resist to the drug will replicate rapidly and eventually become dominant throughout the microbe populations.<sup>(13)</sup> Drug resistance has been responsible for numerous negative consequences for increased medical treatment costs, prevention costs as well as morbidity and mortality as the result of the resistance.<sup>(14)</sup> As mentioned, there are huge negative impacts on the overall society around the world not only in terms of economic aspects but also in terms of people's quality of life. In addition, drug resistance including antimicrobial resistance and antibiotic re-

sistance has been accelerating as well as spreading globally. This trend will possibly continue in the future if nothing is done in order to alleviate the issue. This is considered as a major global concern due to the fact that the resistance could cause infections which might be impossible to treat with existing drugs. Moreover, apart from the damage to antimicrobial resistance towards a country's economy, medical procedures including surgery would definitely become more insecure without effective drugs.<sup>(15)</sup>

### Associated theory

Perceived Behavioral Control (PBC) could be defined as the confidence in one's abilities of an individual to accurately perform the behavior according to the given question. Therefore, it is associated with shaping one's particular behaviors.<sup>(16)</sup> A Knowledge, Attitude and Practices (KAP) survey is a quantitative approach with preset questions in standardized questionnaires which allow access to quantitative and qualitative information. The KAP survey records thoughts in the form of declarative therefore could aid in acknowledgement of misconceptions and misunderstandings which could be possible barriers to changes in behavior.<sup>(17)</sup> The KAP stated that the changes of human behavior are divided into three consecutive mechanisms: the accession of knowledge, the generation of attitudes and the formation of behavior. Firstly, knowledge is the establishment of changes in behavior. Consequently, belief and attitudes generate behavior changes.<sup>(18)</sup>

Theory of Planned Behavior (TPB) aids in acknowledgement of how individuals' behavior can shift. An assumption of the model is that behavior is arranged, therefore the model predicts calculated behavior. Behavior is led by behavioral beliefs (beliefs of possible outcomes of the practiced behavior), normative beliefs (beliefs about the prescriptive anticipations of other individuals), and control beliefs (beliefs about the existence of factors which might facilitate or interfere with the performance of the behavior). Behavioral beliefs generally are contributed by supportive or unsupportive attitude towards a particular behavior, normative beliefs result in observed social pressure or subjective norms, and control beliefs generate perceived behavioral control. In general, the stronger an individual's aim is to perform the asked behavior is associated with greater favorable behavior, subjective norm as well as perceived control.<sup>(19)</sup>

### Antibiotic resistance situation in Australia

According to the study "The drivers of antibiotic use and misuse: the development and investigation of a theory driven community measure" conducted by Mitchell K. Byrne et al.<sup>(20)</sup> in Wollongong and Illawarra, New South Wales, Australia, the results revealed that each of TPB variables (PBC, social norms and attitudes and beliefs moderated by knowledge) could substantially explain the intent of antibiotic use behavior also the TPB construct could aid in predicting 70% of the variance in antibiotic use and misuse. In addition, PBC was found to be relevant to

antibiotic use behaviors.

There were a range of relevant factors such as attitudes, beliefs, behavioral control, and knowledge which contributed to antibiotic use. Along with the results from the observation of an interaction effect between knowledge and attitudes/beliefs, it could be concluded that relying solely on information and educational-driven interventions might not be able to change the mentioned behavior; therefore, other means to motivate and encourage people should be enforced. In addition, consistent with the TPB, peers, family and community/cultural factors had influences on the antibiotic use behaviors. However, other demographic factors (education level, income and socioeconomic status, gender and age) were not found to have considerable influence on antibiotic use behaviors. This could be explained by the differences in geographic locations, healthcare systems and policies of the target group.

In conclusion, the study represented that the TPB variables had potential in describing intent of antibiotic use behavior as well as the projection of variance in antibiotic use and misuse while PBC was found to have a correlation with antibiotic use behaviors. Attitudes, beliefs, behavioral control, some demographic factors and knowledge were influential in the aspects of antibiotic use behavior. Therefore, other actions apart from educational measures should be imposed in order to alleviate the issue.

### Antibiotic resistance situation in Sweden

The study of public awareness and individual responsibility needed for judicious use of antibiotics: a qualitative study of public beliefs and perceptions by Mirko Ancillotti et al.<sup>(21)</sup> found that antibiotic resistance was defined by all participants as a far-reaching health issue which could have terrible future consequences. There were some possible reasons; Sweden is a developed country where citizens are generally provided with adequate knowledge, including antibiotic resistance.<sup>(22)</sup> Despite the acknowledgement of the threat, disengagement was sometimes able to be detected. For example, many believed that living in Sweden could reduce the possibility of being affected. However, some found overprescribing of antibiotics was contributed by the fear of losing patients to other physicians of some family doctors, therefore patients should also take responsibility when asking for antibiotics.

On the other hand, the fright of deprivation of effective antibiotics observed among the participants along with financial reasons as well as welfare policies encouraged antibiotic use behaviors of the participants positively. In terms of economic loss, people in Sweden tried to recover from the maladies as soon as possible in order to go back to work. Therefore, some welfare policies with more generous approaches aimed to conquer these financial barriers and reduce antibiotic use.

In summary, the study discovered that the overall sample acknowledged the antibiotic resistance issue as a detrimental

crisis. However, the disregard towards the situation could occasionally be noticed. Fortunately, some persuasive policies along with personal concerns of scarcity of antibiotics could encourage people to enhance cumulative antibiotic use behaviors.

### Antibiotic resistance situation in Italy

According to the study “Knowledge, attitudes and behaviors on antibiotic use and resistance among healthcare workers in Italy, 2019: investigation by a clustering method” conducted by Martina Barchitta et al.<sup>(23)</sup>, it was found that differences in type of profession as prescribers and antibiotic use advisor played an important role in the awareness as well as knowledge about antibiotic use and resistance. The cluster which was made up of medical professionals with the responsibilities as prescribers and advisors was found to have the highest knowledge on antibiotic use and resistance. However, the cluster of mixed medical workers including nurses, technicians, non-prescribing medical doctors and some pharmacists presented a higher level of awareness than the first mentioned one. This could be explained as medical personnel with less level of antibiotic use knowledge generally be more aware when involving antibiotics; this might be contributed by uncertainty of the appropriate use. In addition, this group of mixed healthcare personnel was the most conscious about the national action plan on antibiotic resistance and the international antibiotic awareness campaigns European Antibiotic Awareness Day (EAAD) and World

Antimicrobial Awareness Week (WAAW), on the other hand, the lowest knowledge on antibiotic use and resistance were found among this cluster. Another cluster which primarily consisted of pharmacists realized most of their essential roles in battle against antibiotic resistance.

All in all, the study illustrated that career fields as prescribers and antibiotic use advisors along with knowledge regarding the topic contributed to antibiotic use behavior of an individual. In addition, awareness might sometimes have a greater impact on behavior than expertise.

### Antibiotics resistance situation in Poland

According to the study “Surveys of public knowledge and attitudes with regard to antibiotics in Poland: Did the European Antibiotic Awareness Day campaigns change attitudes?” conducted by Beata Mazińska, Izabela Strużycka, and Waleria Hryniewicz.<sup>(24)</sup> The study showed that the inappropriate use of antibiotics was still highly predominant in Poland, however, the positive trend was observed after educational campaigns were held. In addition, the most influential factor against antibiotic resistance was found to be public knowledge. This supported the need for educational campaigns, and the study also found that the educational campaigns conducted were found to slightly improve antibiotic uses. Public ignorance with regard to the ineffectiveness of viral infections treatment of antibiotics was also indicated. Also, inadequate public awareness of antibiotic resistance contrib-

uted to false expectations for antibiotic prescription. Correspondingly with other worldwide studies, in terms of demographic factors, age and education level along with gender were main factors influencing attitudes towards antibiotics. In this study, beliefs of the antibiotics’ potential towards viral infection treatment were most likely to be found among young adults. This could be supported by the fact that some young adults might have less fear or concern about one’s health than the older participants in the study. In addition, participants with lower education levels were found to have lower levels of awareness of inability of antibiotics in viral infection treatment. However, the incidents of self-medication of antibiotics were considered insignificant due to the fact that Polish regulation did not allow Polish to have free access to antibiotics without the prescriptions from physicians or dentists. Moreover, the disobeying medical practitioners’ recommendations regarding antibiotic use was found as the minority among a group of mostly young adults.

In conclusion, prevalent improper antibiotic use behavior was found, however the occurrence declined after educational campaigns were held. Additionally, demographic factors, age and education level along with gender were main factors contributing to attitudes towards antibiotics. Despite the misconception, self-medication of antibiotics as well as defying physicians’ suggestion regarding the topic was considerable.

## Antibiotics resistance situation in The United States of America

According to the study “Antibiotic use for emergency department patients with upper respiratory infections: prescribing practices, patient expectations, and patient satisfaction” conducted by Samuel Ong et al.<sup>(25)</sup>, the results showed that medical practitioners had higher possibilities of prescribing antibiotics in case they believed that patients were expecting them even though the accuracy of identification that patients expected to be prescribed was only 27%. Moreover, 87% of patients who visited ED and received antibiotics, as well as 89% of those who did not receive antibiotics reported satisfaction. 92% of patients who had beliefs that they had a better understanding of their illness, while only 72% of those who had thought that they did not improve their understanding reported satisfaction. This could be the result of the US being a developed country, which might contribute to the value which people put in the improvement of an individual’s knowledge about personal disorders. According to the study “Consumer Attitudes and Use of Antibiotics” conducted by Jodi Vanden Eng et al.<sup>(26)</sup>, knowledge and attitudes regarding antibiotic use were found to be significant factors. In addition, 53% of the participants reported at least one misconception about antibiotic resistance. In demographic aspects, participants including individuals of lower socioeconomic status, lower educational status (this could support the fact that knowledge was an influential factor), males (this represented the same finding as another study “Knowledge

of antibiotics and antibiotic resistance among Norwegian pharmacy customers – a cross-sectional study” conducted by Marit Waaseth et al.<sup>(27)</sup>, which gave an explanation that female participants usually had more concern about health issues than males.), younger age and the elderly (this trend was also presented in another study “Secular trends in antibiotic consumption in the adult population in Emilia-Romagna, Italy, 2003–2009” conducted by A Pan et al.<sup>(28)</sup> showed that The highest antibiotic use was observed in the elders (>=80 years old)) in had higher levels of misunderstanding and lower levels of knowledge about possible negative effects of antibiotics. The study also mentioned that educational attempts were suitable in adjusting patients’ expectations, which could aid in alleviating pressure on the one who prescribed antibiotics. On top of that, individuals with higher education and earning were more likely to use antibiotics due to the easier access to antibiotics. To clarify, people who used antibiotics recently were more likely to hold medical insurance. However, the correlation between recent antibiotic use and lower levels of knowledge was not found.

To sum up, the study found that patients’ expectation for prescribing antibiotics had correlation with the possibility of doctors actually providing the medication. Furthermore, knowledge and attitudes regarding antibiotics as well as some demographic factors such as gender, socioeconomic status, ages and educational level were fundamental variables.

## Antibiotics resistance situation in Thailand

According to the study “Factors Predicting Antibiotic use Behavior Among Healthcare Volunteers in Pathumthani Province, Thailand” conducted by Patson Oumgerd, Jeeraporn Kummabutr, and Wanalada Thongbai<sup>(29)</sup>, antibiotic use behavior of the participants was found in good level as the average score calculated from the level of appropriate antibiotic use was at a good level which might be contributed by their professions as village healthcare volunteers who were quite familiar with healthcare fields, moreover, wide-variety of accesses to antibiotic knowledge including television, radio and the internet. In addition, it was found that the antibiotic use behavior with the greatest score was reading personal drug labels in order to confirm the ownership of a particular drug. This could be explained by the place that participants (healthcare volunteers) usually took their medicines was infirmaries, which was crowded and was a risk for mistaking other patients’ drugs. Knowledge and attitudes towards antibiotic use was found at a moderate level, according to misunderstanding antibiotics as anti-inflammatory drugs. This could be contributed by wide-spread false information on the internet as well as other media. For example, when searching the English translation of anti-inflammatory drugs on the internet, antibiotics were found as the result. Moreover, inappropriate attitudes regarding antibiotics use were found among the participants as they believed that antibiotics were able to cure most diseases,

this led to taking antibiotics every time that they felt ill. On top of that, ceasing taking antibiotics after feeling better and taking others’ antibiotics behavior were also found. The study “Antibiotic use behavior of patients in Srangsoke, Ban Mo District. Saraburi Province” conducted by Suparak Sukphaiboon, Chupasiri Apinandecha, and Kawee Chaisira<sup>(30)</sup> found that demographic factors including age, gender, profession, and education level were associated with antibiotic use behaviors of participants. Older people were found to be more careful and have more experiences and knowledge about antibiotic use. Male participants were found to be associated with better antibiotic use behavior than females. In terms of occupation, merchants and state enterprise employees were found to exhibit better antibiotic use behaviors than agriculturists, freelancers and housewives. Higher levels of education were found to have association with better antibiotic use behaviors. In addition, better antibiotic use behaviors were found among a group of participants with lower income. The possible explanation for this was that people with lower earnings might have less ability to purchase antibiotics than the richer group. Moreover, having antibiotic use knowledge was found to correlate with better antibiotic use behaviors.

In conclusion, as the result of the conducted studies, participants’ professions in the healthcare field contributed to relatively impeccable performances regarding antibiotic use behaviors. Knowledge and attitudes towards antibiotic use were found

at a moderate level, since there were some misconceptions. Another study found that demographic factors including age, gender, profession, income bracket and education level were associated with antibiotic use behaviors of research attendees.

## Conclusion

In conclusion, knowledge, attitudes, beliefs regarding antibiotic use as well as demographic factors including profession, socioeconomic status, education level, gender and age were associated with antibiotic use behaviors. The appropriate knowledge, attitudes, and beliefs contributed to better antibiotic use behaviors. In terms of demographic factors, participants with health-care related professions, state enterprise employees, and merchants tended to perform better antibiotic use behaviors than agriculturists, ordinary employees and housewives. This might be a result of the former group having higher exposure to related knowledge regarding the topic than the latter. People from higher socioeconomic status were more likely to have performed better antibiotic use behaviors, possibly due to harder access to antibiotics. In addition, participants with lower socioeconomic status (according to the research conducted by Jodi Vanden Eng et al.<sup>(24)</sup>) and education level (according to the research conducted by Beata Mazińska, Izabela Strużycka, and Waleria Hryniewicz<sup>(24)</sup> as well as by Jodi Vanden Eng et al.<sup>(26)</sup>. Suparak Sukphaiboon, Chupasiri Apinandechea, and Kawee Chaisira<sup>(30)</sup>) were more likely to have higher levels of misunderstanding and low-

er levels of knowledge about possible negative effects of antibiotics. However, the research conducted by Mitchell K. Byrne et al.<sup>(20)</sup> did not find the correlation between education level, income and socioeconomic status, gender and age and the behavior. Moreover, older people were found to have association with better understanding regarding antibiotic use (according to the research conducted by Suparak Sukphaiboon, Chupasiri Apinandechea, and Kawee Chaisira<sup>(30)</sup> and by Beata Mazińska, Izabela Strużycka, and Waleria Hryniewicz<sup>(24)</sup>). However, the research conducted by Jodi Vanden Eng et al.<sup>(24)</sup> found that younger age and elderly had higher levels of misunderstanding and lower levels of knowledge about possible negative effects of antibiotics which the study conducted by A Pan et al.<sup>(28)</sup> also found that the highest antibiotic use was observed in the elderly. In addition, the study conducted by Suparak Sukphaiboon, Chupasiri Apinandechea, and Kawee Chaisira<sup>(30)</sup> found that male participants were found to be associated with better antibiotic use behavior than females. This was contradicted by the result of the study conducted by Jodi Vanden Eng et al.,<sup>(26)</sup> and by Beata Mazińska, Izabela Strużycka, and Waleria Hryniewicz<sup>(24)</sup> as well as by Marit Waaseth et al.<sup>(27)</sup>

Furthermore, influences on antibiotic use behavior could be observed in financial aspects, since typical citizens usually have a great deal of concerns towards the cost of hospitalization and medical treatment. This could adversely lead to self-medication by taking antibiotics by one

self and worsen the antibiotic resistance situation. Therefore, the federal government of a particular country should bring this aspect into consideration to enforce regulations ensuring workers the welfare payment in order to alleviate the issues as could be seen in the Swedish enforced regulations. All in all, the factors could be observed in two scales: individual and

national scale. Individual scale represented the personal antibiotic use of the citizens influenced by knowledge, awareness, attitudes etc. while national scale could demonstrate the enforced federal regulations and laws regarding antibiotic use management. In order to tackle the issue, these two contexts should be cooperatively considered.

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