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**The American University in Cairo**

**School of Global Affairs and Public Policy**

**TO WHAT EXTENT WORLD HEALTH ORGANIZATION'S POLICIES OF  
ANTIMICROBIAL RESISTANCE ARE IMPLEMENTED IN EGYPTIAN HOSPITALS**

**A Thesis submitted to the**

**Public Policy and Administration Department**

**in partial fulfillment of the requirements for the degree of**

**Master of Public Administration**

**By**

**Amira Farouk Ahmed Hussein**

**Spring**

**2019**

## **Acknowledgement**

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*Amira Farouk Ahmed Hussein*

## **ABSTRACT**

Antimicrobial resistance is a major public health problem. In the Egyptian hospitals the problem was discovered since 2006; however, seven years ago, this problem drew the attention to be one of a major risk factors worldwide and in the Egyptian hospitals as well. International organizations, such as World Health Organization (WHO) tried to find different solutions to prevent transmission of these communicable diseases from country to another by setting different guidelines and standards to be followed by countries. The case is to assess the barriers to implementation of objectives and guidelines of WHO in one of the biggest public Egyptian hospitals, in order to have enough knowledge and gather information about the current situation in Egypt. In order to fulfill these objectives, case study from a large public hospital was extensively studied through qualitative research methods including interviews and observational studies. Findings of the current research are most relevant to public hospitals which serve a huge sector in developing countries. Behavioral factors such as weak managerial support, lack of communication between healthcare departments, absent standards and guidelines for diagnosis and treatment, and subjective decisions in managing patients' cases are among the major factors contributing to the problem. Non behavioral factors such as inadequate infrastructure and poor resources are also existing.

The results of the research give substantial contribution in understanding and identifying the behavioral causes of prevalence of multidrug resistance (MDR) problem in Egypt and shed light on the possible solutions.

Key words: WHO, behavioral aspect, antimicrobial policies, MDR.

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## **Chapter One: Introduction**

Antimicrobials are medicines which eliminate different pathogens causing infections, such as bacteria, viruses and parasites (Li et al, 2012). The nastiest microorganisms are the bacterial infections which are treated by antimicrobials named antibiotics. Other antimicrobials which combat viral and parasitic diseases, such as HIV and malaria are named antivirals and anti-parasitic (World Health Organization, 2016). Since the first discovery of antibiotics, they have saved millions of lives; this started 70 years ago (CDC, 2018).

Antimicrobial resistance (AMR) occurs when pathogens acquire new traits and new genes that enable them to prevent the action of antimicrobials (CDC, 2019). Thus, People or animals who are infected with resistant pathogens will suffer infections that are not responding to antibiotics. Furthermore, the bacteria will be more aggressive; it will survive, and the patients get sicker and may die (Tadesse et al, 2017). These resistant pathogens have the ability to transfer from one patient to another; moreover, have the ability to transfer the resistance from one bacterium to another; thus, the cost of medical care rises, and disease spreads nationally and internationally (Santajit, 2016- Huddleston, 2014). AMR is on the rise and currently responsible for more than 700,000 deaths per year worldwide (Roca et al, 2015). According to the World Bank 2017 (<http://www.worldbank.org/en/topic/health/publication/drug-resistant-infections-a-threat-to-our-economic-future>), if no strong measures are taken to prevent the progress, AMR will cost approximately 10 million lives by 2050 worldwide in addition to about US\$100 trillion per year extra expenses which is more than cancer and diabetes burden combined (Scarafilo, 2016).

## **1.1 Antimicrobial resistance is a global problem**

AMR is a global problem which require to apply the concept of “one health”; every country irrespective of its level of income and development should be concerned about the problem as resistant pathogens do not respect borders (Exner, 2017; WHO, 2016).

In recent decades, it is estimated that with every misuse of the antimicrobials either in the dosing, frequency or timing, antimicrobial drugs are rapidly losing their effectiveness in both developing and developed countries, and this foster the opportunity for AMR to flourish (Sefton, 2002).

However, rigorous management can limit the risks. As a result, people may face a reversal of the public-health gains of the past century, and the economic growth if this trend continues (Allen, 2014). To contain the problem globally and nationally, the world health organization (WHO) set global action plan (GAP) in 2015 with definite goals to be followed by countries. Each country should set its strategic actions to fulfill the goals and ensure sustainability of actions (Mendelson et al, 2016).

## **1.2 RESEARCH OBJECTIVES**

This research is intended to investigate the current behaviors and actions done by healthcare workers which affect antimicrobial resistance and barriers to implementation of the global action plan (GAP) in public hospitals in Egypt. Another aspect of the research is to understand whether healthcare workers in Egypt are aware of the problem and of WHO international plans for AMR. The research also will try to reach some characteristics of the needed reform and the impeding factors.

## **1.3 Conceptual framework:**

*A conceptual framework* definition is a chain of linked concepts which when analyzed it offers the procedure required to build the frameworks based on the grounded theory method (Jabareen, 2009). Analysis of conceptual framework has many benefits including

its flexibility, capacity to modify and understanding instead of predicating (Jabareen, 2008).

Conceptual frameworks analysis offers the knowledge of know-how and plays fundamental epistemological role to understand the difference between beliefs and facts. It also explains the knowledge of the way things are in real existence. (Finney & Corbett, 2007).

Despite the importance and relation of pharmaceuticals with social and political science, there has been a noticeable lack of input of social sciences in setting policies on how to use the pharmaceuticals (Smith, 2015). This engagement represents the effective mean to address the problem of AMR and to contain the risks of the problem (Cabral, 2015).

There is great trend to learn from the considerable work of social sciences, so as to provide a collective and broader conceptual map through which effective strategies to tackle AMR could be created (Cleary, 2016).

In this thesis the conceptual framework can be perceived by dividing the sectors of the problem to private clinics which are managed by owners and depends on dispensing antibiotics from pharmacies and pharmacies which are responsible for dispensing antibiotics to the community. The second section is the public hospitals which are managed by the government and its related departments including infection control and stewardship departments. The two sectors are under the umbrella and existing in the community and are affecting each other. This research will tackle the public hospitals part as it serves huge sector in the community.

Figure 1: Conceptual framework (WHO, 2006).



#### **1.4 RESEARCH QUESTIONS:**

Based on the previous objectives, the research questions which are proposed could be formulated as follows:

- To what extent the WHO international policies of AMR are implemented in the Egyptian hospitals? This question will examine the process, tools, monitoring and evaluation used by healthcare workers to apply the standards of WHO.
- Are health care workers aware of the problem? This question will give an idea about the importance of the issue to healthcare workers.

- Are health care workers aware of the WHO policy for AMR? This will give an idea about the effectiveness of WHO in local community and whether health care workers know the WHO or not.
- What prevent them from implementing the policy? This question will help to understand the different barriers in different communities especially the behavioral barriers.

### **1.5 Research outline**

The present research is divided into five chapters. The first chapter contains the introduction which gives a glance about the problem of antimicrobial resistance worldwide, role of international organizations and countries to contain the problem. Research objectives, research questions and conceptual framework are also presented in the introduction. Chapter two is the literature review which tackles the problem and its health, economical and developmental consequences; in addition, a detailed history of the emergence of the problem in Egypt starting 1999 till now and the actions that were taken in Egypt till now. The different qualitative methodologies and SWOT analysis are clearly discussed in the third chapter. Chapter four gives an analysis to the findings and discussion of the research. Finally, chapter five provides the conclusion and recommendations of the study.

## Chapter Two: Literature Review

The literature review will cover the following six points in details

- The problem of Antimicrobial resistance
- The history of the problem
- The extent of the problem
- The consequences of Antimicrobial resistance on countries
- The status of Antimicrobial resistance in Egypt
- What should be done to face the problem?
- How the crisis is currently handled.
- The gap in the research that we will fulfill

### **2.1 The problem of Antimicrobial resistance.**

Antimicrobial resistance crises (AMR) is a grave threat to economy and health (Shrestha, 2018).

The excessive and faulty usage of antimicrobials in plants, animals, and human being, lead to evolution of bacteria which is more aggressive and resistant. This phenomenon occurred naturally from the continuous pressure of antibiotics (Shrestha, 2018).

Those infectious diseases become resistant to any known anti-microbial agent; moreover, they are increasing in frequency and scope which will lead to detrimental consequences for the public health (Marshall & Levy, 2011). This major crises was shaped by three main factors: the first one is the fact that the bacteria are always changing evolutionary with different AMR phenotypes due to the wide use of antibiotics (Spellberg et al, 2008) The second cause is that the world now has no borders and the microbe can transfer from one community to another easily; the third and last factor is the irrational and extensive use of antibiotics especially in developing countries where there are no rules undermine over the counter consumption of antibiotics (Holmes et al, 2016).;

thus, this antibiotic selective pressure will eventually improve the evolution of bugs to AMR ones. Some of these factors are amendable, others are not (Holmes et al, 2016). The fact that the world become interconnected and open for all human being cannot be changed, but rules and regulations can be put in place to reduce and prevent the evolution of bacteria by setting the legislations and change behaviors for the rational use of antimicrobials in addition to extensive education program to teach common people and healthcare workers (Michael, 2014).

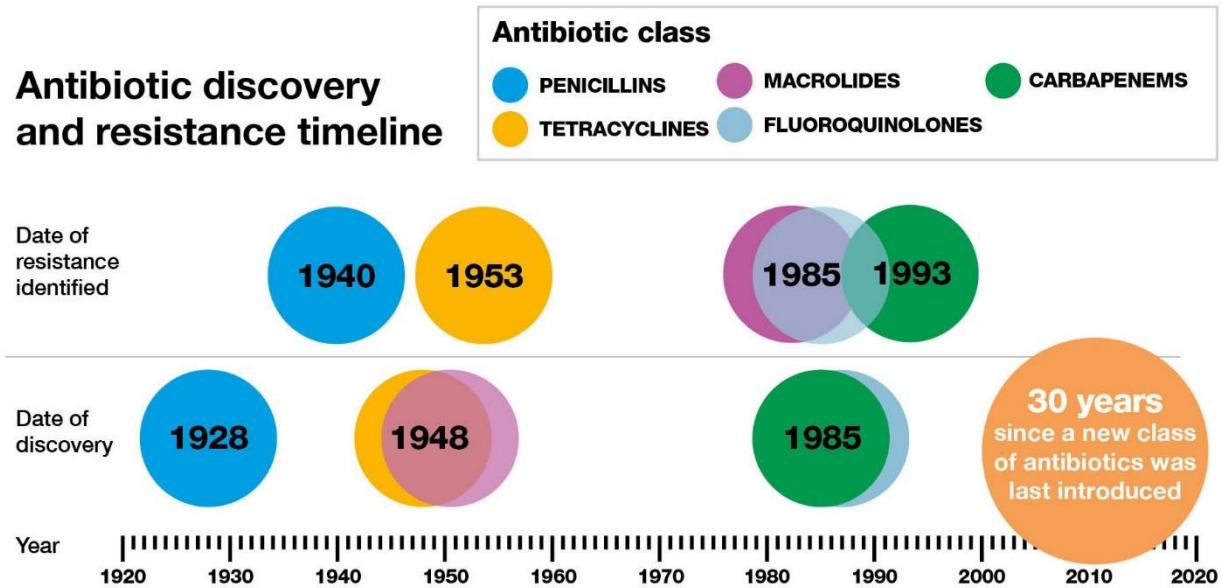
Projections and speculations suggest that AMR will be a cause of public health crisis and economic inequality globally which will mostly affect low and middle-income countries where the burden of AMR is highest (Lim et al, 2016).

## **2.2 The history of the problem**

Discovery of penicillin, the first antibiotic in the world, by Sir Alexander Fleming in 1928 is considered the start of modern era of antibiotics (Sengupta et al, 2013). Penicillin transformed the modern medicine and saved millions of people worldwide (Gould & Bal, 2013).

In 1940 antibiotics were prescribed for the first time to treat serious bacterial infections, and in World War II Penicillin controlled serious bacterial infections among soldiers (Sengupta et al, 2013). However, shortly after introduction of penicillin in the market, penicillin resistance became a huge clinical problem, and by 1950s resistance to penicillin became almost 100% (Spellberg & Gilbert, 2014). In response, new antibiotics were discovered and developed by pharmaceutical companies; however, the first case of resistance to the new antibiotics was identified during that same decade, in 1962 in the United Kingdom and in 1968 in the United States. Afterwards, resistance has been seen to nearly all antibiotics that have been designed and developed by pharmaceutical companies (Ventola, 2015).

Figure 2: Antibiotic discovery and resistance timeline (Bush et al, 2011).



### 2.3 The extent of the problem

The problem of AMR is affecting three sectors: animals, plants, and human beings (Cabello, 2006); however, the scope of this thesis is AMR in human beings in hospitals.

On the side of human being, AMR has dramatic consequences on health; however, the indirect impact of antimicrobial resistance are beyond health risks; for example, it has a negative effect on development; in addition, it is a drain on economy with many economic losses due to reduced productivity caused by sickness (of both human beings and animals) and higher costs of treatment (Regea, 2018).

#### 2.3.1 Effect on health

Antibiotic resistance problem is rising dangerously worldwide, bacteria are acquiring new resistance mechanisms and have the ability to transfer from one place to another and spread all around the globe. Infections such as pneumonia, tuberculosis are becoming difficult to treat and



sometimes impossible to treat because antibiotics become not effective. The problem grows especially in the countries where purchasing of antibiotics is easily made over the counter and there is over prescription by health workers and over usage by the public (WHO, 2019)

For example in the United States of America, it was estimated that around 50.9 % of bacteria causing surgical site infections are multidrug resistant (Li & Webster, 2018).

In another example according to WHO report which gather information from 22 countries, the proportion of patients who have blood stream infections due to resistant bacteria ranged within countries from zero to 82% depending on application of the standards of antibiotic usage. (WHO, 2018).

### **2.3.2 The status of Antimicrobial resistance in Egypt**

Egypt is one of the low and middle-income countries (LMIC) where data regarding endemic antimicrobial resistance are sparse, especially because over-the-counter antibiotic use is common (Abegunde, 2007). Data from resource rich settings and hospitals is generally better compared to that in the community and resource limited settings (Ayukekbong, 2017). The striking findings about AMR have been recently detected in Egypt; the prevalence of AMR is almost 90% of the bacteria circulating hospitals.

The information in Egypt is sparse; however, the current data is alarming. According to a study done to assess the resistant microbes in five hospitals in Egypt from 1999-2000, high rate of microbial resistance was detected, 70% of gram positive infections were resistant. Resistance among gram negative bacteria is higher, resistance ranges from 94% , 62% and 48% according to the type of antibiotic which called at that time urgently for nationwide surveillance to monitor these patterns in Egypt (El Kholy et al, 2003).

This was followed by another study in 2006 to assess the rate of resistance by active surveillance in three big university hospitals ICUs in Egypt from 2006-2007. 600 isolates were detected from which around 80% were resistant in gram negative bacteria and 60% resistance in gram positive bacteria. Again this highlights the urgent need for actions to augment infection prevention and control and setting the standards to be strictly followed (Saied et al, 2011).

Another study was done to study the microbiological profiles, and investigate the increasing rate of mortality in intensive care units in three hospitals in Cairo University only. Between 2009 and 2010, the study revealed high level of antimicrobial resistance in different gram negative bacteria ranging from 85% to 76% of resistance which differ according to the type of bacteria isolated (El-kholy et al, 2012).

In 2013 there was a trial to develop a surveillance system in Egypt and a study was published from a joint project between the Egyptian ministry of health and center of disease and control (USA) stated that, from twenty eight hospitals with 91 ICUs were investigated for the prevalence of multidrug resistant bacteria, the percent of resistance ranged from 92.8 to 54% according to the type of bacteria. The paper also called again for urgent sustainability of the surveillance system and enhancing infection prevention and control to contain the problem (Talaat et al, 2016).

### **2.3.3. Health system barriers in Egypt**

Egypt has a huge issue in the fragmentation of the Egyptian healthcare system which make setting the standards and implementation is hard. There are different providers and different financing agents either public, private, NGOs or public private partnership (Haley & Bég, 2012).

These different agencies are managing the healthcare sector under various authorities in the

government with different laws and levels of independence (Muleady-Mecham et al, 2009) which make controlling people's behavior, monitoring and evaluation extremely difficult This is an alarming level of bacterial resistance which highlight the fact that widespread antimicrobial resistance exists in Egypt and need immediate interventions (Gladstone, 2017).

Due to this Egypt embraces the WHO global action plan to develop the national action plan to combat antimicrobial resistance in Egypt. This Global action plan was approved by all member states. The WHO plan adopts the one health concept which states that people's health is connected to animals' health and plants' health, it is a collaborative approach at the regional, national and global level for better health outcome for all (CDC, 2018).

#### **2.3.4 Effect on development:**

AMR will hamper and impede the implementation of the Sustainable Development Goals 2030 (WorldBank, 2017). In contrary to the SDG 1 ,which states that no poverty, AMR will be driving around 24 million people into extreme poverty (Cecchini, 2015) and potentially resulting in millions of deaths which is also against SDG 3" Good health and wellbeing" (Barredo, 2015) Moreover, it will result in increasing inequality which is against SDG10. Sustainable development goals are strongly interconnected with the containment of AMR; thus, failure or loose actions towards AMR would definitely make these SDGs less likely to be achieved (World bank, 2017).

### **2.3.5 A Threat to the Global Economy**

The worldBank has made a simulation to the spread of AMR from now to 2050 to quantify the global losses, and attract the policy makers and draw their attention towards the problem (Shrestha et al, 2018). Two scenarios were set; one scenario with low AMR burden, and another scenario with high AMR impact. The models and scenarios were based on the economic effect on the labor supply and livestock productivity (O'Neill, 2015)

In the scenario of low AMR impacts, the simulations found that, by 2050, there will be a decline in the annual global gross domestic product GDP by 1.1 percent, relative to a base-case with no AMR effects; the decline would exceed one trillion dollars annually after 2030. In the other scenario with high AMR-impact, the loss worldwide will be 3.8 percent of its annual GDP by 2050, with an annual loss of \$3.4 trillion by 2030 (World bank, 2017).

By comparing the losses due to AMR in the period through 2050 and the losses due to global financial crises, we found that the reduction in global GDP caused by AMR will be equal to the losses provoked by the financial crisis, at their most severe (Van Boeckel et al, 2015). However, the impact of AMR is worse because the repercussion would be felt during the entire period until 2050, not just for a couple of years, as was the case in the acute phase of the financial crises which has occurred recently (Michael, 2014- Friedman, 2016). The economic inequality between countries would increase (Levy, 2001), and this would happen because low and middle- income countries (LMIC) would experience larger drops in economic growth than wealthy countries. Low and middle income countries will have higher prevalence of AMR and greater dependence on labor incomes (Singer, 2016), and most of the burden would occurs in low-income countries. With increasing the disease burden by 2050 and rising the AMR, the healthcare expenditure,

both public and private, will exceed 25% in low income countries, where the prevalence of AMR is highest, and 15% in middle and 6% in high income countries (Economou, 2015).

#### **2.4 Protecting a Global Public Good**

Containment of AMR is considered to be protecting a global public good. This is because all countries can enjoy the benefits of successful AMR containment; on the other hand, all countries will be harmed if AMR is remained without being curbed and controlled (Saleh et al, 2015).

This responsibility is held on public authorities, especially national governments, in protecting this good and prevent spread of pathogens, including drug-resistant strains (IDSA, 2011).

The loss of efficacy of antibiotics and other antimicrobials worldwide can be understood as a common goods curse (Holmes et al, 2016). The problem of commons occurs when people in a community waste a limited, shared resource, as each one pursues own self-interest by exploiting the resource for private benefit. No one wants the common resource to be exhausted. However, the group's behavior leads to precisely this result. This was the same case as in the collapse of fisheries due to overfishing, for example. The overuse and misuse of antimicrobial drugs worldwide show a similar pattern (World Bank, 2017).

#### **2.5 The role of stakeholders in the control of antimicrobial resistance**

There is no sole institution responsible for controlling antimicrobial resistance. The responsibility is shared between healthcare providers and others (Silbergeld, 2008) However, continuous education is mandatory for physicians and scientists to be aware and learn the importance of evidence based and good prescription practices. Other stake holders who include general population and government also play a fundamental role. Governments ought to put this issue as a priority and a public concern. Polices and regulation should be set and enforced in their

implementation; in addition, monitoring and evaluation of these implementations should be done to ensure that policies are applied effectively (Blakely et al, 2006).

The population on the other hand was perceived by researchers as a vital sector who needs to be educated on the threat of Antimicrobial resistance. The role of Media professionals appeared to be the link to convey this message to the population and consequently they require adequate training on conveying scientific and medical information in simple language (Eysenbach, 2008). Other researchers stated the importance of using multiple channels to learn population about the consequences and unsafe practices that increase the emergence of multidrug resistant bugs and recommended this as another important approach. This approach had shown success when used with journalisms to fight HIV/AIDS in developing countries, and many policy makers are expecting that it will be effective also in Antimicrobial resistance. There are a number of initiatives have been done to fight AMR by the governments in developed countries but these initiative are still limited in developing countries due to financial stress and limitation of the resources (Ayukekbong et al, 2017).

Currently, the international health care bodies acknowledged the importance of the critical situation of antimicrobial resistance crises and its effect on the human nature (Kuehn, 2013). These bodies are concerned with solving the problem and managing the crises. They provided a number of regulations and recommendations which could lead to actions taken by governments to address this serious issue. Indeed, these recommendations lead to programs and chain of actions in a trial to contain the problem; the actions fall in two categories: either prevention or control (Hidron, et al, 2008). The idea is that with prevention, the need for antimicrobials will be limited because the problem will be prevented from the start. With control they aim to provide new antibiotics which are more effective than the currently used

antimicrobials. In conclusion the measures that were taken aimed to prevention through controlling the bugs, vaccination, and educating public and clinicians about the standards of antimicrobial usage (Laxminarayan et al, 2013). Governmental legislations are mandatory to emphasize the implementation of policies (Harmsen et al, 2013). All the initiatives which were taken by the international bodies had proved success; however in this problem, the frequency by which the infectious bugs are evolved and propagated in the communities gives an alarm that these actions need to be expanded and more actions are needed to be added to contain the problem. (World Health Organization, 2012).

## **2.6 The gap in the research that the thesis will fulfill**

The causes which lead to prevalence of antimicrobial resistance differ from one country to another. In developing countries, root causes are more complex from developed ones. Most of the current research about antimicrobial resistance is targeting the resource limitedness and lack of infrastructure in the developing countries (Aslam et al, 2018). Other researches are looking for new antibiotics to kill the microbes and urge the pharmaceutical companies to design new antibiotics in the pipeline (Li& Webster, 2018). The current Research lack the behavioral aspect of healthcare practitioners and patients' in using antimicrobials. These factors include inadequate prescription of antibiotics, inadequate patient and clinician's education, and lack of experienced personnel and presence of antibiotics on the counter to be sold without prescription. Thus, the intervention efforts should be home-planned and based on the factors prevalent in the developing countries to meet the needs of this part of the world. These root causes if managed could be and its importance as it could be an easy and effective solution in controlling the risk of antimicrobial resistance and this will be assessed by this thesis. Taking the interventions in the developed

countries as a guide will be beneficial; however, we cannot depend on them blindly and must take the situation of developing countries into consideration (Podolsky et al, 2015).



## **Chapter Three: Research Methodology**

### **3.1 Design**

The research question is to detect the extent of implementation of WHO international policies for antimicrobial resistance in the Egyptian hospitals, and to reach our target we used qualitative research methodologies. The qualitative method aims to gather in-depth understanding of social behavior and the reasons that govern such behavior (Yilmaz, 2013). As this problem is considered to be a collective social behavior, data gathering will depend mainly on qualitative research methods. The methods will focus on meanings, views, and perceptions, where participants' description of the situation will be highly valued. Multiple methods of qualitative research will be used including in-depth interviews and participant observation. This variation is valuable as it will allow triangulation and ensure validity and reliability of data.

### **3.2 Methodology**

The interviews were designed to be semi-structured based on flexible structure with many open ended questions to explore the issue broadly. This was followed by in depth questions to study certain issues in details, such as the training and policies physicians use to contain the problem of antimicrobial resistance. In addition, further questions were designed based on what the interviewee have said to obtain more clarification and details (Britten,1995).

The following table gives a descriptive data about the interviewees, their positions, years of experience, the educational background and the working sector. Interviewing physicians from different backgrounds, working sectors and positions was mandatory to collect a clear view about the situation.

Table 1: Data about the participants to the interviews.

Code	Status	Years of experience	Educational background	Working sector
01	Representative from the hospital administrative council	>20	Laboratory consultant	Public hospital
02	Department head in international health organization	>20	Laboratory consultant	International organization
03	Chest physician	7	Specialist physician	Public hospital
04	ICU physician	15	Consultant Physician	Public hospital
05	Internal medicine	5	Resident Physician	Public Hospital
06	Surgical nurse	6	Nurse	Public hospital

07	Lab consultant	10	Clinical microbiology lab	Public hospital
08	Lab specialist	8	Clinical microbiology lab	Public hospital
09	Infection control practitioner	3	Infection control doctor	Public hospital
10	Infection control practitioner	4	Infection control doctor	Public hospital
11	Pharmacist	8	Pharmacist	Public hospital

Moreover, Observational method was used to systematically observe and watches people in their normal settings and working environment thus it was an effective way to find out people’s behaviors and actions in their working places (Pope et al, 2000). This way was important because it required going to the field and studying the whole situation followed by describing and analyzing the field. In health care settings this method has been proved to be profound and descriptive (Mays & Pope, 1995).

Table 2. Schedule of observational study

Day/ February	Observational site
Saturday / 2 <sup>nd</sup>	The infection control
Sunday/ 3 <sup>rd</sup>	The microbiology lab
Monday/ 4 <sup>th</sup>	The inpatient pharmacy
Tuesday/ 5 <sup>th</sup>	The ICU
Wednesday/ 6 <sup>th</sup>	The surgical department.
Thursday/ 7 <sup>th</sup>	The chest department, The internal medicine department
Friday/ 8 <sup>th</sup>	The obstetrics and gynecological department

*SWOT* analysis was added as a tool to identify core strengths, weaknesses, opportunities, and threats lead to evaluate recommendations and new ideas to solve the problem (Van Wijngaarden, et al, 2012).

### **3.3 Sampling**

Purposive sampling strategy will be pursued in choosing the participants; preliminary criteria relevant to the research objectives will be predetermined to guide the selection process (Guetterman, 2015). The selection criteria are as following: all participants who are working in the medical field and have direct or indirect effect on the rate of AMR in the hospital; in addition, all stakeholder which includes representatives from the WHO will be interviewed. Interviews are an effective qualitative method for getting participants to discuss their personal encounters, opinions, and experiences (Alshenqeeti, 2014). In turn, eleven interviews will be

conducted and intended to include participants from different medicinal fields.

Interviews questions are designed to elicit a vivid picture of the participant's perspective on the problem and the current status of AMR. The questions are prospectively semi structured to let interviewees talk freely, and probing questions will be asked if the discussion skewed to unneeded direction.

All interviews are conducted in Arabic, then translated and transcribed in English by the researcher. Before conducting the interviews, all participants will be informed about the nature, purpose and possible outcomes of the research through the written informed consent.

The interviews handouts will be kept confidential and the data will be analyzed and interpreted by the researcher.

### **3.4 Limitations**

Limitations in the interviews: The size of the sample is limited to the number of the interviewees, and also limited to the area in which the interviews are expert in. The quality of the interview depends mainly on the respondents; in addition, the response may be subjective. We will not be able to meet and interview patients to assess the situation from their view.

Limitations of observational study: Many behaviors are not open for observation and also cannot be quantified by observational techniques. Moreover, observational study is subjective and needs experience from the observer to avoid personal bias or pre-conceptions which could kill the objectivity in research.

### **3.5 Ethical considerations**

All interviews and observational study were held in the period between January and February 2019, after the IRB approval (Annex 12). The interviews were done in Arabic language then translated by myself. Before the interview, all interviewees were informed about the research and outcome and signed the informed consent (Annex 13). All handouts were kept confidential, and the data was interpreted and analyzed by myself.

## **Chapter Four: Findings and Discussion**

Interviews are effective qualitative methods for allowing participants to discuss their opinions, and experiences (Mack et al, 2005). In turn, eleven in-depth interviews were conducted with personnel who are involved in dealing with patients and prescribing antibiotics. The interviewed participants were of different specialties and ages; they were physicians from chest, ICU and internal medicine department, deputy dean for environmental issues, infection prevention practitioners, Lab specialists, pharmacists and nurses and the head of communicable diseases in WHO Regional Office for the Eastern Mediterranean EMRO. Most of interviewees aged from 25 to 35, and some of them aged 45 to 60 (table 1). Moreover, observational study was done during the regular working days with nurses and physicians, Lab specialists and the pharmacy. This variation was extremely important because it helped triangulation and ensured validity and reliability of data.

### **4.1 Interviews themes and discussion**

The first interview was conducted with the vice dean of the hospital for environment issues, she joined the organization since she was resident; this was 23 years ago and she was promoted during her career until she reached this position. She knows every aspect in the hospital and what was surprising that she knows most of the problems facing the institute from the infection prevention and control issues and she knows the ideal solutions, but the solutions are difficult to be implemented on the ground due to many reasons; one of them is financial issues. The interview was in her office. It seems that the decision is centralized and she had to look into every matter in details by herself and give a decision in every single aspect. There is no delegation or decentralization of tasks (Annex 1).

The second interview was with a department head in international health organization concerned by the problem of MDR in Egypt. She was pessimistic about the situation in Egypt. She praised infection control department in Alexandria University. However, she mentioned that jobs, such as infection control, stewardship of antibiotics in most places in Egypt are part time jobs but these jobs require full-time. In addition, people are not compliant and there are no strict rules to follow. She stated that the national action plan had been released to fight multidrug resistant bacteria, but it is not for public yet and will not be found on the Internet. She stated that the International organizations, such as Center of Disease and Control (CDC) and World Health Organization (WHO) are not funding agencies, and they are only agencies for consultation and gives advice to nations. The government in Egypt has to set its own policies and the way they are going to implement, monitor and evaluate and in her opinion, we are still there and away from stated goals.

Another interview was with an assistant lecturer (a position after completing residency and had master's degree in the specialty) and the one responsible in the chest department. Residents and assistant lectures are the ones who are doing almost all the work in the wards, they are making rounds to assess the cases of patients, prescribe antibiotics and following up the patients. The interview took place in the ward with a lot of noise and interruption either by the patients or the nurses. The physician looked very busy and exhausted; in addition, he knew nothing about the antibiotic policy, he was only exposed to some concepts of the infection prevention and control during his residency. The physician knows that the problem is huge and there are many MDR in the hospital, but do not know how to improve and they are dealing with the situation to isolate patients if they have a space for isolation. He do not know anything about the global action plan of the WHO (Annex 3).



The fourth interview was with Lecturer in the intensive care unit (ICU); this was a mid-senior staff dealing patients, most of them harbor multidrug resistance bacteria. The physician know that the problem is big and around 70% of patients capture these kinds of bacteria die not from the original disease but from the bacterial infection which is not responding to antibiotics. The interview was in the office, and there were many interruptions from nurses and junior doctors who were asking for consultations. Junior doctors were always asking about prescribing antibiotics and the doses required. Nurses were asking for supplies which are not sufficient and want to purchase more supplies from donation money. The physician do not have antibiotic policy but he tried to teach himself about antibiotics. He had never received training about infection control, yet he finds it important and crucial for safe environment. He is looking forward to have a program to train junior physicians, but he do not know anything about the initiative of WHO (Annex 4).

The fifth interview was with a resident in internal medicine department. The office of the residents was very missy and crowded with around five residents in a same small room. The resident had a night shift the day before and he supposed to work for the next 24 hours also. He was very tired and was giving short answers and seemed not to be interested. The resident knows the problem is increasing and getting difficult to have quick fixes. The department develop its own internal antibiotic policy and they are following. They do not receive any general antibiotic policies from the hospital and he did not receive any training. In addition, he does not know about the WHO initiative and global action plan. The decision to isolate the patient or not is very subjective i.e some physicians isolate if the patient has MDR infections, others not (Annex 5).

There were two interviews with infection control practitioners, one responsible for the orthopedic department and the other is responsible for the intensive care units in the hospital. The meeting was in their offices where the interview was very friendly. The place was quite with little

interruption. One of them was more knowledgeable than the other, both were the same age mid seniors, just completed their doctorate degree, they were active and responsible and want to improve the infection control situation in the hospital. They both declare that MDR is a huge problem in the hospital and everywhere in Egypt. The infection control guidelines are written and updated by Ministry of health every 4 years, which is not enough to cope with the rapid change in the epidemiology of bugs. They stated that implementing and monitoring the policies is a very difficult part. The policies are not distributed to all physicians and nurses, they are only with infection control committee. Implementing policies needs training first followed by continuous monitoring and evaluation by monitoring tools such as infection rate and surveillance. There are different ways to ensure compliance of people either praise or punish but most of the time punish works better and this is sad. We try to monitor the infection rate by the surveillance but I find the infection is rising. Infection control is a part time job and without resources it means that no infection control policies could be applied effectively on ground. They stated that the main factors increasing the infection rate and level of MDR resistance is the misuse of antibiotics by physicians. The infection control practitioners are working hard with the limited resources they have, they do not know about the initiative of WHO global action plan; however, they are applying their own objectives which by the way the same as of the WHO objectives (Annex 6, Annex 7).

Two interviews were conducted with Laboratory consultant and laboratory specialist in the lab. The lab was busy with many technicians and physicians, many times patients or nurses come into the laboratory to ask about the results and interpretation or availability of clinical tests. There was high interruption but the lab doctors were very cooperative. They stated that MDR is a huge problem affecting the whole world, they do not know the GAP initiative but they know that there should be a national plan to contain the problem of antimicrobial resistance otherwise the

situation will be critical. They are doing the antibiogram to trace the change in the behavior of the bacteria every 6 months but they are doing this on demand i.e if any ward want to know its antibiogram they make it otherwise it is not part of their routine work. There is no connection between the Lab and the pharmacy which means that the lab may be testing for the sensitivity of certain antibiotics and these antibiotics are not available for dispensing in the pharmacy and vice versa may be the pharmacy has different types of antibiotics but the lab is not testing them in the sensitivity thus they are not reported in the sensitivity report and the physician won't know about these antibiotics to dispense them for the patients. In addition, there is no communication between the lab personnel and the physicians to consult about cases and their management. Physicians are so busy and Laboratory doctors as well; moreover, there is no intranet or working internal phones in the wards for communication. The lab request missed many important data about the patient's case and diagnosis which make the interpretation of data from the lab defective and call for urgent communication with physicians. From the lab opinion, surgical wards and operating rooms are the highest wards with infections and managing these wards means that we managed almost 60% of the problem. The major cause of the problem is the misuse of antibiotics either it is empirical antibiotics or wrong dosage or wrong duration because most of physicians do not know anything about antibiotics and its right usage (Annex 8, Annex9).

The tenth interview was with a nurse from the surgical department. This is a senior nurse who is working for 24 years in the surgical department. The interview was on the counter of nurses in the ward where the files of patients and medications to be administered. This was the night shift from 8 pm to 8 am, it was somehow quite comparative to the morning shift. The nurse was cautious at the beginning because she did not understand the meaning of the interview, but after a while she became at ease and friendly and started to say all the negatives in the ward because she wanted to

improve and asked me to try to send her suggestions to the dean. She stated that the problem of MDR is a huge problem and it was taken lightly in the beginning until one of her friends caught chest infection with MDR bacteria and she was treated for almost 6 months until she recovered with remaining complications. She found the infection control policies important. But cannot be implemented in these crowded and busy hospitals where the infrastructure is not compatible with infection control policies. The patients are sitting side by side and the number of nurses is very defective. They do not have the infection control policies in hand it is only with infection control nurses, and they are receiving infection control training may be once a year. The measures they usually take to prevent transmission of MDR is isolation but this is not available all the time because of the limited places and the decision depends on the physician, thus it is subjective decisions. She did not hear about the initiative of the GAP WHO before but she found the objectives of the global action plan important and feasible for application (Annex 10).

The last interview was with a pharmacist in the main pharmacy of the hospital. There are many branches for this pharmacy, two internal pharmacies in each hospital for the inpatients and one in each hospital for the outpatients. The concept of clinical pharmacy is still new in this hospital and there is huge resistance from the physicians to allow the pharmacist to prescribe the antibiotics, adjust doses and decide the frequency of therapy. The pharmacist is in mid-senior age and she confirms that the problem of MDR is serious problem. She states that there are no general antibiotic guidelines for the hospital, it depends on every department or it is culture based which leads to misuse of the antibiotics. The decisive and final decision in antibiotic prescription is for the physician and the role of the pharmacist is only as a consultant if the physicians ask for his/her consultancy. She stated that there are initiatives to start a committee to control the antibiotic usage which is the stewardship committee but it is still an idea. She do not know what is the GAP

initiative; however, she is convinced by the objectives and wants to apply to find a way to control this huge problem (Annex 11).

## **4.2 Observational study**

The observation was for one week and was divided based on a preplanned schedule (Table 2). One day spent in the infection control department, one day in the microbiology laboratory, one day in the inpatient pharmacy, 4 days in the wards of different departments to see the environment of the nurses and physicians and how they are dealing with the patients.

The observational study was very useful to study the actual and true environment and analyze how people are interacting and dealing with each other. On the first day, there was a visit to infection control units at 9 a.m; however, the nurses did not show up except at around 10 o'clock. The high nurse went for audit on the surgical ward, and what was very distinguishable that the audit was for nurses only, not for physicians, there was a physician who was not wearing gloves from patient to patient and the infection control nurse only gave a comment to the physician very nicely and he did not respond to her. The nurses of the ward were compliant to the infection control policies; however, the wards were extremely crowded, there were no spaces between beds. The nurses complained that there was no alcohol or gloves and they were purchasing gloves out of their pockets, and the infection control nurse responded that the hospital has no resources now try to adapt yourself. One of the patients complained that the nurse did not change the dressing for 3 days however it was soaked with blood, the infection control nurse wrote this to be reported and asked the nurse to change the dressing, but the nurse complained that their number is too low to the number of beds in the ward and they need more nurses.

On the second day in the microbiology laboratory, the working day which started at 9a.m and ended at 1 pm. There were eight technicians and three doctors per day, one of these three doctors is a supervisor; thus the working hands are only two physicians responsible for the routine work which is around 100 samples each day. During the four working hours, all people were very busy working, and responding to the queries of the patients and nurses, which gives a high prediction for human error. There were no gloves and the sterilium bottle was empty. They were working with their bare hands without gloves. People were touching all surfaces with their hands which means they are transmitting infections everywhere. Officially patients are not allowed to enter the laboratory; however, they were getting in the lab asking for test results. The workload was extremely high for four working hours; moreover, some doctors were required to finish their work and then go as a part timer in the infection control department. There was no time to communicate with physicians or pharmacists, or to give training for nurses about sampling.

The pharmacy on the third day was very crowded with pharmacists and nurses. The pharmacy opened at 9 a.m, nurses bring the patients' files with the requests for the antibiotics. Dispensing of antibiotics, doses and frequency based on the physician's request not based on isolation of the organism and detecting the true antibiotic sensitivity specific for this organism. The policy is that dispensing of antibiotics based on isolation of the causative organism and doing antibiotic sensitivity; however, no pharmacist was asking for the culture results and when by asking them why the policy is not followed, the response was that they will not postpone the antibiotics for patients based on culture and the physicians will never send it; thus the treatment for patients will be delayed of no use. Many times, the nurses came asking for antibiotics and were not available, again because of the resources are weak or because there is delay from the companies' supplies.

No physicians came to communicate with the pharmacists, only nurses and companies' representatives who came for pharmaceutical marketing.

The fourth day in the intensive care unit (ICU), the unit had its own policy of antibiotics. Nurses and physicians are trained to follow this policy. The head of the ICU is very strict in infection control policies and antibiotics policies, he set rules and no one is allowed to break these rules. They have plenty of resources which come from donations. The spaces between beds are preserved and the nurse bed ratio is maintained. The work for nurses is divided to three shifts each is eight hours; however, for physicians there is shortage in number and the shifts are for 36 hours. The physicians were extremely exhausted and stressed. There are strict regulations of no entry except for people working in the ICU; thus, only few hours were allowed to stay there. Each nurse is responsible for two patients and taking care of every single item. The infection rate in ICU is still high because there are many devices piercing the skin barrier, such as cannulas, ventilators, central venous lines etc, and because they are receiving terminal cases from the regular wards.

The fifth day was in the surgical ward, surgeons from observations are different from all other physicians. They are not believing in bacterial infections and the presence of MDR infections, and not following the policies of infection control, and they are very resistant to any change. They believe that once the surgical operation is successful then their role is done. They do not care about infection or bugs that patient can capture before, during or after the surgical operation. They are very hard minded and very difficult to be convinced. They need long times of negotiations and leadership commitment to be convinced about the presence of microorganisms and bacteria. Nurses are more committed than physicians because the infection control audit is for nurses and the nurse who is not following polices will receive a punishment. Number of

nurses is lower than the normal nurse: patient ratio which is between 1:4 or 1:6, the ratio in the surgical ward was around 1:15. There was lack of resources as well. I stayed until 8 p.m; however, no one of the surgeons showed up in the ward, it seems that they were spending all the day in the operating rooms for surgical operations. There were interns in the ward and they were taking care of the patients and can call the resident in any serious situation. The ward was crowded and the number of patients was exceeding the capacity of the ward. During 2018, the percentage of surgical site infections in the ward was around 5% on average; however, in October there was an outbreak in surgical site infections i.e patients with surgical sites after the operation were capturing infections in their wounds which lead to failure of the surgery or septic infections. The outbreak, which means that many cases were infected by the same MDR organism, was discovered by the infection control team in late October, the infection control team applied a bundle of actions to control the infection and disinfect the ward. By tracing the outbreak back, they discovered that the primary case was a patient admitted from the emergency department with stabbed wound in the abdomen. The patient had MDR bacteria and transmitted it to patients in the ward either from the patient by contact, or from the physicians who do not wear gloves. The outbreak was controlled, and the infection control head notified the head of the surgical department officially by the incident, and since then there is some sort of commitment in the surgical wards which confirms the same concept that managerial commitment is required to change people's behavior.

The sixth and seventh days were in the chest, internal medicine and obstetrics and gynecology departments. They were very similar to each other; wards were crowded with patients and their relatives. There was no restrictions for visits of relatives. Nurses were trying to implement the rules of visiting of relatives but relatives were waiting everywhere. Beds are beside each other



with no enough space to prevent transmission of infection from one patient to another. Patients were bringing food and drinks from outside the hospital and hiding them in pillows or blankets, so not to be discovered by the nurse. The number of nurses compared to patients is very defective which indicated less care for patients. Nurses did not wear gloves because everyone should purchase gloves out of their pocket and gloves are expensive. Patients were complaining from lack of care and that they may stay for days without antibiotics or routine care from nurses. The bed sheets have some old stains on it and look pretty old. There were only four nurses for the whole ward with 60 patients. No physicians were seen and when asked about them nurses responded that they were in the operating rooms or in the outpatient clinics and will come at 7pm. They were three residents in the ward. It seems that they were overwhelmed by many tasks and duties and this explains why there is no time to communicate with other departments such as the Laboratory or to receive trainings for antibiotics or infection control or knowing about WHO global plan. At around 6 pm residents started to come to the wards looking exhausted they sat in their room looking into the patients' files. Patients started to leave their beds and come to ask them about their queries. They look nervous and told patients in a high-pitched voice to return back to their beds and that they will coming to them in the ward. They started their rounds from patient to another. They were examining patients without washing their hands or wearing gloves due to lack of resources or because they were overwhelmed by tasks. They then finished their rounds, returned back to their room, and wrote their observations in patients' files.

### **4.3 Research findings**

It is extremely important to assess whether healthcare personnel are aware of the situation or not ; thus, a question was introduced at the beginning of the interview to know the percent of their awareness about the problem. It returned back that all sectors of healthcare personnel know the

problem and aware of its consequences and this was obvious in their responses “Yes, I know there is MDR problem and I am convinced that this is a big problem, gram negative organisms are the most common”. This quote was received by all the interviewees which gives a clear vision that the issue became clear and well known to all.

However, by probing the question, another finding was detected about the limitedness of facilities they have. This was reflected by their response “There is no space for isolation of patients” (chest and ICU physicians). Absence of resources or its limitedness was the first finding detected and the clearest one; moreover, this finding was expected in all public hospitals that depend on governmental funding.

Digging deep in the interviews to elucidate the behavioral factors, communication factors that represent a huge part of the problem. The research discovered that absence of standards and guidelines lead to individual decisions based on one’s experience. ”The physician knows that this patient is MDR and we isolate the patient” (surgical nurse). “We give him the sensitive antibiotic and isolate” (ICU physician). The opposite response that received from two different physicians about the way they are dealing with a case of MDR bacteria illustrate that there are different directions in ways of treatment not on definite policies or regulations to face the problem but on personal concepts.

Deeper in the interviews another concepts were discovered, in the core elements that should control and prevent resistant bacteria for example, there are no written distributed policies about infection control or antibiotic policies; thus, healthcare personnel including physicians lack the essential knowledge for proper usage. The response received from physicians was shocking “I don’t have a copy of the infection control policies and no one told us about it except few times”(chest physician) another physician replied the same “I do not have antibiotic

policies”(internal medicine physician). These results give an overview about the huge problem of education and training that healthcare workers suffer from and shed light on the importance of studying these root cause taking into consideration the huge effect of these cause on the consequences of the problem. By probing the question, another fact was realized that with lack of standards, everyone will set his/her own policy which will lead to huge corruption in management of the problem. When some physicians were asked about how they treat their patients, they responded that “we have an internal policy for antibiotic use (ICU physician). Definitely this creates a gap in application of a generalized plan and unified steps to reduce the burden of AMR in the hospital settings.

In testing the response of healthcare workers on importance of guidelines and standards, the response was surprisingly positive and they know that these policies are extremely important to prevent the problem. “However, I find infection control is important”(chest physician). These findings illustrate the need to have a systematic training, education and standards to facilitate medical interaction in the right way and thus decrease the behavioral part of the problem.

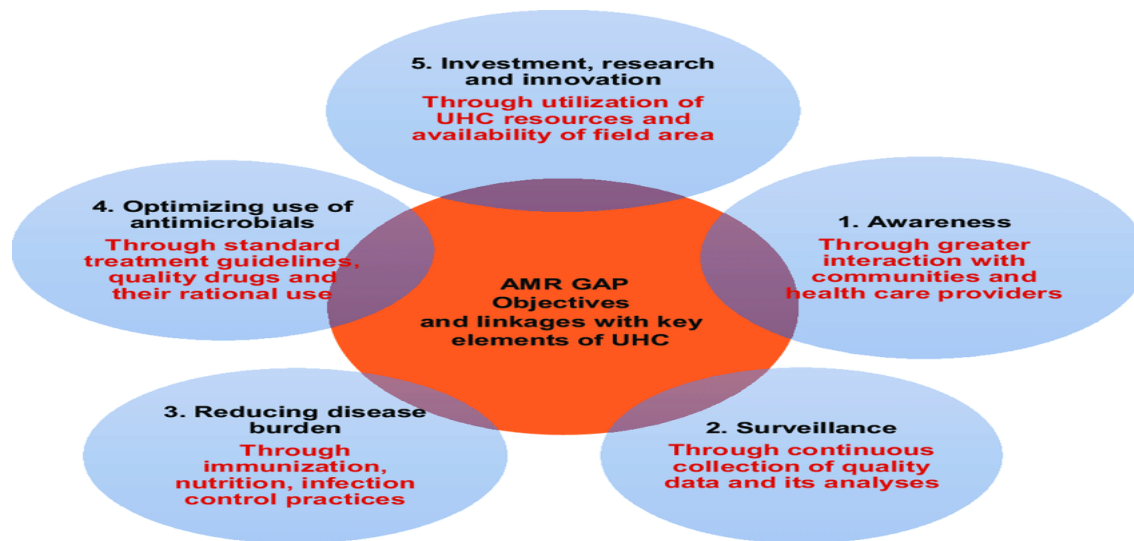
Absence of leadership commitment is another factor that leads to failure of good initiatives. On a trial by infection control practitioners to set a surveillances system to monitor the MDR in the hospitals; the problem was in the application of the system and this was because of lack of support to workers in the system financially and by time and the initiative ended up by being inefficient as stated by one of the infection control practioners. “If the surveillance is well planned and implemented in the right way with regular follow up it will reduce the rate of infection because this is a way of tracing infection. But this is not happening in the right way and also it depends on the leadership and commitment” (infection control practitioner). Commenting

on this finding, lacking of leadership commitment is another issue which affects the problem in a negative way.

To understand whether the different departments have communication with each other or not, questions were introduced in each department to physicians and nurses to understand how different departments are communicating to finally reach a decision for the patient. The most striking finding was that each unit in the hospital is acting as a separate entity and there is no communication between the departments, the lab has no connection with the pharmacy as stated by a pharmacist “No we do not have any connections with the Lab” (pharmacist), and physicians have no connection with the lab; as stated by a lab physician “We are not consulting the physicians” (Lab consultant) and another one “We do not have time and it is difficult to reach them”(Lab specialist). In conclusion, they are not notified about the presence of MDR bacteria infecting their patients except after days; consequently, treatment of patients will be delayed or mistreated and the problem aggravates. . Another finding discovered from the interviews with the Lab specialists that diagnosis of MDR bacteria in the Lab is not considered critical to be notified to the physicians immediately and that most of cultures revealed MDR bacteria which indicates that it became like an endemic pathogen. The problem of AMR in hospitals and its prevalence is mainly seen as a problem of behavior and resources; however, behavior comes first and contribute to more than 70% of the problem, such as the misuse of antibiotics, lack of communication between the lab and physicians and lack of managerial commitment”.

Consequently, if we look into the objectives of GAP to estimate to what extent the WHO plan is implemented, we will find that the plan and its objectives are met by about 40% if we considered that objective 2 and objective 3 are met; however, objective 1,4,5 are not met.

Figure 4: Objectives of GAP of WHO (Bhatia, 2018).



#### **4.4 Themes for answering the sub research questions:**

- All sectors of healthcare personnel know the magnitude of the problem and aware of its consequences and are afraid from spreading of the risk in the community. This was clear in their quotes “Yes, I know there is MDR problem and I am convinced that this is a big problem. Ecoli and Klebsiella are the most common”(All physicians). These quotes were common among all the interviewees who stated that the risk is very high and the causative agents are very aggressive as well. However, due to absence of unified set of policies, each sector is trying to contain the problem from its own perspective and depending on the resources they have, but they do not have the facilities to deal efficiently with the problem, and this is clear in the quotes” I manage according to the patient clinical situation. If the clinical situation of the patient is ok, the patient stays in his place and continue treatment without isolation because we do not have enough isolation rooms” (03), this is different from the other physician who stated that “Sure I

isolate the MDR patient “(04). These different decisions indicate that lack of standardized policies make the decisions subjective.

- The global action plan of the WHO is not known to anyone, the vice dean for environmental and infection control among the healthcare workers was the only one who knows about it. There was no announcement about this action plan or the objectives of the WHO. This means that the WHO needs to expand and reach all healthcare sectors to convey their messages because their messages only reach to certain categories of people who are the managers or deputy managers but not go deep to other sectors. The same response was received from all healthcare workers when asked about the initiative “I do not know about this”(all physicians). Lack of publicity is another major factor in spreading the risk because people do not know about the causes of the risk or the actions they should take to manage the problem.
- Healthcare personnel are taking steps to detect and combat the risk. Infection control practitioners are making the surveillance to capture the whole picture of MDR and monitoring the change in infection rate rapidly “We have the surveillance program collected by nurses to enter data of patients in daily audit and monitored daily then notify to the infection control doctor. These data is entered by infection control nurses. This is a program affiliated to ministry of health and ministry of higher education in joint with the Center of Disease and Control (CDC)”. But the final report usually missing important data because they are not well trained on the system “if the doctor or nurse who is writing the report is knowledgeable, he/she will write important details but this is not always happens.” (09, 10) Nurses are following the policies because there is continuous audit and monitoring, punishment and praise; but their number is lower than

the required nurse to patient ratio; thus, nurses are always drained and exhausted; In addition, lack of resources is another burden as seen in the surgical nurse quote “The place is very crowded and busy and every patient is sitting in close contact to the other patient. There are no isolation rooms only one room in the department” (06). Physicians are dealing with patients depending on the situation, and all actions are subjective depending of the present physician. They know the problem but lacking standardized polices and rules to follow. Their quotes represents their situation “there are many problems I cannot do anything with it, such as absence of isolation rooms, the crowdedness of patients and the disease can be easily transmitted from one patient to another”(05); however, they are doing their maximum effort to contain the risk.

- There are many impeding factors which act as obstacles in the implementation of antimicrobial resistance plan. These includes, the inadequate infrastructure represented in the small space, crowdedness of the hospital and absence of isolation rooms. Inadequate resources and dependence on donations is another major factor. Insufficient number of healthcare workers to number of patients, and the huge workload are additional factors which forced people not to follow the standards.

**Table3. SWOT analysis**

STRENGTHS	WEAKNESS
<ul style="list-style-type: none"> <li>• Support from management</li> <li>• Experienced personnel</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

<ul style="list-style-type: none"> <li>• Awareness of importance of the problem</li> <li>• Good understanding of actions required</li> </ul>	<ul style="list-style-type: none"> <li>• No one knows about the initiative of WHO</li> <li>• Small group of people driving the issue</li> <li>• Reliance on individuals rather than institutions</li> <li>• IC and stewardship are add-ons to already high workload</li> <li>• Implementation and monitoring</li> <li>• Weak communication with physicians (esp. in surgical dept.)</li> <li>• Training of physicians on IC and Stewardship policies.</li> <li>• Neglect of workers (cleaners) and patients training</li> <li>• The role of clinical pharmacists is minimized</li> </ul>
<b>OPPORTUNITIES</b>	<b>THREATS</b>
<ul style="list-style-type: none"> <li>• Established infection control structures</li> </ul>	<ul style="list-style-type: none"> <li>• Increase in the number of patients dying from infections rather than cancer.</li> </ul>



<ul style="list-style-type: none"><li>• Growing nat. and intl. attention to AMR</li></ul> <p>- Exchange</p> <p>- Funding</p> <ul style="list-style-type: none"><li>• Strong reputation of the hospital.</li></ul>	<ul style="list-style-type: none"><li>• Competitive public and private hospitals</li></ul>
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## **Chapter Five: Conclusions and Recommendations**

### **5.1 Conclusion:**

What concluded from the study that barriers against implementation of AMR plan differ in developing countries from developed ones, the causes in developing countries are much complex because it depends on behavioral factors in addition to financial and resource limited factors. However, the behavioral factor is playing a major role in these countries and can be fixed by setting the rules and have a strong leadership.

Absence of strong leadership commitment which is required to set and maintain the rules leads to loose or absent application of initiatives such as the surveillance which was not implemented efficiently as it was supposed to be effective in containing the problem of AMR.

Lack of standardized policies and regulations for the usage of antibiotics in treatment and policies of infection control and absence of programmed training for residents and nurses about infection control opens the door for subjective decisions for using certain types of antibiotics, or applying different standards.

Lastly, lack of communication between different departments is another major challenge because each department acts autonomously and is seeing the problem from its own side. People are aware of the magnitude of the problem; however, do not know how to manage it with the current and available resources. There is low publicity about the WHO GAP; however, healthcare workers are aware by the objectives. People are welcoming any initiative from international organizations as long as these organizations are trusted, such as Center of Disease and Control

CDC and World Health Organization WHO, but the major concern is about sustainability which needs a lot of money and leadership commitment and these are lacking currently.

## **5.2 Recommendations:**

After analysis of the study a set of recommendations is developed which could help to contain the problem;

The better use of human resources, it is important to use these human resources in a right way.

Part time jobs and multitasking are not good options. Jobs should be full-time which enables personnel to work efficiently. Setting adequate ratio between nurses and patients, physicians and patients and not overloading the staff is another important factor.

Authority should be given for pharmacists who are more knowledgeable than physicians in antibiotics, their interactions and their side-effects. This should be a decision of the upper management, implemented and followed by pharmacists. Clinical pharmacy is a well-established branch in USA and Europe countries; however, countries like Egypt still there is strong domination for physicians which will has bad consequences on antimicrobial resistance.

Communication with different healthcare personnel is mandatory. Physicians should be communicating with pharmacists and laboratory physicians for better interpretation of results. Communication will also lead to rapid detection of multidrug resistant cases, rapid management and isolation to prevent transfer to others. Communication system is present in hospitals of USA and Europe; however, in Egypt it is not settled yet except in some private hospitals.

Hospitals should hire full-time consultants for infection prevention and control and stewardship.

These specialties should not be add-ons to already high workload. There should be time to set

plans, implement and monitor, then receiving the feedback to improve again. Part-time jobs with high workload is a mess and people wont be focused on their targets.

Systematic training on infection control policies and stewardship should be given to physicians at the beginning of their residency in the orientation program; thus, they will be exposed to these concepts before touching patients. These programs need the commitment and support of the higher management. Moreover, intensive training and follow up should be given to cleaning workers who are dangerous source of transmitting infections through mops, door knobs and light switches.

Big public hospitals should use their strong reputation and great history to make collaboration with international organizations for capacity building and funding opportunities, so there will be mutual benefits and experience exchange between the two organizations.

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# ANNEXES

## Annex 1

1-Do you see ABR as a big problem

3-Are there any guidelines for infection control policies?

4-Who wrote the policy?

5-How is the implementation of guidelines of infection control implemented and monitored? E.g hand hygiene?

6-How do you improve compliance of people?

7-Are there any guidelines on collecting and analyzing (surveillance) data of resistant strains?

8-Who coordinates ABR surveillance, (The microbiology lab or the infection control unit?

10- What information does the report contain and report to whom?

11-How much ABR surveillance reduce the ABR problem?

12- Which organisms pose the greatest problem? What information is the answer based on?

13-Do you have XDR or PDR pathogens reported?

13- How many infection control nurses and physicians you have, full time of part time?

14-What are the measures done for wards with higher infection rates to reduce the infection?

Politically with heads and physicians if not cooperate.

15- What do you see as the greatest drivers of ABR?

16-Is there an intranet to share data within the hospital? Do you share data outside the hospital?



17-From your opinion what could be done to improve ABR?

1. In your experience, how are international AMR initiatives perceived by the Egyptians?
2. “Sustainability”, how can we reach it for AMR when international organisations stop funding these programs?
3. How do you find the WHO global action plan to combat AMR?

## **Annex 2**

1. To start off, I would like to ask you to briefly describe your current role and the main areas of your work?
2. Which organisations does WHO collaborate with to strengthen AMR surveillance in Egypt?
3. What are the main challenges for strengthening AMR surveillance in Egypt?
4. In your experience, is the sharing of data problematic in Egypt? If so, what are the greatest hurdles?
5. Does WHO have political support for AMR surveillance in Egypt? What convinces policy makers to start surveillance on AMR?
6. What is the difference between the work of the US CDC on AMR surveillance in Egypt and the work undertaken through WHO? Is there coordination between both organizations?
7. In your experience, how are international AMR initiatives perceived by the Egyptian government?
8. “Sustainability”, how can we reach it for AMR when international organisations stop funding these programs?
9. There is a National Action Plan under way in Egypt. Do you know who is involved in working on this Plan, and what the main priorities are?
10. How does WHO deal with the complicated health care structure in Egypt e.g hospitals are under the umbrella of different ministries, and the role of private hospitals? Does WHO consult and interact with all these different players in the healthcare system?

### **Annex 3**

1-Do you see Antimicrobial resistance (AMR) as a big problem at your hospital? What is the percent?

2-Are there antibiotic policies you follow?

3-How do you find Infection control policies?

4-How do you find the WHO global action plan to combat AMR?

5-What are actions you take to prevent transmission of AMR?

6-What kinds of problems are you facing in your work which could hinder the application of AMR GAP?

#### **Annex 4**

1-Do you see Antimicrobial resistance (AMR) as a big problem at your hospital? What is the percent?

2-Are there antibiotic policies you follow?

3-How do you find Infection control policies?

4-How do you find the WHO global action plan to combat AMR?

5-What are actions you take to prevent transmission of AMR?

6-What kinds of problems are you facing in your work which could hinder the application of AMR GAP?

## **Annex 5**

1-Do you see Antimicrobial resistance (AMR) as a big problem at your hospital? What is the percent?

2-Are there antibiotic policies you follow?

3-How do you find Infection control policies?

4-How do you find the WHO global action plan to combat AMR?

5-What are actions you take to prevent transmission of AMR?

6-What kinds of problems are you facing in your work which could hinder the application of AMR GAP?

## **Annex 6**

1-Do you see ABR as a big problem

3-Are there any guidelines for infection control policies?

4-Who wrote the policy?

5-How is the implementation of guidelines of infection control implemented and monitored? E.g hand hygiene?

6-How do you improve compliance of people?

7-Are there any guidelines on collecting and analyzing (surveillance) data of resistant strains?

When, why, type?

8-Who coordinates ABR surveillance, (The microbiology lab or the infection control unit?

10- What information does the report contain and report to whom?

11-How much ABR surveillance reduce the ABR problem?

12- Which organisms pose the greatest problem? What information is the answer based on?

13-Do you have XDR or PDR pathogens reported?

14-What are the measures done for wards with higher infection rates to reduce the infection?

15- What do you see as the greatest drivers of ABR?

16-Is there an intranet to share data within the hospital? Do you share data outside the hospital?

17-From your opinion what could be done to improve ABR?

## **Annex 7**

1-Do you see ABR as a big problem

3-Are there any guidelines for infection control policies?

4-Who wrote the policy?

5-How is the implementation of guidelines of infection control implemented and monitored? E.g hand hygiene?

6-How do you improve compliance of people?

7-Are there any guidelines on collecting and analyzing (surveillance) data of resistant strains?

When, why, type?

8-Who coordinates ABR surveillance, (The microbiology lab or the infection control unit?

10- What information does the report contain and report to whom?

11-How much ABR surveillance reduce the ABR problem?

12- Which organisms pose the greatest problem? What information is the answer based on?

13-Do you have XDR or PDR pathogens reported?

14-What are the measures done for wards with higher infection rates to reduce the infection?

15- What do you see as the greatest drivers of ABR?

16-Is there an intranet to share data within the hospital? Do you share data outside the hospital?

17-From your opinion what could be done to improve ABR?

## **Annex 8**

1-Do you see ABR as a big problem?

2-Which organisms pose the greatest problem? What experiences, information is the answer based on?

3-Is the lab going through a proficiency testing by external agency for sample analysis and interpretation?

4- Do you contact the pharmacy to be sure that the drugs tested are available at the pharmacy?

5-How are the results recorded and reported to the ward?

6-Do you give a pre-analytical awareness for the nurses and physicians for sampling and transport of samples?

7-How often do you consult a physician on managing a serious infection?

8-Do you notify physicians directly if you have MDR diagnosed?

9-Do you have XDR and PDR?

10-What are the wards show highest infection rates with MDR?

11-What do you see as the greatest drivers of ABR?

12-From your opinion what the lab could do to improve the ABR problem?



## **Annex 9**

1-Do you see ABR as a big problem?

2-Which organisms pose the greatest problem? What experiences, information is the answer based on?

3-Is the lab going through a proficiency testing by external agency for sample analysis and interpretation?

4- Do you contact the pharmacy to be sure that the drugs tested are available at the pharmacy?

5-How are the results recorded and reported to the ward?

6-Do you give a pre-analytical awareness for the nurses and physicians for sampling and transport of samples?

7-How often do you consult a physician on managing a serious infection?

8-Do you notify physicians directly if you have MDR diagnosed?

9-Do you have XDR and PDR?

10-What are the wards show highest infection rates with MDR?

11-What do you see as the greatest drivers of ABR?

12-From your opinion what the lab could do to improve the ABR problem?

## **Annex 10**

1-Do you see ABR as a big problem?

2- Is there any guidelines regulate antibiotic use, prescription for treatment?

3-Who have the decisive role in controlling antibiotic usage,?

5-What do you see as the greatest drivers of ABR?

6-What aspects of prescribing practices may contribute to ABR?

7-Does the pharmacy report on the consumption of antibiotics?

8-Has application of ABR surveillance, infection control and antibiotic policy affected the antibiotic consumption?

9-From your opinion what the pharmacy can do to improve the ABR problem (Dose, duration, cycling)

## **Annex 11**

1-Do you see Antimicrobial resistance (AMR) as a big problem at your hospital? What is the percent?

2-How do you find Infection control policies?

3-What are actions you take to prevent transmission of AMR?

4-What kinds of problems are you facing in your work which could hinder the application of AMR GAP?