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A Literature Review On Drug Resistance Prevention

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Abstract

Antibiotics are medications that destroy or slow down bacterial growth. Antibiotic resistance is an arising global threat in public health. When the bacteria and fungi are resistant to antibiotics, they become less effective and develop the ability to defeat the medicines that are designed to kill them. The purpose of this study was to investigate antibiotic resistance prevention behaviours, knowledge, attitude and practice among Thai people on antibiotic use. The methods to study and analyze previous studies regarding Thai people's inappropriate antibiotic use based on secondary data from research databases and scholarly sources. The result showed that age, gender, education, wealth quintile and area of living are factors that indicate the level of people's knowledge on antibiotic resistance and their irrational drug use behaviours. In addition, lack of knowledge, misunderstandings, self-medication with antibiotics, overprescribing antibiotics and inappropriate use of antibiotics in farm animals are the main causes of the occurrence and spreading of these emerging resistant bacteria. In conclusion, individuals should be prescribed and dispensed antibiotics appropriately and drug use rate in farm animals should also be reduced. Moreover, ensuring their hands, belongings are clean and their food meets official hygiene and sanitation standards are essential.

Keywords: Antibiotic resistance, bacteria, inappropriate antibiotic use behaviours

Introduction

Antibiotics are drugs that inhibit growth of bacteria in various mechanisms, such as inhibiting protein synthesis in bacteria, inhibiting the synthesis of bacterial cell walls, interfering with the function of the cell membrane, and inhibiting the synthesis of genetic material in bacteria [1]. Antibiotics are essential for combating many widespread outbreaks, increasing productivity in farming, treating infections received after chemotherapy treatment and surgeries after mass production of antibiotics has existed for more than 60 years in medicine and agriculture [2]. On the other hand, a huge number of people have gotten bacterial infections since Penicillin was discovered in the 1920s. Moreover, a growing number of bacteria that resist to antibiotics continually increased during the development of new classes of antibiotics [1].

Antibiotic resistance is a detrimental problem to global health because of the difficulty of the treatment with troublesome consequences, such as a considerable number of deaths and hospitalizations [3]. Some bacteria have become resistant to antibiotics, causing the spread of antibiotics resistant bacteria from person to person through poor hygiene, unclean prepared food and close proximity [4]. The significant factors that contribute to antimicrobial resistance (AMR) are the overuse of antibiotics for non-indicated diseases, the inappropriate antibiotic dispensing among qualified and unqualified healthcare providers or grocery stores in different districts, self-medication of antibiotics, excessive use of antibiotics in farm animals, etc [5].

Global Antibiotic Resistance Situation

People continuously develop antibiotics resistance infections, leading to 700,000 deaths reported each year. By 2050, if we do not take this issue seriously, there is a prediction that global total deaths from antibiotic resistance will reach 10 million cases each year which will have a huge impact on the economy. Asia and Africa are likely to be reported by that year as two of the most mortality rate continents with 4.7 and 4.2 million deaths, respectively [6]. The associated costs are predicted to be as high as US $100 trillion worldwide if no action is taken. In the European Union (EU) alone, 25,000 patients die due to infections caused by multiresistant bacteria each year, costing society approximately €1.5 billion annually. By 2050, expected cumulative losses due to multiresistance will reach 2.9 trillion USD per year [7]. The major pathogens that cause a significant threat to public health are Acinetobacter baumannii, Pseudomonas aeruginosa, Enterobacteriaceae, Enterococcus faecium and Staphylococcus aureus [2].

Drug resistance situation in Southeast Asia

Southeast Asia countries had a relatively high level of unnecessary use of self-medicated antibiotics due to the lack of knowledge and access to qualified health services. Furthermore, the special Euro-barometer 478, conducted in September 2018, demonstrated that Europeans' knowledge about antibiotics was higher than Thais. The determinants associated with degrees of knowledge about antibiotics were age, area of residence, educational levels and wealth quintile [5].

According to recent research in China, due to the fact that antibiotics are easy to be accessed and a great number of the general population have inappropriate antibiotic use behaviours, irrational use of antibiotics are common among the general population in China. Antibiotics were more likely to be obtained unnecessarily by people from western regions of this country. Aside from the fact that the demand of citizens in China for antibiotics from physicians has decreased over time, the trend of irrational use behaviours of antibiotics hasn't declined eminently in the previous decades. The potential reasons behind this may mainly lie on their misunderstandings of antibiotics. Many people tend to be incapable of recognizing common antibiotics, comprehending in what situation antibiotics are required, demonstrating adequate knowledge of proper antibiotics usage and perceiving adverse outcomes of antibiotics. These inappropriate behaviours may bring expectations of unnecessary antibiotics from the public and obstruct people's rational antibiotic use [3].

In Japan, 80% of the survey participants did not know that antibiotics cannot kill viruses and that antibiotics do not shorten or reduce the severity of flu and colds. According to a 2019 study in Thailand, a majority of respondents (>65%) answered correctly to the two question about antibiotic use: "unnecessary or inappropriate use of antibiotics makes them become ineffective or induces bacterial resistance" and "antibiotic treatment should only be stopped when the whole course of antibiotics has been taken as directed". Fewer respondents (50.7%) answered incorrectly that "antibiotics can kill viruses"; "antibiotics are effective for treatment of colds and flu" (48.8%); and "antibiotics are equivalent to anti-inflammatory drugs" (41.3%). A significant number of respondents (40.4%) did not recognize the side effects of antibiotic use such as diarrhoea.

The respondents with higher education and richer wealth quintiles tend to have higher knowledge on appropriate antibiotic use. However, females were 1.1 times more likely to have an awareness of antibiotic use and AMR than males (OR=1.08; 95%CI =1.02-1.15; p-value=0.011). Adults were 1.2 times more likely to be aware than adolescents (OR=1.22; 95%CI =1.05-1.40; p-value=0.007). Respondents who reside in rural areas were less aware of proper antibiotics use and AMR compared to urban residents. Referring to a 2017 national household survey in Thailand, the majority of survey participants (63.6%) correctly recognized the resistance which is the result of inappropriate use of antibiotics; 61.7% perceived that they should stop antibiotics after accomplishing a complete course of treatment; 42.9% answered correctly that antibiotics are not anti-inflammatory drugs. However, a huge number of participants (52.3%) answered incorrectly to the idea that antibiotics are able to cure common cold and flu symptoms; 49.8% have a misunderstanding that antibiotics can treat viral infection. Lastly, almost half of the participants (47.4%) lack knowledge about side effects, such as diarrhoea, of excessively using antibiotics [5].

Drug resistance situation in Thailand.

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According to the antibiotics markets report, irrational use of antibiotics continually increased the antibiotics consumption and usage in Thailand from 2000 to 2010. In 2010, the estimated cost of antibiotics production in Thailand was over 27,291.53 million baht, or around 19.02% of total national pharmaceutical expenditure. The amount of Thai people who develop infections that are resistant to antibiotics have been reported approximately 88,000 per year, no less than 20,000-38,000 of these people result in death yearly. The resistance rate of Acinetobacter spp. to imipenem doubled from 38.5% in 2006 to 64.8% in 2014 and the trend of imipenem-resistance is extensively rising among gram negative bacilli, specifically P. aeruginosa. The total number of days that antibiotics resistance patients are admitted to hospital appears to be 3.24 million days or an average of 24-46 days per each person [8].

In Thailand, healthcare professionals are crucial agents who can encourage people to use antibiotic in proper ways since people in Thailand primarily received antibiotics from healthcare providers at 98.1% which is higher than South Africa (93.0%), Mexico (92.0%), Vietnam (75.0%), Indonesia (83.0%) and the Russian Federation (56.0%) [9]. However, as reported by the Thai drug system in 2009, several inappropriate uses of antibiotics have been identified including 42% of overprescribing of antibiotics by healthcare providers, prescribing fault of antibiotics, using wrong dose regimen of antibiotics, maintaining wrong antibiotics course duration, and using antibiotics unnecessarily which can cause the spread of harmful antibiotics resistance in Thailand [10]. There are a considerable number of reports worldwide regarding inappropriate use of antibiotics for upper respiratory infections (URI). In developing countries, drugstores are one of the major providers of health care service, but antibiotics are often being dispensed needlessly and excessively by pharmacists. In Thailand, a practising pharmacist can legally dispense antibiotics without prescription. Thai and Korean studies reported that pharmacists believed that antibiotics speed up the healing process of patients as well as prevent secondary infections. Based on the theory of reasoned action, Plianbangchang stated that attitude — an individual's perspective on antibiotic dispensing for URI — certainly influenced intention to dispense antibiotics for this disease among central Thai pharmacists. Furthermore, Lambert et al., referring to the theory of reasoned action, and Liabsuetrakul et al., referring to theory of planned behaviour, claimed that subjective norm — the perceived social pressure on antibiotic dispensing decisions — have an influence in physicians' intention on antibiotics use for ambulatory patients in a managed-care setting and for prevention of post-caesarean infections in a hospital [11]. However, some viruses cause symptoms that are similar to bacterial infections, therefore doctors should dispense proper medicines that can actually kill the bacteria since antibiotics cannot treat viral infection; otherwise the treatment will not cure the root cause of the diseases [10]. In 2019, the World Health Organisation (WHO) declared that antimicrobial resistance is one of the top 10 global public health threats confronting humanity and in 2020 antimicrobial resistance became a latest indicator for the sustainable development goals (SDGs). Thailand's National Strategic Plan on Antimicrobial Resistance (2017-2022) takes the Global Action Plan on antimicrobial resistance into account and aligns political affirmations with the national context. A determined objective set of the plan and six strategies for achieving them include antimicrobial resistance surveillance, regulation of antimicrobial distribution, antimicrobial resistance containment in humans, antimicrobial resistance containment in agriculture and animals, public awareness-raising, and governance mechanisms [12]. There are various sources of data indicating that the idea of using the Web to search about antibiotics information is widespread. The internet is considered the second most abundant source of antibiotic-related information. This suggests that healthcare professionals (HCPs) could provide more accurate information and address any misunderstandings electronically since 73.4% are reported to be exposed to antibiotics information through the internet. However, Web users believe that it is acceptable to take antibiotics without a physician's prescription, and they have already administered self-medications with antibiotics. This finding apparently highlights that the main problem is the quality of information on internet's health topics [13]. In brief, all the studies that are mentioned signify that the emergence of antibiotic resistance is growing rapidly. The dreadful consequences of this incident continually affect global health, economy and increase cost and length

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of treatments since the past decades. Misunderstandings, self-medication with antibiotics, inappropriate use of antibiotics, overprescribing antibiotics are the main causes of the occurrence and spreading of the resistant bacteria. However, the knowledge and behaviours of people on antibiotics use predominantly depend on age, gender, education, wealth quintile and area of living.

Antibiotic use in farm animals

Antimicrobial exposure in livestock or farm animals is one of the most crucial causes of the emergence of AMR, which can transmit from animals to humans through food, the environment or by direct contact. However, some nations still use as much as 80% of the total consumption of antibiotics in the animal sector [14]. From the report of the Department of Medical Science, chicken was found to be the most contaminated meat by antibiotics (78.9%), followed by pork and beef with 65.6% and 51.8%, respectively.

Many farmers tend to have misunderstandings of antibiotics use. They use antibiotics in animal agriculture to marginally improve growth rate and also to prevent infections from developing in an absence of the disease, or known as prophylactic use. However, according to the basic principle of antibiotic therapy, antibiotics can only treat diseases by killing or inhibiting the growth of bacteria.

If farmers habitually send milk as a product from their dairy cattles to private dairy companies, antibiotics residue testing beforehand is required in order to reach hygiene standards and ensure milk from animals under antibiotics treatment does not enter the food chain. Meanwhile, some milk vendors manage to buy milk directly from farms for selling without a certified antibiotics milk testing process. Therefore, there is a tendency that milk products containing antibiotics residues are distributed to consumers around that area.

Most farmers choose to administer antibiotics to farm animals by various techniques such as intramuscular injection, breast injection, oral administration including antibiotics in feed or drinking water, aerosol spraying, etc. The amount of antibiotics given to each cattle is typically 20 mL. Farmers use cloxacillin-ampicillin 2-3 weeks before calving to force milk cessation and against mastitis. After cattle parturition, oxytetracycline is used immediately by breeders for treatment and to reduce the risk of inflammation. In an inflammatory state, cattles are exposed to oxytetracycline, penicillin, sulphamethoxydiazine, amoxicillin or kanamycin for cures. Tetracycline spray, an external drug, is used with cattle's wounds. For the small calf, considering the size and metabolic rate differences, lower dosage of penicillin and oxytetracycline are started to be used against omphalitis or cases that are associated with skin injury from lying in wet and humid conditions.

In livestock, farmers often administer colistin via drinking water to 1-month-old pigs consecutively until the pigs are 5-month-old, while having common misconceptions about the goal of antibiotic therapy by considering it as a supplemental vitamin. Apart from the use of colistin, neomycin is fed to the whole stall of pigs in drinking water to treat and prevent conjunctivitis at pig's eyes. Some farmers apply ceftriaxone concurrently with enrofloxacin + vit.B12 or amoxicillin to eradicate various bacterial diseases.

Farmers occasionally feed chickens with mixed enrofloxacin with drinking water when every new member has been settled in a farm for 2 consecutive days and after vaccination to avoid vaccine reactions in poultry flocks. Farmers believe Enrofloxacin has the potential to prevent fowl cholera and diarrhoea. Cocidiocidal triazinetrione is also given to chickens to cure and prevent diarrhoea from spreading in poultry stalls. When the quantity of eggs produced does not reach farmer's satisfaction, sulfadimethoxine is used.

Previous systematic review revealed that farmers commonly use antibiotics in the suckling and post-weaning stages of production among pig farms. According to research about antibiotic use for pig farming in Thailand, lots of farmers believed that using antibiotics is an approachable way to reduce pig mortality due to its cheapness. One farmer estimated that administering antibiotics to the whole herd via pig's food was less labour intensive than individual treatment and also low-cost. However, all of the three smallholder farmers do not understand the word "antibiotics" (*yaa-pati-cheewana*) while commercial farmers could discriminate between antibiotics and other medicines. Most farmers who understood the meaning of antibiotics informed that

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they perceived the use of antibiotics by following the indications on the labels and the suggestions of pharmacists. Nevertheless, there were a number of farmers who regularly used high potency antibiotics in the absence of clinical justification [15].

The intensive use of antibiotics in tilapia cage production in Thailand is the key source contributing to the freshwater contamination issue. Ecosystems are often exposed to antibiotic mixtures. In addition, the repeated antibiotic use, which is expected to enhance antibiotic's quality, actually made antibiotics become ineffective against the target pathogens. By this, farmers are forced to increase drug doses and constantly change antibiotic ingredients, weakening the (environmental) sustainability of this aquaculture practice [16]. Moreover, when the conventional and cheap antibiotics become impracticable due to the antibiotics resistance, healthcare providers have to seek for new ones that have potential to cure those diseases which might be expensive and unaffordable for some groups of people

In 2015 meat production within 30 European countries, antibiotic use per population correction unit, i.e. per kg of biomass produced, varied from 2.9 mg in Norway to 434.2 mg in Cyprus [17]. In Brazil, antibiotics are therapeutically and prophylactically used as growth-promoting additives by farmers. All farmers thought that antibiotics are indispensable in pig farming as it was considered a major way to prevent infections in pigs. Moreover, farmers failed to differentiate between bacterial and viral infections since antibiotics are also used to treat viral infections by them [18].

Estimations show that 75-90% of livestock fed antibiotics excretion are un-metabolized and have a potential to enter sewage systems and water sources. Waste from livestock may contain antibiotic-resistant bacteria and active antibiotics that tend to contaminate the environment and also promote the emergence of antibiotic resistance [19]. In Summary, many farmers have misconceptions about antibiotics use in livestock and therefore unnecessarily administer antibiotics to farm animals by several methods depending on the cost and appropriateness. These farmer's actions lead to antibiotic overuse problems which threaten ecological balance and human health by polluting fresh water and the surrounding environment, and distributing products with antimicrobial residue to the village market.

Thai citizen's hygiene and disease prevention behaviours

Personal hygiene behaviour is a fundamental disease preventive measure. Thai people's lifestyle and sanitation, whether on food preference, healthy living or cleanliness, varies between groups of people with different jobs and areas of living. According to the National Statistics Office survey in 2017, emotional value influenced Thai people's behaviour more than functional value since the Thais gave importance on food's preferences rather than cleanliness and nutrition of them. Siam Commercial Bank Economic Intelligence Centre (2020) reported that there was an increase of sweets and salty foods and beverages consumption as well as lower fruit and vegetable intake. Furthermore, Thai people noticeably consumed more dietary and food supplements.

The Thai people health behaviour report found that people during early adulthood have unhealthy eating habits, lack of regular exercise, heavy smoking rate and excessive alcohol intake in both males and females. People during middle adulthood also have several behaviours and actions that have negative impacts on their health such as smoking, consuming alcohol. They additionally have inappropriate behaviours on treating chronic health conditions, for instance, hypertension and diabetes. According to a study among the Thai working-age population in 2009, working people in Bangkok mostly have a hurried lifestyle that increases fast food consumption during rush hour. Because of time-limited before work, people select ready meals rather than home-cooked meals which contributes to the loss of food quality control among this group of urban people. Especially, they have to rely on ready meals which are found to gain high calories, have inadequate nutrients and tend to have poor food hygiene [20].

Total influenza-associated deaths from Africa and Southeast Asia countries accounted for more than half of all unassessed mortality. According to the study of the Thai/Myanmar community, people with a higher education knowledge and households with a higher income tended to have a better knowledge of influenza A (H1N1). Higher knowledge was also associated with better practices for influenza A (H1N1) prevention. This studied survey is taken

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along the Thai border where the majority of the population is non-Thai, has low income, lack of education and poor access to health services. Therefore, the insufficiency of influenza A (H1N1) knowledge among Thai/Myanmar border population was generally reported, including disease transmission, common symptoms and self-protection practices. More than 80% of participants shared personal possessions, such as drinking glasses, spoons, towels, between parents and children. Additionally, more than half the studied population had never exercised. A survey of 801 individuals from two provinces in Northern Thailand, Chiang Rai and Tak, revealed that only 21% of participants would agree to stay at their homes if they got infected with influenza during an outbreak. Participants preferred hospital (43%) to home (29%) as a confinement location. Only one quarter of respondents had used face masks back in the day when they had an illness. Slightly less (24%) said they would agree to use a face mask when sick in the future. Over half (53%) said they would not wear a face mask. Lower than half of respondents (46%) would increase hand washing frequency during an outbreak, 50% of these people do not consider using soap. Just over half (55%) would agree to take preventative medicine and avoid travelling to places with no outbreak occurring if they had been in contact with an infected person. In addition, people residing at border areas have a proximity to international borders, therefore, they may increase the possibility of cross-border disease communication and incident of future pandemic [21].

During poultry outbreaks of highly pathogenic avian influenza (HPAI) H5N1, several educational campaigns launched by ministries of the Thai government, including the Ministries of Education and Public Health, were conducted to teach Thai children and their families about protective ways to keep themselves away from avian influenza infection. A survey of personal protection in 2008 regarding HPAI reported that respondents have conducted routine activities such as slaughtering, cooking, carrying dead birds with bare hands, selling dead birds and cleaning the mucous discharge of fighting cocks which are considered as high-contact jobs with poultry. Despite this, there was a small use of PPE (gloves and masks) and inconsistent hand hygiene practices after doing activities involving poultry, for example, carrying fowl and collecting eggs. To clarify, unfamiliarity, discomfort, apathy and poor availability were the backyard poultry owners' impediments of mask and glove-wearing behaviours [22].

Research regarding practices during avian influenza reported that the knowledge and attitudes of Thai people in Nakhon Phanom about how to protect oneself from poultry diseases significantly changed after they were exposed to avian influenza information. The percentage of adults who thought direct contact with sick or dead poultry with bare hands was safe decreased from 40% to 14% and from 23% to 5% for children in their households.

However, seventy-seven percent of people already had an appropriate level of practice by usually washing their hands after touching poultry. If persons were required to touch sick or dead poultry, 138 (70%) said they would use gloves as a protective equipment; only 10 (5%) people believed that wearing a mask could also protect themselves. Despite extensive knowledge and ways of protecting influenza, many Thais have not changed their behaviour, for instance, they continue to take dead poultry for household consumption which can increase high infection risk [23].

The interactions of three components including humans, animals and the environment engage in the transmission of leptospirosis. The study population mostly have occupations that involve animal exposures and/or environmental bodies of water, such as rice paddy fields. In some parts of Thailand, there are many actions that can lead to the direct transmission of leptospirosis, for example, many people keep various types of animals in their house, along with being in contact with the urine of infected animals while working. Domestic pets (in particular dogs) and farm animals such as chickens and pigs are the majority of animals that participants reported owning or having contact with. Households in northeast Thailand frequently share several environmental water sources together for use in agricultural work. The incident of human leptospirosis is associated with agricultural work. In general, people in the northeast of Thailand had a lower level of education and took fewer protective measures against infectious diseases compared with

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the number of measures taken by people living in southern Thailand [24].

Many trichinosis cases, a widespread food-borne parasitic zoonoses in Thailand, were recorded each year. More than 135 trichinosis outbreaks were reported between 1962 to 2006 in Thailand, especially in the north of the country, due to the fact that northern traditional dishes involve meat from pigs and wild boars that are usually eaten raw or under-cooked by many local people [25].

Thai people, especially in the northeast, have unsafe consumption behaviours, for instance, eating traditional foods that are raw or undercooked fish such as Koi Pla (raw fish salad) or Pla Jom (pickled fish), eating food that contain nitrosamines, eating fermented fish and soured fish which are considered as risk factors towards liver fluke infection that can cause Cholangiocarcinoma (CCA). One of the major habits that increase CCA risk is immoderate alcohol consumption that is found to be a massive problem among people in this area. It is essential to reduce risk factors for CCA and promote proper preventive behaviours in order to decrease the incidence rate of this cancer [26].

All the aforementioned studies suggested that there are many factors which indicate the rate of disease transmission such as level of knowledge, education, rate of income, area of residence, etc. Thai people have a substantial chance to get antibiotics resistance as they choose food by the taste and tend to give less attention to its cleanliness and health benefits. Moreover, in rural regions of Thailand, the Thais usually eat raw meats as they are parts of their traditional culture, which further contribute to foodborne diseases and antibiotic residue consumption. Furthermore, people who do agriculture jobs frequently are in close contact with farm animals that they fed antibiotics to, and there are obstacles for farmers to wear gloves and masks which mainly is the discomfort. These groups of people can therefore easily get infected with avian influenza and antibiotics resistance from their animals. Overall, Thai people's level of preventive measures for antibiotic resistance crisis might be low as it can also be seen by substandard preventive behaviours against previous outbreaks such as influenza, etc.

Conclusions

Antibiotic resistance is a huge problem that is happening worldwide and its incident rate tends to continually increase. This happens when changes in bacteria make the drugs become less effective as the bacteria develop the ability to survive that particular antibiotics. The main causes of this infection are inappropriate use of antibiotics due to the misunderstanding of the drug's concept, unnecessary use of antibiotics, over-prescription of antibiotics and overuse of antibiotics in farms and livestock. Apparently, some people have an inappropriate lifestyle contributing to poor hygiene and sanitation which are the behavioural determinants of antibiotic resistance, such as consuming raw food regularly by considering them as a culture. Therefore, people should be instructed in order to receive sufficient knowledge about drug use and the effects of drug misuse. Antibiotics should also be dispensed appropriately by healthcare providers. Furthermore, only accurate information about antibiotics should be published on social media to avoid public confusion. Lastly, the farmers should reduce antimicrobial usage among farm animals. If antibiotic resistance can eventually be overcome, the cost and length of hospitalisation and death rate will decrease, along with the global economy will be improved.

References

1. Araya Khoka. Antibiotics and antibiotic resistance [online]. 2020 [cited 2022 Jun 15] Vol.27 No.2 Available from: https://he01.tci-thaijo.org/index.php/jmhs/article/download/244782/166171/864571
2. Preechaya Naraprasertkul. A Literature Review on Antibiotic Use Behaviors Comparative Analysis [online]. 2022 [cited 2022 Jun 15] Vol.6 No.2. Available from : https://he01.tcithaijo.org/index.php/iudcJ/article/view/253200/172233
3. Duan, L., Liu, C., & Wang, D. The General Population's Inappropriate Behaviors and Misunderstanding of Antibiotic Use in China: A Systematic Review and Meta-Analysis. Antibiotics,2021;10(5): 497
4. Supachai Pithikultung. Factors related to infectious disease carriers Streptococcus pneumoniae and antimicrobial resistance in healthy children at pediatric centers. in a health promotion hospital. Thai Journal of Public Health [online]. 2010 [cited 2022 Jun 15] Vol.6

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No.2 Vol. 40 No. 2 Available from : https://he02.tci-thaijo.org/index.php/jph/article/view/7914
5. Chanvatik, S., Kosiyaporn, H., Lekagul, A., Kaewkhankhaeng, W., Vongmongkol, V., Thunyahan, A., & Tangcharoensathien, V. (2019). Knowledge and use of antibiotics in Thailand: A 2017 national household survey. PLOS ONE, 14(8)
6. Patcharapan Kitpan. Anitimiccribial resistance csisis to rational drug use. Food and Drug Administration Academic Program Division [online]. 2018 [cited 2022 Jun 15] Available from : https://he01.tci-thaijo.org/index.php/fdajournal/article/download/140318/104087/
7. Machowska, A., & Stålsby Lundborg, C. . Drivers of Irrational Use of Antibiotics in Europe. International Journal of Environmental Research and Public Health, 2018 16(1), 27
8. Amphorn Yana. Factors related to Antibiotic Use Behaviors among Patients in Outpatient Departments of Community Hospitals. Nursing Journal of the Ministry of Public Health. [online]. 2021 [cited 2022 Jun 15] Available from : file:///C:/Users/infinix/Downloads/nbaisri,+%7B$userGroup%7D,+10.
9. Viroj Tangcharoensathien. Population knowledge and awareness of antibiotic use and antimicrobial resistance: results from national household survey 2019 and changes from 2017. BMC Public Health are provided here courtesy of BioMed Central [online]. 2021 [cited 2022 Jun 15] Available from : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8630906/.
10. Savi Klinkajorn. Antibiotics Use Behavior of Patients in Health Promotion Hospital, Regional Health Promotion Center 3. [online]. 2009 [cited 2022 Jun 15] Available from : https://hpc6.anamai.moph.go.th/web-upload/migrated/files/hpc6/n630_630c173087e9b6109544cd511f47ca68_som1.pdf.
11. Saengchar oen, W., Chongsuvivatwong, V., Lerkiatbundit, S., & Wongpoowarak, P. Factors influencing dispensing of antibiotics for upper respiratory infections among Southern Thai community pharmacists. Journal of Clinical Pharmacy and Therapeutics, 2008;33(2):123–129.
12. Sumpradit N, Wongkongkathep S, Malathum K, Janejai N, Paveenkittiporn W, Yingyong T, Chuxnum T, Vijitleela A, Boonyarit P, Akaleephan C, Manosuthi W, Thienthong V, Srinha J, Wongsrichai S, Laoprasert T, Athipunyakom P, Kriengchaiyaprug N, Intarukdach K, Numsawad omjetanakul N, Punnin S, Kiatying-Angsulee N. Thailand's national strategic plan on antimicrobial resistance: progress and challenges. Bull World Health Organ, 2021;99(9):661-673
13. Zucco, R., Lavano, F., Anfosso, R., Bianco, A., Pileggi, C., & Pavia, M. Internet and social media use for antibiotic-related information seeking: Findings from a survey among adult population in Italy. International Journal of Medical Informatics, 2018;111: 131–139.
14. Holmes, A., Holmes, M., Gottlieb, T., Price, L. B., & Sundsfjord, A. End non-essential use of antimicrobials in livestock. BMJ, (2018) 259.
15. Lekagul, A., Tangcharoensathien, V., Liverani, M., Mills, A., Rushton, J., & Yeung, S. Understanding antibiotic use for pig farming in Thailand: a qualitative study. Antimicrobial Resistance & Infection Control, 2021;10(1)
16. Rico, A., Oliveira, R., McDonough, S., Matser, A., Khatikarn, J., Satapornvanit, K., … Van den Brink, P. J. Use, fate and ecological risks of antibiotics applied in tilapia cage farming in Thailand. Environmental Pollution, 2014;191: 8–16.
17. Wongsuvan, G., Wuthiekanun, V., Hinjoy, S., Day, N. P., & Limmathurotsakul, D. Antibiotic use in poultry: a survey of eight farms in Thailand. Bulletin of the World Health Organization, 2017;96(2):94–100.
18. Albernaz-Gonçalves R, Olmos G, Hötzel MJ. Exploring Farmers' Reasons for Antibiotic Use and Misuse in Pig Farms in Brazil. Antibiotics (Basel). 2021;22:10(3):331.
19. Wongsuvan, G., Wuthiekanun, V., Hinjoy, S., Day, N. P., & Limmathurotsakul, D. Antibiotic use in poultry: a survey of eight farms in Thailand. Bulletin of the World Health Organization, 2017;96(2):94–100.
20. Mongkol Karunngampan. employee behavior in large urban enterprises Sathorn, Bangkok.

Volume 5, Issue 5; September-October 2022; Page No 526-534

Songkhla Nakarin College of Nursing [online]. 2012 [cited 2022 Jun 15] Available from : file:///C:/Users/infinix/Downloads/tanomsri,+Journal+manager,+mongkol5.pdf

21. Hickey, J., Gagnon, A. J., & Jitthai, N. Pandemic preparedness: perceptions of vulnerable migrants in Thailand towards WHO-recommended non-pharmaceutical interventions: a cross-sectional study. BMC Public Health, 2014;14(1).
22. Somrongthong, R., Beaudoin, A., Bender, J., Sasipreeyajan, J., Laosee, O., Pakinsee, S., & Sitthi-amorn, C. Use of Personal Protective Measures by Thai Households in Areas with Avian Influenza Outbreaks. Zoonoses and Public Health, 2012;59(5)
23. Olsen, S. J., Laosiritaworn, Y., Pattanasin, S., Prapasiri, P., & Dowell, S. F. Poultry-handling Practices during Avian Influenza Outbreak, Thailand. Emerging Infectious Diseases, 2005; 11(10):1601–1603
24. Narkkul U, Thaipadungpanit J, Srisawat N, Rudge JW, Thongdee M, Pawarana R, Pan-Ngum W. Human, animal, water source interactions and leptospirosis in Thailand. Sci Rep. 2021;5:11(1):3215.
25. Natthawut Kaewpitoon, Soraya Jatesadapattaya Kaewpitoon, Prasit Pengsaa . Food-borne parasitic zoonosis: Distribution of trichinosis in Thailand. World Journal of Gastroenterology are provided here courtesy of Baishideng Publishing Group Inc [online]. 2008 [cited 2022 Jun 15] 2008 ;14(22): 14 . Available from : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2716607/
26. Nopparat Songserm, Somkiattiyos Woradet, Banchop Sripa, Akhtar. Sustainable Prevention of Cholangiocarcinoma Through Community Participation in a High-incidence Area in Thailand. Asian Pacific Journal of Cancer Prevention : APJCP are provided here courtesy of West Asia Organization for Cancer Prevention [online]. 2020 [cited 2022 Jun 15] 2020;21(3). Available from : Ali5https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7437333/.

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