LITERATURE REVIEW

1. Gyssens I C, et al (1999). In this study, researchers suggested that, major reasons to frame antibiotic policies are to improve the quality of patient care, to limit the emergence of resistance, and to contain costs. Recommendations for the content and management of future antibiotic policy strategies in hospitals include educational programmes, consultation by infectious diseases physicians, restriction of the formulary, timely narrowing of empirical broad spectrum therapy or streamlining, and automatic stop orders.

2. Bavestrello L, et al (2000). They conducted a retrospective study to find out the impact of regulatory measures on antibiotics sales in pharmacies. The consumption unit used was the Defined Daily Dose per 1000 inhabitants/day (DDD). There was an important reduction in DDD, after the introduction of regulatory measures, for broad spectrum antibiotics. The regulatory measures of the Ministry of Health had an immediate and great impact on antibiotics sales in Chile.

3. Basetti M, et al (2001). They compared the expenditure and usage of antibiotics at the San Martino Teaching Hospital, Italy, before and after the implementation of an antibiotic control program that streamlined the hospital formulary and the creation of a restricted group of antibiotics requiring approval before use. After the implementation of the antibiotic control program, overall antibiotic usage decreased by 8.5%, 28.00 DDD/100 patients, and the creation of a restriction program using the expertise of infectious disease physicians resulted in significant reductions in the use of and expenditure for antibiotics.

4. Darren R Linkin, et al (2002). The investigation team tried to determine the incidence of inaccurate communication of patient data during ASP interactions in a tertiary care hospital. Communicated patient data were evaluated for clinically important inaccuracies using the medical record as a gold standard. The study concludes that, a high proportion of ASP calls for prior approval included patient data inaccuracies, which have the potential to affect antimicrobial prescribing. Inaccurate communications may compromise the utility of prior approval ASPs in optimizing antimicrobial use.

5. Ho P L, et al (2004). This study was a discussion to assess the implementation of an 'antimicrobial stewardship programme' as a means to improve the quality of antimicrobial use in a hospital setting in Hong Kong. From data search, five
commonly asked questions about an 'antimicrobial stewardship programme' were selected for discussion by the participants. Published information on the rationale, components, outcome measures, advantages, and disadvantages of the programme was reviewed. The discussion ends with a conclusion that, antimicrobial resistance substantially raises already-rising health care costs and increases patient morbidity and mortality.

6. **Ng C K, et al (2004)**. The focus of the study was to reduce inappropriate prescription of broad-spectrum antibiotics and overall antibiotic prescription through implementation of a multidisciplinary antibiotics stewardship programme (ASP). The ASP reduced the restricted and total antibiotic consumption as well as the antibiotics-related costs. It is cost-effective to implement a multidisciplinary ASP in acute service hospitals.

7. **VanKasteren M E, et al (2005)**. The objectives of this study were to reduce the quantity and improve the quality of surgical prophylaxis and to reduce costs. The quality of prophylaxis was audited before and after an intervention consisting of performance feedback and implementation of national clinical practice guidelines. After the intervention, antibiotic choice was inappropriate in only 37.5% of the cases instead of in 93.5% expected cases. The intervention led to improved quality of surgical prophylaxis and to reduced antibiotic use and costs without impairment of patient outcome.

8. **K L Buising, et al (2005)**. This study evaluates the impact of a novel computerized antimicrobial approval system on antibiotic-prescribing behaviour in a hospital. Effects on drug consumption, antibiotic resistance patterns of local bacteria and patient outcomes were monitored. Data were collected over 7 years that is 5 years before and 2 years after deployment. The gradients in the use of all antibiotics fell after deployment, while extended-spectrum penicillin use increased. The system was successfully adopted and significant changes in antimicrobial usage were demonstrated.

9. **La Rosa L A, et al (2007)**. The researcher evaluated whether prescribers wait until after the prior-approval period to order restricted antimicrobial therapy that is in conflict with guidelines or unnecessary. Compared with restricted antimicrobial therapy ordered when the ASP is active, these courses of therapy are less often continued by the ASP, suggesting that they are more likely to be in conflict with guidelines or unnecessary.
10. Mach R, et al (2007). The study objective was to evaluate the impact of a restrictive antibiotic policy, efficacy of inpatient therapeutic and prophylactic antibiotic regimens and susceptibility patterns of infecting bacteria. It was a retrospective computerized survey of antibiotic prescribing practices over a five-year period, using medical records and laboratory data from the hospital information system (HIS). Due to a restrictive antibiotic policy implemented in 2002, the use of several antibiotics in 2003 was significantly reduced.

11. Elias Iosifidis, et al (2008). The team conducted retrospective study to find correlation between the rates of antimicrobial drug consumption in hospital departments and the prevalence of antimicrobial resistance among clinically important bacteria recovered in the hospital. This study demonstrated significant correlations at the hospital department level between the rates of consumption for certain groups of antimicrobials and the prevalence of resistance in specific bacterial species.

12. Marc H Scheetzl, et al (2008). It was a study to determine the cost-effectiveness of Antimicrobial Stewardship Teams (ASTs) on the reduction of morbidity and mortality associated with nosocomial bacteraemia. A decision analytic model compared costs and outcomes of bacteraemic patients receiving standard treatment with or without an AST consult. The difference in effectiveness between the two strategies was 0.08 QALYs. Results from the probabilistic sensitivity analysis demonstrated there was more than 90% likelihood that an AST would be cost-effective.

13. A M Kadal, et al (2009). The aim of this study is to determine antibiotic related medication errors in Indian hospital setting. The medication errors were analysed by using chart review method in prospective spontaneous reporting study conducted in MICU. The various antibiotic classes involved in medication errors were β lactam antibiotics (55.6%), Nitroimidazole (25%), Monobactam (8.3%) and Quinolones (6.9%) antibiotics. Medication errors occur frequently in MICU of tertiary care hospital. Therefore it is essential to establish medication error reporting system at each hospital.

14. Julie Bruce, et al (2009). They evaluated the effect of implementation of European Commission Concerted Action Antibiotic Resistance Prevention and Control (ARPAC) Project in the various ASPs in the European hospitals. A questionnaire survey on antibiotic stewardship factors was completed by 170 hospitals from 32 European countries. Hospital antibiotic policies commonly included recommendations on individual drugs, drug choices, dosage, duration and route but were less likely to
contain information on side effects and cost. Policies and practices relating to antibiotic stewardship varied considerably across European hospitals.

15. Wagner D (2009). The study was conducted to assess the specific measures implemented to control transmissible antibiotic resistant bacteria or ‘Alert Organisms’ in European hospitals in 2001. It was a questionnaire surveys on policies and practices for surveillance and control of Alert Organisms (AO) in 167 acute care hospitals in 34 European countries. In 87% of hospitals, the laboratory provided AO detection reports to the infection control team.

16. Dominik Mertz, et al (2009). Their study was to evaluate outcomes following implementation of a checklist with criteria for switching from intravenous (IV) to oral antibiotics on unselected patients on two general medical wards. During a 12 month intervention study, a printed checklist of criteria for switching on the third day of IV treatment was placed in the medical charts. The study concludes that on general medical wards, a checklist with bedside criteria for switching to oral antibiotics can shorten the duration of IV therapy.

17. Stein G E et al, (2010). A literature review was conducted to investigate the pharmacokinetics and pulmonary and tissue penetration of vancomycin and linezolid. Using MEDLINE and EMBASE, the most relevant articles in English published over the past 25 years were identified and summarized. Review gives insights not provided by the clinical trial data and together provides clinicians with a more comprehensive basis for selecting appropriate antimicrobial therapy for the treatment of serious MRSA infections.

18. Nga do T T, et al (2010). A quantitative and qualitative aspect of antibiotic sales in private pharmacies in northern Vietnam was studied. Result of the cross section study was that, over the counter sales of antibiotic without a prescription remains a major problem. Suggested areas of improvement are enforcement of regulations and pricing policies and educational programs to increase the knowledge of drug sellers as well as to increase community awareness to reduce demand-side pressure for drug sellers to dispense antibiotics inappropriately.

19. Amer M R et al (2010). The primary objective of this study was to compare the prescribing appropriateness rate of the empirical antibiotic therapy before and after the ASP implementation in a tertiary care hospital. For the ASP group, initially 79.1% (19/24) of the antibiotic uses were inappropriate and diminished by ASPs to 0% on
the recommendations implementation. This study highlights the importance of stewardship program and may serve as a foundation for further ASP initiatives.

20. Dunn K, et al (2011). The aim of this study was to assess the impact of the introduction of guidelines and criteria for switching to oral antimicrobials. The study was divided into pre-intervention and post-intervention phases. The duration of intravenous treatment, the timeliness of switch to oral therapy, length of stay and cost savings were measured. The duration of IV antimicrobial treatment and timeliness of the switch reduced significantly in the study group post-intervention, compared to the control group. This study may be used as a template for the introduction of further pharmacist-led antimicrobial stewardship initiatives.

21. Nanitha, et al (2011). The main objective of this study was to assess the impact of antimicrobial stewardship programs on the multidrug resistance patterns of bacterial isolates. The study is divided into two phases, that is Phase I intervention programme, implementation of an antibiotic policy in the hospital and assessment of the impact of the Phase I intervention programme. Phase II intervention programme include formation and effective functioning of the antimicrobial stewardship committee. Phase I interventions resulted in a decrease of 4.47% in ESBLs (E.coli and Klebsiella) and a significant decrease of 40.8% in carbapenem-resistant Pseudomonas. Phase II intervention brought a significant reduction (24.7%) in carbapenem-resistant Pseudomonas. This study strongly suggests that, an antimicrobial stewardship programme is essential to promote the judicious use of antibiotics.

22. Valerie Leung et al (2011). In this study, researcher evaluated the antimicrobial stewardship program in the intensive care unit of a hospital, in order to determine the cost and utilization of antimicrobials, as well as the rate of nosocomial acquired C. difficile infection. The study concludes that, antimicrobial stewardship program in a community hospital was associated with significant decreases in antimicrobial costs and in utilization of antipseudomonal antimicrobial agents and a nonsignificant decrease in the rate of C. difficile infection.

23. M K Joung, et al (2011). They evaluated clinical outcomes and risk factors related to de-escalation therapy in patients with intensive care unit (ICU)-acquired pneumonia. This was a retrospective observational cohort study of ICU patients who developed pneumonia more than 48 hours after admission to the ICU at Samsung Medical Center. The 137 patients comprised 44 (32.1%) who received de-escalation therapy
and 93 in the non-de-escalation group. The de-escalation group showed a lower pneumonia-related mortality rate than the non-de-escalation group by day 14.

24. **Palanisamy A, et al (2011).** They have implemented the conversion based on the eligibility criteria and assessed the impact of intervention provided. All inpatients who have prescribed at least one IV Antimicrobial Agents included from the general medicine department for a six month period. Researchers divided all the participants to control and test group with 90 and 36 respectively. They concluded that average cost of therapy was low for test group compared with the control group was obtained.

25. **Katsios C M, et al (2012).** Their objective was to determine whether the introduction of an ASP in an ICU altered the decision to treat cultures from sterile sites compared with nonsterile sites. They also sought to determine whether ASP education improved documentation of antimicrobial use, including an explicit statement of antimicrobial regimen, indication, duration, and de-escalation. Introduction of an ASP in the ICU was associated with improved microbiologically targeted therapy based on sterile or nonsterile cultures and improved documentation of antimicrobial use in the medical record.

26. **Angela Huttner, et al (2013).** Their view is antimicrobial resistance (AMR) is now a global threat. Antimicrobial conservation/stewardship programs have seen some measure of success in reducing antimicrobial overuse in humans, but their reach is limited to acute-care settings in high-income countries. Educational programs targeting both antimicrobial prescribers and consumers must be further developed and supported.

27. **John M Boyce, et al, (2013).** In this study researchers evaluated a strategy of discontinuing vancomycin if both nasal and throat cultures were negative for MRSA when lower-respiratory-tract cultures were not available. An antimicrobial stewardship team identified patients receiving empirical vancomycin for suspected or proven health care associated pneumonia, but for whom adequate lower-respiratory-tract cultures were not available. Study suggests in the absence of adequate lower-respiratory-tract cultures, it is reasonable to discontinue empirical vancomycin.

28. **Marwa R, et al (2013).** The primary objective of this study was to compare the prescribing appropriateness rate of the empirical antibiotic therapy before and after the ASP implementation in a tertiary care hospital. Adult medical ICU patients were enrolled in a prospective fashion under the active ASP arm and compared with historical patients who were admitted to the same unit before the ASP.
implementation. The study suggests, a proactive ASP is a vital approach in optimizing the appropriate empirical antibiotics utilization in an ICU setting in tertiary care hospitals.

29. Alan P Johnson, (2013). In this research, the researcher reports the development of an interactiveweb tool, called AmWeb, for the local surveillance of resistance by hospital laboratories in England. The application of AmWeb should help to both optimize the management of patients with infection and contribute to efforts to prolong the active life of antibiotics currently available for use.

30. HK Ki, et al (2013). Researchers conducted a study to know the impact of antimicrobial restriction program on the pattern of antimicrobial prescription and antimicrobial resistance. They reviewed the prescribed antimicrobial agents and the dosage of each antimicrobial agent from the year 2005 to year 2012. This study concluded that antimicrobial restriction program decrease the usage of broad spectrum antimicrobial agents.

31. Yashwant Kumar, et al (2013). The study was aimed to formulate an antibiogram and to characterize resistance marker among E. coli isolate from UTI. From a total of 55 patients 9% of isolates was found to be sensitive to nitrofurantoin and high resistance 48 (87.3%) was found against nalidixic acid followed by ampicillin 46 (85.5%). The study concludes that generation of antibiograms are essential to withstand the changing trends of antibiotic resistance and empirical selection should be based on knowledge of local prevalence rather than universal guidelines.

32. N. Shanmug, et al (2014). This team conducted a study to analyze antibiogram and altering susceptibility pattern of multi drug resistant pathogen. From the study they found that ESBL E. coli (73%) followed by K. pneumonia (61%) are most prevalent MDR gram negative and MRSA (24.5%) among gram positives. Thus the data obtained from the study showed the empiric therapy for each type of infection is required there by optimized the antibiotic use with antibiogram.

33. John P Furono, et al (2014). They conducted a cross sectional study among residents of three nursing facilities with an objective to develop SNF specific antibiograms and identify opportunities to improve antibiotic prescribing. At the end of the study, they found that prevalence of appropriate antibiotic prescribing was increased from 32% to 45% after antibiogram implementation. This study supports the use of antibiogram to improve empirical antibiotic prescribing.
34. **M. Salman Shah, et al (2015)**. The have conducted a cross-sectional study to identify medical doctor’s knowledge and attitudes regarding antimicrobial resistance and current antibiotic prescribing practices at tertiary care hospitals. In that, 85% doctors considered use of broad spectrum antibiotics as very important factor and believes that use of anti-biograms was helpful. Thus all measures should be taken to bridge this gap in an endeavor to reduce hospital acquired infections and antibiotic resistance.

35. **Susette K Var, et al (2015)**. The team conducted a retrospective study to formulate and evaluate a regional anti-biogram to monitor antimicrobial resistance by compiling recent anti-biograms from 12 hospitals. By analyzing the compiled anti-biogram they found that *Staphylococcus aurea*, was most common isolate. This study propose that it is advantageous to have a sense of resistance patterns in a region in order to decide on the best antibiotic for use, lessening the increased lengths of stay, multiple trials of antibiotics, and non-judicious use of broad-spectrum antibiotics.