

## Study on Antimicrobial Resistant in Saudi Arabia

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**Abstract:** This study aimed at assessing the underlying causes of antimicrobial resistance in Saudi Arabia. About 50 patients randomly selected whose proved to have Staphylococcus antimicrobial resistance detected by Bact tech in Assir hospital microbiology laboratory. A special questionnaire was used to assess the knowledge, attitude and practice of patients towards using antimicrobials beside epidemiological and demographic data. Results showed that the nationality of all patients were Saudian (49 patients) only one was a Sudanese. About 22 patients were 16-40 years of age, the attitude of patients towards their treating doctor or pharmacist involved 13, deferent 11, critical (serious) 14 and ignored by 12 which almost equally distributed. About 64% patients used to exaggerate their symptoms to their doctor to let him prescribed any antimicrobial drugs. About 64% of patients purchase the antimicrobial drugs depending on the quality. Knowing the dosage of antimicrobial was enlisted by 84% patients. About 64% of patients used to have description of the antimicrobial dosage by treating physicians 20% by pharmacists. About 35 patients (70%) have received drug side effects description. The patients compliance grading <50% towards following their medication dosage was enlisted in 22 patients (44%). About 27 patients (54%) have no home animals while 23 patients (46%) have got home animals (7 patients have cats, 7 have goats, 6 have sheep, 2 have camels and 1 have dog). Only 7 patients (14%) have noticed infected wound on their home animals, 2 patients of them (4%) used to treat their home infected animals. About 20 patients (40%) used to through some of antimicrobial home waste in open carbidge. Conclusion deduced from of this study; antimicrobial resistance is a major health problem and patients often do not comply with antimicrobial prescription, enhancing the development of antimicrobial resistance during treatment.

**Key words:** Antimicrobial, resistance, MRSA, compliance, staphylococcus, Saudi Arabia

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### INTRODUCTION

Three important points that highlighted different aspects related to the development and spread of antimicrobial resistance. The antimicrobial misuse associated with patients noncompliance, the spread of antimicrobial resistance by disposal of industrial antimicrobial waste and the role of pets as reservoirs of resistant bacteria. It is acknowledged that antimicrobial resistance is a consequence of antimicrobial use and furthermore that misuse of antimicrobials augments the development of antimicrobials resistance. Patients noncompliance in usage of antimicrobial therapies enhance the emergence of resistance strains during treatment because of low antimicrobial concentration or short antimicrobial exposure attained in body tissue. The available data on patients contribution to antimicrobial misuse with particular regard to noncompliance in prescribed antimicrobial treatment regimens contrary to doctors expectations, noncompliance seems to be common worldwide. A questionnaire survey including 3610 individuals from 6 different countries showed that on

average, 25% of patients miss one or more doses of antimicrobial treatment whereas 31% of patients stop before the end of the course (Branthwaite and Pechere, 1996). The data revealed national differences in the frequencies of compliance with British patients being more compliant (90%) compared with Italian (65%) and Spanish patients (55%). Among the patients who stopped the course of treatment too early, approximately 95% did so because they felt better and 5% due to side effect or palatability these figures can change according to countries developing and developed ones.

In some population sector the affordability of the drugs can play a major role in this aspect. Some patients (44%) admitted saving part of the course for future use. Majority of adults and child carers expected their doctors to prescribe antimicrobials for the treatment of flu, sore throat, earache and bad cough. Some patients (11%) confessed that they use to exaggerate symptoms in order to obtain an antimicrobial prescription by their doctors. Other study (Pechere *et al.*, 2002) addressed how the type of patients may influence antimicrobial misuse. In this study, the patients attitudes related to their doctors were

classified according to four categories: involved, deferent, critical and ignored. Involved patients typically came from Germany and France, deferent from France and Spain and ignored from Italy. Involved and deferent patients are more confidence in their doctors in comparison to the other two categories and considered the amount of information received during medical consultation to be more satisfactory.

The survey also indicated that longer consultation time was with patients satisfaction and perception of therapy efficiency. In conclusion, good communication between patient and physician seems to contribute to more appropriate antimicrobials uses. Relevant information provided by treating doctors to their patients will yield patients that comply well hence reducing the antimicrobial misuse and consequent development and spread of resistance.

Industrial antimicrobial production generates large volumes of waste containing antimicrobial residues. About 1-4 kg of antimicrobials are discharged into the sewage system for each kg antimicrobial produced (Goodacre *et al.*, 1997). Antimicrobial waste represents a perfect habitat for the growth of resistant bacteria. The spread of Vancomycin-Resistant Enterococci (VRE) have been associated with the disposal of waste from vancomycin production. VRE are presently of major concern due to their importance as nosocomial pathogens especially in USA as well the risk of spread of vancomycin resistance genes to other pathogenic bacteria such as *Staphylococcus aureus*. High concentration of vancomycin (0.1-1 mg mL<sup>-1</sup>) and VRE of the VanA-type (10<sup>6</sup> CFU mL<sup>-1</sup>) in sludge derived from vancomycin production and discharged into a sewage treatment plant (Guardabassi *et al.*, 2002).

The Pulsed Field Gel (PFGE) analysis a discriminatory method commonly used for genetic typing of enterococci, revealed the similarity of VRE isolates of the sewage from the source isolates. Pharmaceutical industries should prevent and monitor waste contamination. The magnitude of the problem should be studied and assessment of human health risks. Antimicrobial are widely used as therapeutics agents for animals mainly for the treatment of chronic skin infections.

Cephalosporines are the commonly used which are used in human similarly. Accordingly, intensive use of antimicrobials in small animals could present a hazard to the human population by promoting the development of resistant bacteria which subsequently can be transmitted to their owners either directly by physical contact by petting, licking and physical injuries or indirectly through contamination of food or furnishings. The role of pet animals as reservoirs of antimicrobial resistant bacteria have been noticed. Topical and systemic antimicrobial for

treatment of domestic animals such as cats, dogs, camels, etc. provide a situation in which exchange of resistant bacteria can take place such as *Staphylococcus intermedius* 90% of cases, less frequently with *S. aureus* these can vary according to geographical variations (Pellerin *et al.*, 1998). Transfer of resistant human pathogenic *Staphylococci* such as Methicillin-Resistant *S. aureus* (MRSA).

Between humans and animals seems to be more common and serious. Canine MRSA infection is typically associated with chronic infection and repeated treatment (Guardabassi *et al.*, 1998; Lloyd *et al.*, 1996; Tanner *et al.*, 2000). Independent of the source of infection, pets can act as important reservoirs of MRSA within family households (Tomlin *et al.*, 1999; Manian, 2003).

Culture from the nasal cavity of the family dog showed the presence of the same MRSA strain and recurrence of the infection in the couple was stopped after eradication of the organism in the dog. The risk posed by coagulase-negative *Staphylococci* have yet to be assessed as such organisms are commonly much more resistant than *S. intermedius* but whether they readily can transfer antimicrobial resistance to humans remains to be studied.

## MATERIALS AND METHODS

About 50 patients randomly selected whose proved to have *Staphylococcus* antimicrobial resistance detected by Bact tech in Assir hospital microbiology laboratory. Variable specimens were collected from patients that include blood, urine, sputum and aspirates. The patients have presented with variable clinical problems including respiratory tract infections, septicemia, infected wound, severe burns and urinary genital infection.

These patients were presented to Assir hospital (Abha, KSA) so they are nosocomial infection. The specimens were cultured mainly in blood agar from which a gram stained slides were prepared and visualized microscopically (100×immersion oil). The catalase test was applied to gram positive cocci for detection of *S. aureus*. The Bac tech machine was used to determine the resistance against commonly used antibiotics mainly the beta lactam groups (Cheesbrough, 2000; Richard and Pamela, 2007). A special questionnaire was used to assess the knowledge, attitude and practice of patients towards using antimicrobials beside epidemiological and demographic data.

## RESULTS

The patients participated in this study were having antimicrobial resistance towards the common used antibiotics MRSA (Methicillin-Resistant *Staphylococcus*

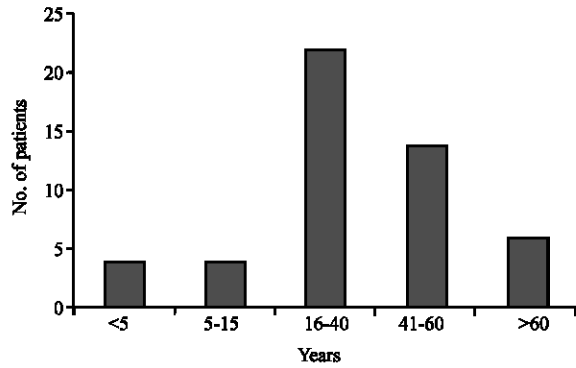


Fig. 1: Age groups of the patients

Table 1: The attitude of patients towards their treating doctor or pharmacist

Attitude pattern	No. of patients
Involved	13
Deferent	11
Critical	14
Ignored	12

Table 2: Describing the antimicrobial dosage to patients

Describing body	No. of patients
Physicians	32
Pharmacists	10
No one	5
Others	3

Table 3: The patients compliance grading towards following their medication dosage

Grade (%)	No. of patients
<10	8
10-<50	14
50	10
51-99	12
100	6

*aureus*) as well as penicillin and Cephalloxcin (cell wall inhibitor). The nationality of all patients were Saudian (49 patients) only one was a Sudanese. The age group of the involved patients were 4 patients <5 years similarly among 5-15 years, 22 patients were 16-40 years, 14 patients were 41-60 years and 6 patients were >60 years of age (Fig. 1). The attitude of patients towards their treating doctor or pharmacist involved 13, deferent 11, critical (serious) 14 and ignored by 12 which almost equally shows Table 1. About 32 (64%) patients used to exaggerate their symptoms to their doctor to let him prescribed any antimicrobial drugs versus 18 patients (36%) used not to do so. Patients purchase the antimicrobial drugs depending on the quality were 32 (64%) and on less price were 18 (36%). Knowing the dosage of antimicrobial was enlisted by 42 patients (84%) in contrast to 8 patients (16%) did not.

Describing the antimicrobial dosage to patients were 32 physicians, 10 pharmacists, 5 no one and 3 described by others (one by relative and two by friends) (Table 2).

About 35 patients (70%) have received drug side effects description and 15 patients (30%) received no description. The patients compliance grading towards following their medication dosage were <10% by 8 patients, 10<50% by 14 patients, 50% by 10 patients, 51<100% by 12 patients and 100% by 6 patients (Table 3). About 27 patients (54%) have no home animals while 23 patients (46%) have got home animals (7 patients have cats, 7 have goats, 6 have sheep, 2 have camels and one have dog). Only 7 patients (14%) have noticed infected wound on their home animals, 2 patients of them (4%) used to treat their home infected animals. About 20 patients (40%) used to through some of antimicrobial home waste in open carbidge.

## DISCUSSION

Infections are considered nosocomial if they first appear 48 h or more after hospital admission or within 30 days after discharge. However, hospitals having large number of patients sick; increased use of outpatient treatment; medical staff moving from patient to another; routine use of antimicrobial agents are considered some of the reasons behind increasing rates of nosocomial infections. It is much obvious the wide spread of nosocomial infection among the hospitals and the misuse of antibiotics. This phenomenon came up with patient's suffering from nosocomial infection and it recorded a number of deaths as a result. For example, it contributed to 88,000 deaths in USA in 1995. One third of nosocomial infection are considered preventable (Ricks, 2007). The incidence of nosocomial infection and prevalence of antibiotic misuse were studied in a 174 bed community hospital in Saudi Arabia over a 6 months period. Of 2445 patients admitted, 8.5% developed nosocomial infection (McBryde, 2004). It was reported recently that a greater rate of treatment failures with vancomycin in MRSA when the minimum inhibitory concentration is  $\geq 2$  mg. Although, the isolation of MRSA strains with MIC of vancomycin  $\geq 2$  mg is more frequent in the hospital acquired bacteremi episodes in the clinical practice, it is not useful predictive parameter because the frequency of isolation of these strains in the community is also high (Klevens *et al.*, 2007). In this study 22 patients were 16-40 years of age, the attitude of patients towards their treating doctor or pharmacist evenly distributed among the studied patients (involved 13, deferent 11, critical (serious) 14 and ignored by 12).

About 64% patients used to exaggerate their symptoms to their doctor to let him prescribed any antimicrobial drugs. About 64% of patients purchase the antimicrobial drugs depending on the quality. Knowing

the dosage of antimicrobial was enlisted by 84% patients. Almost half of the patients have no home animals. The infected home animals wounds were noticed by 7 patients (14%) and only 2 patients of them (4%) used to treat their home infected animals so the animal role is very minor in the spread of antimicrobial resistance. Although, only 20 patients (40%) in this study used to through some of antimicrobial home waste in open carbidge but the habits and attitudes of the population in general will show that >90% of the population used to through some antimicrobial home waste in open carbidge.

Hospitals are following some methods that can help them in preventing the nosocomial infection such as observance of aseptic technique, frequent hand washing specially between patient's, careful handling, cleaning and disinfection of fomites, possible use of disposable items, patient isolation, avoiding some medical procedures that can lead with high probability to nosocomial infection, various institutional methods, i.e., air filtration within the hospital, using apron and gloves (Al-Ghamdi *et al.*, 2002; Abedon, 1998; Black, 1996). The *Staph. aureus* is the predominant bacterial pathogen among hospital acquired and community acquired infections. *Staph. aureus* colonizes the nose and some times the axillae, hair, throat and perineum. Commonly it causes wound infections, superficial or deep and blood stream infections. Hospital acquired infections lead to a prolonged stay in a hospital, *Staph. aureus* strains which are resistant to methicillin MRSA are difficult to treat. If resistant to methicillin, these strains are also resistant to flucloxacillin and to all other B-lactam antibiotics (Tortora *et al.*, 1995). The frequency of resistant to antibiotics among hospital acquired infections are increasing. Resistant rate to methicillin which is the first choice for nosocomial infections are increasing while alternative choice drug, vancomycin is normally very little or no absent (Storr, 2000). About 3439 patient's who were admitted in a maternity hospital in KSA were exposed through a study of nosocomial infection and misuse of antibiotics. Patient's history, diagnosis and clinical and laboratory data were all analyzed. Any developing infection 72 h. Since admission was considered as nosocomial: 4% developed nosocomial infection were mostly found in the urinary and lower genital, among newborns, over 70% of cases were eye, ear, skin and blood infections. Gram negative bacteria cause 65.7% of the infection. 90% were multidrug-resistant and 57% of the single and multiple antibiotics were misused.

The thing that push up to improve the infection control misuses and antibiotic restriction interventions (Ortega *et al.*, 2008). Development and improvement of the current practices and making the infection control more

effective, comprehensive and coherent and following an aggressive approach and a strict infection control strategy will help in reducing the number of the patients who are suffering from nosocomial infections and as a result it will minimize the number of deaths of nosocomial infections (Rojas *et al.*, 2005).

## CONCLUSION

Antimicrobial resistance is an issue of global concern. It request an interdisciplinary approach that involved; clinicians, researchers and pharmaceuticals. Patients often do not comply with antimicrobial prescription, enhancing the development of antimicrobial resistance during treatment. Good physicians should give more care towards their patients to reduce their noncompliance and antimicrobial misuse. Bacterial resistance can develop not only in human or animals treated with antimicrobials but also in environments where antimicrobials are present as residues from industrial production. Similarly, the role of pets as reservoirs of resistant bacteria should be carefully dealt with.

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