



# **Antimicrobial resistance and the nurse's role**

Literature review

Agne Diminskyte

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Author:	Agne Diminskyte
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Supervisor (Arcada):	Satu Vahderpää
Commissioned by:	Isaac T. Robillo Memorial Hospital, Davao, Philippines
<p>Antimicrobial resistance is a global threat as it is present in all parts of the world and it means that there is a shortage of effective antibiotics to treat simple infections and diseases, also statistics reveal that because of antimicrobial resistance patients' morbidity and mortality is increased, as well as healthcare related expenditures. Theoretical frameworks chosen for this study are Mark Salmon White's construct for public health nursing and Tannahill's model for health promotion. Both models focus on promoting and contributing to the health and well-being of the public.</p> <p>In this thesis the nurse's role is explored and steps that can be taken towards contributing to minimizing antimicrobial resistance are listed. Results reveal that nurses are in an ideal position to tackle antimicrobial resistance as they spend a lot of time with their patients so they can function as patient advocates and educate them about antimicrobial resistance and proper use of antimicrobials. Findings reveal that nurses who are allowed to prescribe antibiotics should follow strict sensible antibiotic use guidelines and those nurses who are allowed only to administer antibiotics should get involved in antimicrobial management.</p>	
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# TABLE OF CONTENTS

<b>FOREWORD</b> .....	<b>5</b>
<b>1 INTRODUCTION</b> .....	<b>6</b>
<b>2 BACKGROUND</b> .....	<b>8</b>
2.1 Antimicrobial resistance .....	8
2.2 How bacteria become resistant? .....	10
2.3 Causes of antimicrobial resistance.....	10
2.4 Consequences of antimicrobial resistance:.....	11
2.5 Antimicrobial stewardship.....	11
2.6 Antimicrobial resistance and nurse’s role.....	12
<b>3 THEORETICAL FRAMEWORK</b> .....	<b>13</b>
<b>4 AIMS AND RESEARCH QUESTIONS</b> .....	<b>15</b>
<b>5 METHODOLOGY</b> .....	<b>17</b>
5.1 Data collection .....	17
5.2 Inclusion and exclusion criteria .....	18
5.3 A table showing how articles were chosen from electronic sources .....	18
5.4 Data analysis .....	19
5.5 Articles used for literature review .....	21
5.6 Ethical aspects .....	23
<b>6 RESULTS</b> .....	<b>24</b>
6.1 Why tackle antimicrobial resistance? .....	25
6.2 Nurses role and antimicrobial resistance .....	26
<b>7 DISCUSSION</b> .....	<b>31</b>
7.1 Tackling antimicrobial resistance .....	31
7.2 Antimicrobial resistance and nurse’s role, findings related to theoretical framework .....	32
6.3 How effective antimicrobial stewardship programs have been so far? .....	34
<b>8 CONCLUSION</b> .....	<b>35</b>
8.1 Strengths, limitations and recommendations .....	36
<b>REFERENCES</b> .....	<b>38</b>

Figure 1.....	10
Figure 2.....	15
Figure 3.....	21
Table 1.....	18
Table 2.....	21

## **FOREWORD**

This thesis is dedicated to all the patients whose health is truly important to me and all healthcare professionals. With this thesis I am hoping to raise global awareness of anti-microbial resistance and contribute to promoting health within our society.

I would like to thank my parents who have supported me during my studies. My heart is with them always. Also I would like to say big thanks to the staff in Isaac T. Robillo Memorial Hospital, Davao city, Philippines. You are all amazing and taught me so much during my practical training. Salamat!

I would also like to take a chance and thank all the teachers in Arcada for being supportive and patient, without your help and kindness I wouldn't stand today where I do now.

And finally, I would like to thank all of my friends and fellow nursing students. You are all doing a great and noble job, keep it up and always believe in yourselves.

## 1 INTRODUCTION

*"We currently have effective medicines to cure almost every major infectious disease, but we risk losing these valuable drugs and our opportunity to eventually control many infectious diseases because of increasing antimicrobial resistance." (Gro Harlem Brundtland)*

The discovery of penicillin by Alexander Fleming in 1928 started the golden era of antibiotics. People strongly believed that they have won the war against microbes but Fleming predicted that antibiotic misuse could lead to resistance and he was right (Trossman, 2014). According to World Health Organization, antimicrobial resistance is existent in all parts of the world and new resistant bacteria develop and spread globally. Due to antimicrobial resistance, best available treatments for bacterial infections fail due to bacteria becoming resistant to antibiotics (WHO, 2015). Patients, suffering from an infection caused by drug resistant bacteria, are more prone to poor clinical outcomes and their treatments cost a lot more than for patients infected with non-resistant bacteria. Antimicrobial resistance is economical and clinical burden to healthcare as it requires prolonged hospital stays, extra doctors' visits and also leads to possible long-term disabilities. In United States alone, from approximately 2 million of all healthcare acquired infections, 99,000 will result in deaths due to antimicrobial resistant pathogens (Ventola, 2015). In European Union countries, every year approximately 400,000 patients will acquire an infection with a resistant strain and 25,000 of them will die. Resistance to drugs costs EU an additional 1.5 billion euros of extra healthcare related annual spending (WHO, 2016).

Antimicrobial resistance is a huge threat to public health and it requires action by government and society (WHO, 2015). If antimicrobial resistance will not be tackled, treatments of life-threatening bacterial infections may become impossible (Daniels, 2012). Nurses' contribution to tackling antimicrobial resistance followed by possible development of new drugs brings a hope in preventing emerging drug-resistant organisms (Ladenheim *et al*, 2013).

In this thesis author investigates what is antimicrobial resistance and what actions can be taken by nurses in order to contribute to minimizing the global spread of antimicrobial resistance. Author believes that this thesis will raise awareness among nurses about antimicrobial resistance. Also nurses can use this thesis as a guide on what steps to take towards antimicrobial stewardship. This thesis is commissioned by Isaac T. Robillo Memorial Hospital in Davao city, Philippines.

## **2 BACKGROUND**

Antibiotics are medicines used to treat diseases such as (but not limited to) tuberculosis, urinary tract infections, acne, bronchitis and pneumonia. Antibiotics are effective only on infections and illnesses caused by bacteria as they block vital processes in bacteria, kill the bacteria and in that way help body's immune system to fight bacterial infections (WHO, 2015). All antibiotics are antimicrobials (Michigan state university, 2011). Different types of antibiotics are available to treat various conditions: penicillin (mostly used to treat skin infections, chest and urinary tract infections), cephalosporins (used to treat various infections but are particularly used for septicaemia and meningitis), aminoglycosides (used to treat very serious infections and usually are given as intramuscular injection), tetracyclines (commonly used to treat acne and rosacea), macrolides (used to treat lung and chest infections), fluoroquinolones (used for treating variety of infections (NHS, 2016).

It is important to take the whole course of antibiotics prescribed and even if a person starts feeling better after a few days of taking antibiotics, it does not mean that the infection has cleared up completely and antibiotics must be taken only when really needed (PubMed, 2013). Failure in finishing the whole course of prescribed antibiotics can result in need to restart the treatment later and cause the spread of antibiotic-resistant substances among harmful bacteria (Mayo Clinic, 2014).

### **2.1 Antimicrobial resistance**

Antibiotic resistance is related specifically to common bacteria's resistance to antibiotics. Antimicrobial resistance is a wider term which combines bacteria's and other microbes', parasites', viruses' and fungi resistance to drugs (WHO, 2015). In this thesis, both terms "antimicrobial resistance" and "antibiotic resistance" are taken into consideration and mentioned.



Antimicrobial resistance is microorganism's resistance to antimicrobial drug to which it was originally responsive. Antibiotic use is considered as the main factor of antibiotic resistance (Ladenheim *et al*, 2013). Statistics show that between years 2000-2010 the usage of antibiotics by humans has increased by 30 per cent. About 80 per cent of all antibiotics are being used within community settings which means that the usage is very often left unchecked and availed without prescriptions. In developing countries, resistance is present due to a lack of basic healthcare and public health infrastructure, also limited access to clean drinking water and a huge deficit of trained healthcare providers. Another factor contributing to spreading resistance is non-therapeutic antibiotic use in animals, where antibiotics are being administered to pigs, cows and chickens in order to promote their growth and prevent possible infections. It is expected that the use of antibiotics in animals will increase up to 67 per cent until 2030 (Laxminaryan, 2016). Antimicrobial resistance results in growing numbers of drug resistant bacteria that cause common infections such as pneumonia, urinary tract infections and bloodstream infections. High numbers of hospital acquired infections are caused by resistant bacteria such as MRSA (*Staphylococcus aureus*). Statistics reveal that treatment failures for gonorrhoea have been reported from 10 countries and there is a possibility for gonorrhoea to become untreatable soon. 480 000 cases of multidrug-resistant tuberculosis have been reported in 2013. Multidrug resistant tuberculosis takes much longer to treat than tuberculosis caused by non-resistant bacteria (WHO, 2015).

In order to assess clinicians' perceptions about antimicrobial resistance, a systematic review was conducted. Most clinicians (69 per cent) have heard about antimicrobial resistance and 98 per cent thought it was serious. The percentage who believed that resistance was a problem from their practise was smaller than the percentage that believed it was a problem globally or nationally. Most clinicians claimed that excessive use of antibiotics and patients' non-adherence caused resistance. The results also show that most clinicians knew about methods in reducing antibiotic resistance but they attributed this responsibility for patients, other countries and healthcare settings:" Resistance was considered a low priority and a distant consequence of antibiotic prescribing. Clinicians believe antibiotic resistance is a serious problem, but think it is caused by others" (McCullough *et al*, 2015).

## 2.2 How bacteria become resistant?

Each time a new antibiotic is used extensively, a small amount of bacterial organisms manage to become resistant to the drug and those bacterial organisms develop genome mutations or resistant genes. These resistant bacteria multiply and then create a population of organisms resistant to antibiotics. This is how new strains of bacteria resistant to existent antibiotics develop and they are called superbugs (Capriotti, 2007).

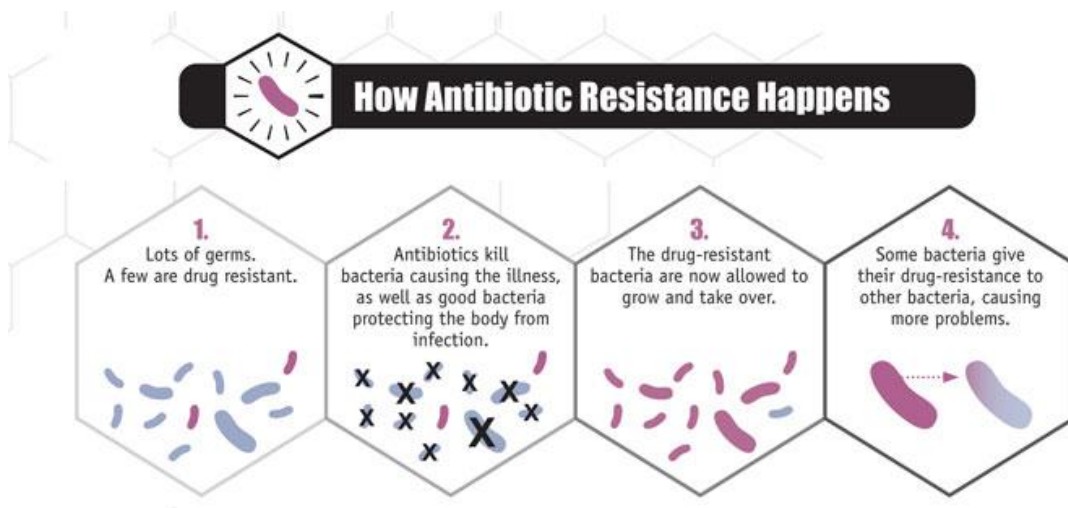


Figure 1 CDC Get Smart: Know When Antibiotics Work (CDC, 2015).

## 2.3 Causes of antimicrobial resistance

The main cause of antimicrobial resistance is misuse and abuse of antibiotics. Antibiotics are very often prescribed to treat viral infections where antibiotics have no power and it just encourages the growth of resistance bacteria and contributes to the spread of antimicrobial resistance. Many patients do not use the whole course of antibiotics prescribed or use antibiotics for long-time, prophylactically and also are able to purchase antibiotics

over the counter. Research and development have failed to develop new antibiotics that would fight the antibiotic-resistant microorganisms (Faoagali, 2014).

#### **2.4 Consequences of antimicrobial resistance:**

Antimicrobial resistance leads to increased mortality and morbidity among patients and is costly for healthcare systems and the costs are constantly growing. The number of useful drugs for future generations of patients have reduced significantly (McGowan, 2004). Because of spreading antibiotic resistance, major infectious diseases have not yet been prevailed (Spellberg *et al*, 2008).

#### **2.5 Antimicrobial stewardship**

Although there is no internationally agreed term on antimicrobial stewardship, The Australian Commission on Safety and Quality in Health care describes the term as an effective approach to improving antimicrobial use in hospitals (Ladenheim *et al*, 2013). The main goal of antimicrobial stewardship is to encourage cautious use of antimicrobials. Three main aims of antimicrobial stewardship are:

- To find the most suitable treatment for patients
- Avoid unnecessary use and misuse of antimicrobials
- Contribute to minimizing antimicrobial resistance within community settings (Ladenheim *et al*, 2013).

## 2.6 Antimicrobial resistance and nurse's role

A survey carried out by Scottish Antimicrobial Prescribing Group (SAPG) assessed nurses' and midwives' knowledge on antibiotics, antimicrobial resistance and stewardship. 79 per cent of all respondents have been qualified for 10 years or more. Survey results reveal that 49 per cent of participants rated their knowledge about antibiotics as average, 15 per cent stated their knowledge was lower than average and 36 per cent claimed their knowledge on antibiotics to be good. Regarding antimicrobial resistance, only 191 out of 887 respondents stated to have heard about antimicrobial resistance. Survey results reveal that Scottish nurses' understanding about antimicrobial stewardship is low, only 22 per cent of respondents claimed to have heard about stewardship; however 74 per cent of participants believed that education about tackling antimicrobial resistance was essential before registering as a licenced nurse (NHS, 2014).

According to American Nurses Association (ANA), nursing is a widely described profession and, apart from providing medical care to patients, nurses are also responsible for providing health promotion, education and coordinating patient care in collaboration with a wide range of other healthcare professionals (ANA, 2016). In the British Nursing and Midwifery Council (NMC) Professional Conduct it is stated that one of the values all nurses are accountable for is acting to identify and minimising the risk to patients (Kozier *et al*, 2008). One of the ways to fulfil these nursing profession values is participating in antimicrobial stewardship. Antimicrobial stewardship means tackling antimicrobial resistance by ensuring proper use of antimicrobials and promoting the best possible drug therapy, dose, duration and route of administration. Antimicrobial stewardship aims to achieve best possible clinical outcomes related to growing resistance, minimize healthcare related costs and adverse events as well as restrict the development of strains resistant to antimicrobials (IDSA, 2016).

According to Roca *et al*, antimicrobial stewardship programmes should be compulsory and they should include educational sessions, clinical rounds, multidisciplinary stewardship teams, consultant services and review of antibiotic perspective (Roca *et al*, 2015).

Nurses are in an ideal position in contributing to minimizing antimicrobial resistance by undertaking a role in antimicrobial stewardship as they can monitor, influence, guide and encourage the implementation of responsible antibiotic use. Nurses have an important role in regulating the use of antibiotics because they know how long treatments last, medication administration routes and timings, prescribing and monitoring of drugs. Nurses that are aware and recognise the importance of antimicrobial resistance can also contribute in reducing medication prescription errors by encouraging compliance with correct prescribing guidelines (Daniels, 2012).

### **3 THEORETICAL FRAMEWORK**

According to Swanson, theories are created in order to understand and explain a certain phenomenon and also broaden the existing knowledge within the already set boundaries. Theoretical framework presents a theory which explains why research dilemma beneath study exists (Swanson, 2013).

There are two theoretical frameworks used for this study. First one is Mark White's construct for public health nursing. Mark Salmon White described public health as "a societal effort to protect, promote and restore the health of people and public health nursing as focused on achieving and maintaining public health." (Nursing Theories, 2013) According to Karen & Sheryn, our healthcare has been modelled to serve mainly individual people but very little focus has been given to the importance of well-being of the society (Karen & Sheryn, 2013). On the contrary, Mark White's model focuses on promoting and maintaining not only individual's but public's health. Values based on public's good are emphasized in this model: assessing, diagnosing, planning, and evaluating. Construct describes three categories of interventions: education, engineering and enforcement. Education is used for prevention, engineering is altering the environment in manner that protects people and enforcement is putting action into a place. The strategy is focused on serving public health (Karen & Sheryn, 2013).

The second theoretical framework is Tannahill's health promotion model. This model focuses on three main areas: health education, prevention and protection (Kozier *et al*, 2008). Health education means that knowledge and point of views are impacted through communication and this leads to increased well-being and prevention of diseases. Prevention includes medical interventions that are taken in order to reduce and avoid illnesses. Health protection defines protecting population's health through legislative, social or financial means (Naidoo & Wills, 2016).

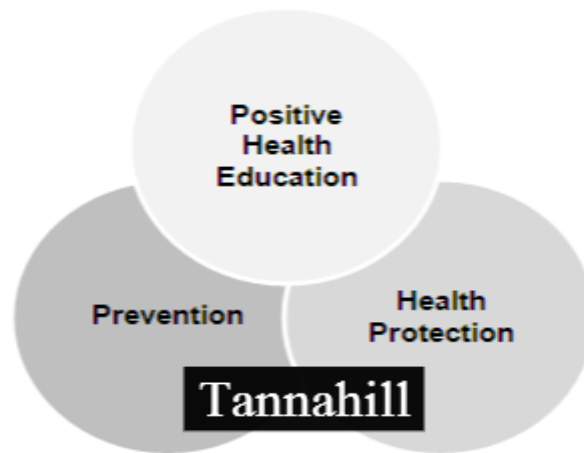


Figure 2: Tannahill's health promotion model (Queen's University Belfast, 2009).

According to Kozier, health promotion gives nurses an opportunity to strengthen their profession's influence through assisting individuals and community to change long-established health habits. Nurses can promote health through educating, assisting and facilitating (Kozier *et al*, 2008). Both of theoretical frameworks used in this study focus on health promotion and public's good. These frameworks suit this study as the main aim of this thesis is to explore how nurses can promote health and contribute to public well-being by tackling antimicrobial resistance.

## **4 AIMS AND RESEARCH QUESTIONS**

The main aim and purpose of this study is to investigate how nurses can contribute in minimizing antimicrobial resistance and also raise awareness among nurses about antimicrobial resistance. Research questions:

1. What is antimicrobial resistance and why it should be tackled?
2. How can nurses contribute to minimizing antimicrobial resistance?



## **5 METHODOLOGY**

This study is a qualitative research, literature review. According to Ormston *et al*, qualitative research is a very broad term and there can be various methods and approaches to it. But generally, qualitative research has a naturalistic, interpretative approach that explores a certain phenomenon internally (Ormston et al, 2014). Literature review is a systematic investigation of knowledge that is available on a certain topic. It is written using peer-reviewed articles and sources which are designed to be as unbiased and objective as possible. It is essential for literature review to be unbiased and the information given must be accurate and uninfluenced by somebody's opinion or personal interests (Dawidowicz, 2010). Professionals use literature reviews as reports in order to keep up to date in a current field. For scholars, the depth and breadth of the literature review emphasizes the credibility of the writer in his or her field. Literature reviews also provide a solid background for a research paper's investigation. Comprehensive knowledge of the literature of the field is essential to most research papers (The University of North Carolina Writing Centre, 2010-2014).

A literature review method was chosen for this study as 12 scientific articles were reviewed and knowledge gathered from the articles is presented in this work. This thesis is a review of existing literature about chosen topic and the main goal is to raise global awareness about antimicrobial resistance and nurse's role and to encourage further research about the topic.

### **5.1 Data collection**

Data for this thesis was collected from articles retrieved from Arcada library academic databases EBSCO, Ovid, Sage journals, ScienceDirect also from Google Scholar and Google search engines. The main search terms used were: "antimicrobial resistance", "antimicrobial resistance" AND "nurse's role", "antibiotic resistance", "antimicrobial stewardship" AND "nurse's role", "antimicrobial resistance" AND "interventions".

## 5.2 Inclusion and exclusion criteria

Below are mentioned inclusion and exclusion criteria that were essential when conducting the article search from electronic databases:

- Inclusion criteria: scientific articles from academic databases and electronic sources, full articles, published between years 2006-2016, articles must be written in English, free of charge.
- Exclusion criteria: articles with abstracts only.

## 5.3 A table showing how articles were chosen from electronic sources

Below is a table showing which databases were used and what search words were entered and how many hits the search resulted into.

*Table 1: Summary of databases, search terms and hits*

Database	Search terms	Number of hits	Chosen articles
EBSCO	“Antimicrobial stewardship”	236	2
	“Nurses role in health promotion” AND “antibiotic resistance”	36	3
OVID	“Superbugs”	67	1
	“Antibiotic resistance” AND “nurses role”	8	1

Sage journals	“Antimicrobial stewardship”	110	1
ScienceDirect	“Antimicrobial resistance” AND “interventions”	16,643	1
Google scholar	“Antimicrobial resistance and nurse’s role” “Nurses role in antimicrobial stewardship”	17 300 110 000	1 1
Google	“Countries where nurses are allowed to prescribe antibiotics”	529 000	1

#### 5.4 Data analysis

The articles are analysed using inductive approach. Inductive reasoning is used when a writer begins with specific observations and measures but ends the study with formulated hypotheses and other patterns. Within this approach, writer gradually develops

general conclusions and theories for the study (Trochim, 2006). Inductive approach in qualitative research means that data analysis is done through reading raw data multiple times and data analysis is guided by evaluation objectives that identify the topics to be explored. Evaluation objectives influence the findings of the research but those findings still directly arise from the analysis of raw data and not from biased expectations or models. Inductive open coding process is used in data analysis. This means that author starts reading the articles and then creates new segments where the relevant information is gathered together according to a certain category that has emerged from the findings (Thomas, 2006). In this thesis, the research objectives are research questions: 1) What is antimicrobial resistance and why it should be tackled 2) How can nurses contribute to minimizing antimicrobial resistance? This thesis is not biased by any hypotheses or existing beliefs prior to data collection and analysis process. This research aims to find new data and phenomena. The author starts data collection by searching for articles that provide answers to research questions. By reading the selected articles author then gathers the information in separate segments in order to create different categories of information that has emerged from the articles. Below, figure 3 illustrates the conceptual representation of iterative process of qualitative analysis with an inductive approach. It demonstrates the data analysis using inductive approach. There are 7 steps described: firstly author gets familiar with the data, then categories are constructed and grouped together. Author constantly compares the categories and keeps collecting new data. Then author develops explanations and constructs theories. Lastly author can describe the findings (Kohn & Kristiaens, 2009).

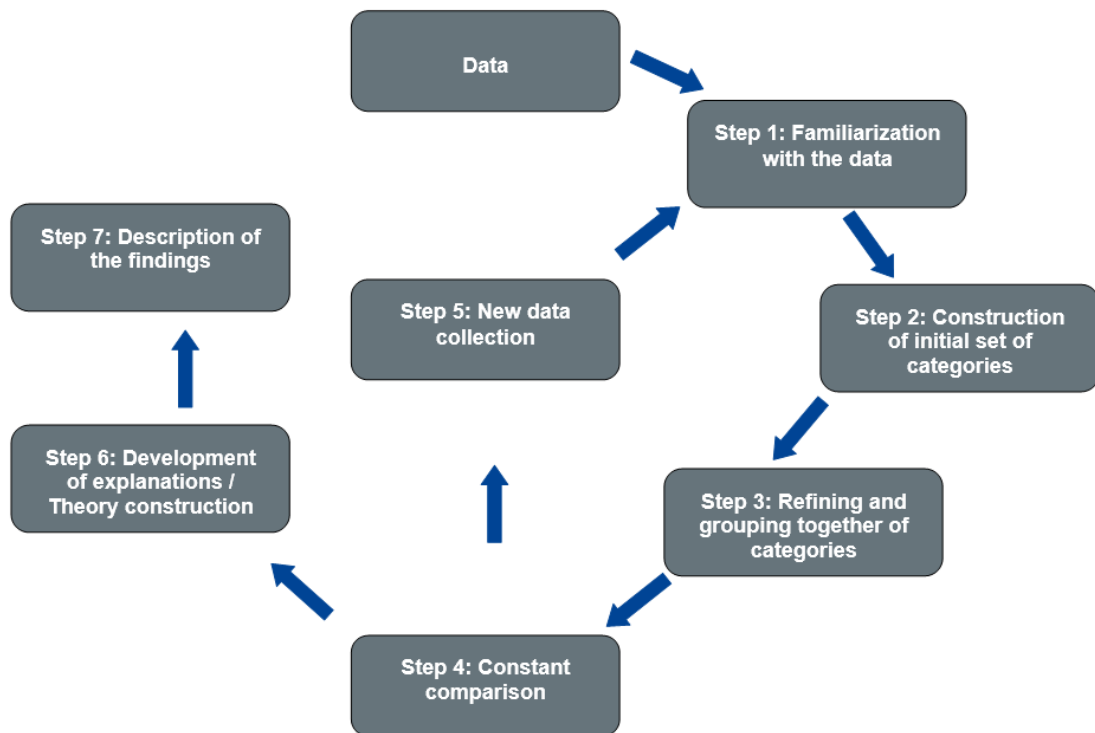


Figure 3 Conceptual representation of iterative process of qualitative analysis with an inductive approach (Kohn & Kristiaens, 2009).

### 5.5 Articles used for literature review

In this table articles that were used for the literature review are presented as well as main objectives of each article.

Table 2: Articles used for the literature review

Author	Article	Journal and year	Objectives
Article 1 Aryee & Price	Antimicrobial stewardship-can we afford to do without it?	British Journal of Clinical Pharmacology, 2015	Antimicrobial stewardship programmes and their effectiveness
Article 2 Capriotti	Resistant “superbugs” create need for novel antibiotics	Dermatology nursing, 2007	Importance of antimicrobial stewardship

Article 3 Edwards <i>et al</i>	Covering more territory to fight resistance: considering nurse's role in antimicrobial stewardship	Journal of Infection Prevention, 2011	Exploring potential contributions nurses can make in fighting antimicrobial resistance
Article 4 File <i>et al</i>	Antimicrobial stewardship: importance for patient and public health	Clinical Infectious Diseases, 2014	Importance of antimicrobial stewardship
Article 5 Gallagher	Cutting antibiotic use	Nursing standard, 2014	Nurses involvement in initiatives reducing antimicrobial resistance
Article 6 Ladenheim <i>et al</i>	Antimicrobial stewardship: the role of the nurse	Nursing standard, 2013	This article focuses on antibiotic misuse and defines the role of the nurse in managing antibiotic therapy through antimicrobial stewardship
Article 7 Kroezen <i>et al</i>	Nurse prescribing of medicines in western European and Anglo-Saxon countries: a systematic review of the literature	BMC Health services research, 2011	To get an insight in professional literature describing in what ways nurse prescribing has been introduced and implemented in Western and Anglo-Saxon countries
Article 8 Roca <i>et al</i>	The global threat of antimicrobial resistance: science for interventions	Journal of New microbes and New infections, 2015	Antimicrobial resistance, multi-drug resistant bacteria and possible interventions
Article 9 Spellberg	The epidemic of antibiotic-resistant infections: a call to action for the medical com-	Oxford Journals, 2008	Antimicrobial resistance, what causes it, possible interventions

	munity from the infectious diseases society of America		
Article 10 Storr & Gallagher	Cutting levels of antimicrobial resistance	Nursing Times, 2012	Why antimicrobial resistance is a serious issue and how nurses can contribute to reducing the spread of antimicrobial resistance
Article 11 Trossman	The war on superbugs	American nurse, 2014	Problem of antibiotic-resistant infections and nurse's role in responsible antibiotic use
Article 12 Weber	Update on antimicrobial resistance	Journal of Dermatology Nursing, 2006	Describe the causes of antibiotic resistance and present ways of combating antibiotic resistance

## 5.6 Ethical aspects

This is a qualitative research, literature review and this work is written according to Arcada writing guidelines. The core element of this study is the strict compliance with ethical aspects in research. According to Resnik, the main reason why it is important to follow ethical norms in research is the aim of the research itself-to provide readers with accurate knowledge, trustworthy data and honest findings, that is why falsification and plagiarism must be avoided in order to present correct without errors and misinterpretation. Some of the main ethical principles important for this study include:

- Honesty. It is essential to report data, results and procedures honestly. Data should not be fabricated, falsified or misrepresented. Deceiving of colleagues or public is not allowed
- Objectivity: it is important for the author to avoid bias in experimental design, data analysis, data interpretation, peer review, personnel decisions, grant writing, expert testimony, and other aspects of research where objectivity is expected or required. Personal interests that may affect research should be disclosed
- Carefulness: avoiding careless errors and examining own and peers' work critically is essential. It is important to keep good records of research activities, such as data collection, research design, and correspondence with agencies or journals
- Openness: sharing data, results, ideas, tools, resources and being open to criticism and new ideas
- Respect for Intellectual Property: honoring patents, copyrights and other forms of intellectual property. Not plagiarizing
- Confidentiality: protecting confidential communications, personal records, and patient records
- Responsible publication: avoiding wasteful and duplicative publication (Resnik, 2015).



## 6 RESULTS

### 6.1 Why tackle antimicrobial resistance?

Antimicrobial resistance is a global threat that requires actions focusing on the origins of antimicrobial resistance. Inappropriate antibiotic use is one of the main factors that determined speedy development of antibiotic resistance. Incorrect prescribing of antimicrobials, fact that antibiotics are available over the counter and self-medication show that society is lacking general awareness about antimicrobial resistance and the risks it poses to the public (Roca *et al*, 2015).

According to Aryee & Price, the main aim of fighting antimicrobial resistance is to achieve best possible clinical results related to antimicrobial practise including minimised toxicity and adverse events and also reduce the costs related to irrelevant antimicrobial use (Aryee & Price, 2015).

Antimicrobial resistance is growing rapidly within community and clinical settings. Pharmaceutical industry, on the opposite, finds it hard to keep up with the growing resistance and that is why no new antibiotics have been discovered in United States for a long time. The latest antibiotics discovered are usually made from existing drugs and bacteria become resistant to the drugs very fast (Capriotti, 2007). Available effective antibiotics are essential in maintaining public health and facilitating numerous medical procedures. Effective antibiotics are critical in medical treatments for patients suffering from traumas and injuries as well as patients that require intensive care and medical interventions such as urinary catheters and mechanical ventilation. Surprisingly, treatments with effective antibiotics have increased the amount of resistant microbes that require treatments with newer, more effective antibiotics. And as population of United States is aging, the amount of patients in critical care (such as those requiring catheters, ventilators, aggressive cancer chemotherapy, surgeries) will also increase and treatment success will all depend on a fact if we will still have effective antibiotics. This is why resistance is a huge problem and it is essential for healthcare professionals to take lead and contribute to minimizing antimicrobial resistance and the time for action is now (Spellberg *et al*, 2008). Statistics reveal that since 1970 no new antimicrobials have

been developed as it is a very costly process. It requires approximately 500 billion dollars to invent a new drug and also takes around 10 to 20 years to do so (Weber, 2006).

Previous studies have shown the effectiveness of implemented antimicrobial stewardship programs within healthcare settings and the outcomes are outstanding: improvement in patient outcomes and reduced adverse events, lower admission rates and also reduced antimicrobial resistance. Previously, antimicrobial resistance programs were hard to implement due to high costs and saving money was the first priority to health care institutions. But according to Infectious Diseases Society of America, the main focus of antimicrobial stewardship programs is to improve clinical outcomes and minimize consequences caused by antimicrobial resistance. According to IDSA, the main focus of antimicrobial stewardship is not the cost; it is the improved quality of treatments (File *et al*, 2014).

## 6.2 Nurses role and antimicrobial resistance

Below the results of possible nursing interventions for tackling antimicrobial resistance are presented:

- **Antimicrobial management.** According to Edwards *et al*, prescribing of antimicrobials is mostly delegated to doctors as they have more expertise in medicines but the reality very often is that antibiotics are being prescribed by junior doctors who are working in different areas and also need assistance from senior doctors in order to assign a proper treatment for a patient. Due to the high rotation of junior doctors within a ward, the information and knowledge about each patient's individual treatment is very often lost. This is why nurses who are the least transient medical professionals should be involved in antimicrobial management as they spend most of the time with a patient and they are in ideal position to collaborate with physicians and pharmacists due to the information they behold (Edwards *et al*, 2011). Nurses are in a key position in contributing to multidisciplinary management of antibiotics

as they work at different levels within health care settings and also are main patient's carers who are always present. Nurses review medication charts and administer medications so they can directly contribute towards antimicrobial stewardship (Edwards *et al*, 2011).

- **Senior nurses' role.** According to Ladenheim *et al*, senior nurses play a huge role in hospital's antimicrobial resistance management. The author states that senior nurses must assure that local antimicrobial stewardship guidelines are documented and are up to date. Author also states that it is essential that those guidelines are regularly reviewed. The main focus should be on reviewing and reporting hospital's antibiotic data, which mean keeping a track of usage of antimicrobials like cephalosporins, carbapenems and quinolones. Ladenheim highlights that non-compliance with antimicrobial stewardship guidelines should be spotted as well as prescribing issues (Ladenheim *et al*, 2013).
- **Nurses and antimicrobial prescribing.** Nurses are currently allowed to prescribe medicines in the following countries: Australia, Canada, Ireland, New Zealand, Sweden, UK and USA (Kroezen *et al*, 2011). In UK, approximately 80 per cent of all antimicrobials are being prescribed by nurses within community settings (Gallagher, 2014). United Kingdom has therefore set very strict antimicrobial prescribing practises. In 2011, hospitals in Britain were asked to promote Start-Smart-Then Focus guidance issued by Department of Health. According to Start-Smart-Then-Focus guidance, the prescribing of antibiotics must be performed following good administration practises as it contributes to effective treatment. Correct route for therapy, timing of administration and knowledge of possible contraindications should be taken into account (Storr & Gallagher, 2012). This guidance focuses on infection prevention and control and its main statements are:
  - Antibiotics should be started only when bacterial infection is confirmed.
  - If bacterial infection is confirmed, antimicrobial treatment should be started immediately
  - Clinical indications, treatment duration, dose and route should be recorder in patient's drug chart and medical notes

- If it is possible, patient's cultures should be examined before prescribing antimicrobials
  - Single dose of antibiotics should be prescribed for surgical prophylaxis
  - The clinical diagnosis should be reviewed and need for antibiotics reconsidered within 48 hours of starting them
  - A clear plan of action should be developed and five steps of the action should be followed: stop, switch IV to oral, change, continue, outpatient parenteral antibiotic therapy
  - Ensuring proper documentation of patient review and decisions (Storr & Gallagher, 2012).
- 
- **Reviewing antimicrobial therapy.** In countries where nurses are not allowed to prescribe antimicrobials, they could take an opportunity and contribute while doing general ward rounds focused on reviewing antibiotic therapy. Even though nurses are not directly involved in prescribing of the medicines, they can cooperate with other health care professionals when supervising prescription decisions, reducing prescribing errors and ensuring medication compliance. If nurses were involved in antibiotic rounds, it would give an opportunity for nurses, physicians and pharmacists to carry out a quick dialogue about antimicrobial treatment, its indication and duration. Ward nurses are responsible for referring patients to outpatient antibiotic therapy instead of admitting them to hospitals as this would reduce patients length of stay in the hospital and also will decrease the risks of healthcare acquired infections and its costs, thus will allow patients to continue treatment in their own homes (Edwards *et al*, 2011).
- 
- **Communication.** A key towards successful antimicrobial management is proper communication. If health care professionals communicate effectively about antimicrobial use, it would encourage the best practise and also benefit towards patient care and reduce nurse's workload. Proper communication would also contribute to reducing the risk of healthcare acquired infections and patient morbid-

ity and mortality and also would prevent patients from prolonged stay in the hospital (Edwards *et al*, 2011). According to Trossman, proper communication is the key for nurses to successfully contribute towards minimizing antimicrobial resistance. First of all nurses should ask patients why are they on certain antibiotics and see if those antibiotics could be changed from intravenous route into oral or discontinued. Also nurses must make sure that antibiotics are stopped on time. Trossman focuses on communication between staff, that nurses have to exchange information with their colleagues about whose medication has been stopped and which patient is prescribed which drug. Trossman also highlights that it is extremely important that nurses take time and reassess every patient's need for antibiotics. According to Trossman, it is important that nurses educate each other during staff meetings about new bacteria and organisms and prepare to work together against its spread. Trossman is suggesting that nursing schools should include more information about antibiotic use, antimicrobial resistance and infection prevention and control (Trossman, 2014).

- **Patient education.** General practitioners, public health nurses and school nurses have a chance to educate the public about proper use of antimicrobials that they work only against bacteria and also teach people about hygiene practises called “catch it, bin it, and kill it (Storr & Gallagher, 2012). According to Trossman it is essential that nurses ask their patients why they are on certain antibiotics and should consider when the treatment could be discontinued or switched from intravenous to oral form. Nurses should educate their patients and be clear with them about how antibiotics work, that they are only for treating bacterial infections. Also nurses should teach their patients that it is essential to use and dispose their antibiotics properly: “Nurses must use every opportunity to increase public awareness and to act as strong advocates for their patients when it comes to proper use of antibiotics.” (Trossman, 2014)
- **Challenges.** Nurses may face challenges while trying to contribute towards antimicrobial stewardship due to the fact that nurses themselves might feel like they are not in the right position in order to participate in antimicrobial resistance

management as it is very much based on power and knowledge and nurses may feel like they do not have enough expertise (Edwards *et al*, 2011). In countries where nurses are not allowed to prescribe antibiotics, another challenge that nurses might face there is antibiotic management. Usually nurses feel like they are not competent enough to discuss about antibiotics with other healthcare team members who have more knowledge. Prescribing refers to pharmacists and physicians but nurses can be included in management which means that they observe that antimicrobials are used properly (Edwards *et al*, 2011). According to Edwards *et al* it is assumed that health professionals have time, motivation, knowledge and all the skills to initiate a change within clinical practise but these beliefs are biased: “In order to more successfully engage healthcare workers in initiatives and produce more successful outcomes, the obstacles and facilitators to changing or adopting new practice must be considered in the development and implementation of any programme.” Author also highlights that it is essential to identify clear roles of nurses and other healthcare professionals, and their responsibilities in order to have a powerful impact on antimicrobial resistance (Edwards *et al*, 2011).

## 7 DISCUSSION

### 7.1 Tackling antimicrobial resistance

The aim of this thesis was to explore the problem of antimicrobial resistance and present how nurses can contribute to minimizing it. The results have shown that antimicrobial resistance is a serious worldwide problem that results in higher healthcare costs, higher morbidity and mortality among patients and also increases the risk of adverse events and prolonged hospital stays. According to File *et al* the discovery of antimicrobials had a huge influence on global health as it helped to fight infectious diseases and also made once deadly diseases easily treatable. But eventually bacteria became resistant to most of the drugs and this is a serious health threat as it means bigger costs to healthcare and higher rates in adverse events. The crisis of antibiotic resistance means that some patients cannot be treated with any existing drugs due to bacteria's ability to mutate and survive antibiotic treatments. Antibiotic use is identified as the main aspect that can be managed within the process of minimizing antimicrobial resistance (File *et al*, 2014).

The European Society of Clinical Microbiology and Infectious Disease (ESCMID) states that more money should be devoted to the development of new medicines, immediate diagnostics and protective measures in order to avoid the progressing antimicrobial resistance crisis. Statistics show that only in Britain approximately 10,000 people die every year due to antibiotic resistance and the numbers will triple or even quadruple by year 2025. According to ESCMID president Murat Akova, the rapid increase in antimicrobial resistance in Europe and the world is putting the modern healthcare in danger. Professor Anthony Kessel, Director for International Public Health at Public Health England, said: "If ever we needed a reminder of what a public health catastrophe looks like then this has to be it." (Practise Nurse, 2015)

Statistics reveal that the development of new drugs has also been abandoned by pharmaceutical companies due to several reasons: it is hard to predict the course of resistance and therefore there is a risk in research and development investment. Another factor influencing impeded development of novel antimicrobials is complicated regulations and low profit compared to high costs of investments (Roca *et al*, 2015).

According to Laxminaryan, only strict antibiotic stewardship will lead to maintenance of antibiotic effectiveness and the most important action is to stop the misuse and over-use of antibiotics and ensure that those who truly need them have access to them. Laxminaryan states that the main problem lies deep within society's thinking that we can fight resistance if we get new medicines, but the truth is that if we also continue to misuse new medicines, it will not help (Laxminaryan, 2016).

## **7.2 Antimicrobial resistance and nurse's role, findings related to theoretical framework**

Nursing duties that are performed daily can be successfully implemented in tackling antimicrobial resistance. Nurses function as communicators, coordinators of care. They monitor patients for 24 hours, care for their safety and supervise the antibiotic therapy process. Integrating nurses into antimicrobial stewardship could lead to better health outcomes for individual patients and the public (Olans *et al*, 2015).

The findings are directly related to theoretical frameworks that were used in this study: Mark Salmon White's construct for public health nursing and Tannahill's model of health promotion. Both models focus on health education, protection and prevention. In this thesis the main aim was to explore nurse's role in tackling antimicrobial resistance and findings reveal that nurses have power to contribute to fighting resistance even though very little consideration is given to nurses as they are usually not the ones prescribing antimicrobials but the ones administering them. Findings listed below are divided in three sections as they are scope areas of both theoretical frameworks used in this study:



**Education:** According to Trossman, it is essential that nurses communicate with patients and ask them why they are on a specific antibiotic treatment and also that they cooperate with fellow healthcare professionals like doctors and pharmacists and are not afraid to discuss why certain antibiotic therapy is needed and observe when it should be discontinued. It is also important that nurses educate each other about antimicrobial resistance and nursing schools should also include more courses about antimicrobial resistance, its spread and effects on society's well-being (Trossman, 2014). One more major thing nurses can do is educate their patients about antimicrobial stewardship. All nurses should take an opportunity and educate their patients about how treatments work, that antibiotics are effective only against bacterial infections and explain about growing antimicrobial resistance. Nurses should be patients' advocates and raise public awareness about antimicrobial resistance and proper use of antibiotics (Trossman, 2014).

**Protection:** The main action would be nurse's participation in antimicrobial management which means that nurses should contribute by reviewing medication charts, treatment length, discuss with doctors if treatment should be continued or discontinued as they are the ones who spend most of the time with a patient (Edwards *et al*, 2011). In countries where nurses are allowed to prescribe antimicrobials, nurses should strictly follow guidance like Start-Smart-Then Focus which focuses on proper antibiotic use and prescribing: antibiotics should be started only if bacterial infection is confirmed, also if possible patient's cultures should be examined before prescribing antimicrobials and a clear plan of action should be developed and five steps of the action should be followed: stop, switch from intravenous route to oral, change, continue, outpatient parenteral antibiotic therapy (Storr & Gallagher, 2012).

**Prevention:** Nurses can also take a chance and contribute to infection prevention and control within a hospital setting which hugely contributes to minimizing antimicrobial resistance (Storr & Gallagher, 2012). Nurses are in an ideal position to contribute to infection prevention and control as it is needed in order to control increasing antimicrobial resistance. In order to prevent the spread of bacteria in hospitals and community healthcare centres, infection prevention and control measures must be undertaken. The main focus is to reduce the load of environmental contamination by microorganisms and

prevent their spread between people. In that way the potential for infection will be minimised. In order to ensure that nurses are promoting infection prevention and control, they must be trained before and after graduation in fundamental infection prevention and control practises (Storr & Gallagher, 2012).

According to Joan Faoagali (2014) nurses as healthcare workers should contribute towards antimicrobial stewardship in their personal lives as well. The few main steps include:

- Not requesting or using antibiotics for treatment of viral or fungal infections in personal and family care
- Using the right drug via right route for the shortest possible period of time
- Do not dispose unused antibiotics into the environment
- Using all infection prevention measures in order to decrease the risk of spread of antibiotic-resistant bacteria (Faoagali, 2014).

### **6.3 How effective antimicrobial stewardship programs have been so far?**

According to Centre for Disease Control (CDC), there are approximately 25,000 of difficile cases which result in around 14,000 deaths every year in United States. From the data collected from single studies in USA it is revealed that antimicrobial stewardship programs strongly contribute to reducing *C.difficile* cases. Antimicrobial stewardship has also proven to be successful on improving treatments of infections as the program is focused on correct antibiotic use. Previous studies have also published that antimicrobial stewardship programs helped hospitals to save around \$200 000–\$900 000 annually (File *et al*, 2014).

North Middlesex University Hospital in UK has prudent policies on antibiotic usage and uses the smallest possible amounts in order to minimize the growing antimicrobial resistance. With a particular focus on MRSA patients, hospital focuses on strict infection prevention control and encourages its staff by reminding that preventing infections is everyone's business. Hospital's data shows that the amount of bloodstream infections has dropped significantly from more than 4,450 to 920 (Dean, 2014).

## **8 CONCLUSION**

Antimicrobial resistance is a growing global threat which causes difficulties for public health and management of individual patients. Antimicrobial resistance is the main reason of increased morbidity and mortality among patients and is also responsible for additional healthcare related costs which are estimated to be 4-5 billion USA dollars per year and approximately 9 billion euros of extra annual expenses in Europe. Antimicrobial stewardship programs are being implemented in order to tackle resistance and ensure cautious antibiotic use. The main goal of these programs is to provide the most optimal antibiotic therapy by ensuring that there will be effective antimicrobials left for future generations (Aryee & Price, 2014). The following measures are distinguished as the core ones in tackling antimicrobial resistance: appropriate use of antibiotics, strict infection prevention and control in healthcare settings, raised public awareness of antimicrobial use, development of new antibiotics (Roca *et al*, 2015).

Nurses are in unique position to contribute to minimizing antimicrobial resistance by educating patients and public about antimicrobial resistance. It is essential to reduce the need for antibiotics and reduce their overall use which will then allow current antibiotics to stay effective (Gallagher, 2014). Nurse's role is vital in ensuring that patients get the most suitable therapy and that antibiotics are prescribed and administered sensibly.

### **8.1 Strengths, limitations and recommendations**

The aim of this thesis was to investigate the importance of antimicrobial resistance crisis and also explore nurse's role in contributing to minimizing it. Overall, research process went very smoothly as proper literature about the topic was found and a lot of useful scientific knowledge was produced. The knowledge gathered in this thesis is very practical as it will guide present and future nurses on what steps to take in order to tackle antimicrobial resistance. This thesis could also be used as a teaching material and included in hospital staff guidance books or nursing schools' lectures content.

The choice of articles about nurse's role in contributing to minimizing antimicrobial resistance was quite limited as not so much research has been done so far on this topic but the literature found was very informative and definitely contains relevant information.

Data quality was very good as all of the articles were from scientific journals and the sources were reliable.

As a recommendation for the future, more research could be done on this topic as the resistance crisis will continue to grow and hospitals and general public will need more knowledge on how to tackle the resistance. It is important to remember that health protection is everyone's business and we should all contribute to the well-being of the society we live in.

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