TRENDS IN ORAL ANTIMICROBIAL DRUG PRESCRIPTIONS IN THE OUTPATIENT SETTING

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A research report submitted to the Faculty of Health Sciences, University of Witwatersrand, in partial fulfilment of the requirements for the degree of

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DECLARATION

I, Nireshini Bhimsan, declare that this research report is my own work. It is being submitted for the degree of Master of Pharmacy in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

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10th day of February, 2000

DEDICATION

To my husband, Visham Bhimsan, for his great support during the research report and the degree as a whole.

ABSTRACT

All prescriptions dispensed in the managed care environment for the period 01 May 1998 to 31 May 1998 were evaluated to identify oral antimicrobial drugs contained in these prescriptions. A total of 2711 prescriptions were evaluated, with 788 antimicrobial prescriptions being identified. The oral antimicrobial prescribing frequency in the managed care environment for May 1998 was 29.07%. In the United States, these drugs represent 12-14% of all drugs prescribed by office based physicians. Thus the prescribing frequency for managed care is high and could be attributed to the high antimicrobial prescribing frequency for the common cold and influenza during this period. Oral antimicrobial drugs identified were classified into 8 different drug classes, with the penicillins being prescribed most frequently, accounting for 35.41% of all antimicrobial prescriptions. Amoxycillin was the most frequently prescribed active ingredient within the penicillin drug class. Antimicrobial drugs were most frequently prescribed for respiratory disorders and symptoms, which accounted for 65.68% of all diagnoses. The managed care data showed a variation in trends of antimicrobial drug use in specified medical diagnoses compared to the Essential Drug List (EDL) recommendations for South Africa. Antimicrobial drugs are frequently used in viral conditions like the common cold and influenza; acute, upper respiratory infections and acute pharyngitis, where clearly, these drugs have no role. In addition, the trend in managed care is towards the use of the newer, broader spectrum, more expensive antimicrobial agents compared to the EDL recommendations. Thus, this study indicates that clinical protocols and treatment guidelines are urgently required in managed care to ensure safe and effective antimicrobial use and to

decrease problems of antimicrobial resistance. This study indicated that the average antimicrobial prescription costs in managed care are higher than the cost calculated based on the EDL recommendations for antimicrobial prescribing in specified diagnoses. Significant cost savings could be achieved with the implementation of the EDL guidelines.

This study helped to assess the current practice of antimicrobial use in the managed care environment and assists in the development of future clinical guidelines and protocols to optimise antimicrobial utilisation and decrease costs associated with antimicrobial prescribing.

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CHAPTER 1

INTRODUCTION

In the outpatient setting, oral antimicrobial drugs feature consistently in the top leading therapeutic classes of drugs, in terms of frequency of use and cost. This trend is similar in the managed care environment. It is thus imperative to monitor and trend antimicrobial usage patterns to determine its impact on the managed health care system.

The concept of managed care is relatively new and novel in South Africa. Health care costs are an increasing concern to the nation and are an important issue as managed care expands[1]. Current economic realities require healthcare providers and administrators to focus on cost-effectiveness and quality and the growth and development of managed care is clearly a response to these concerns[2]. Previously, cost containment in drug therapy concentrated largely on identifying the high-cost drug therapies and attempting to rationalise and minimise their use. It is now increasingly appreciated that use of the most effective treatment, regardless of its cost, may be the most cost effective because this treatment may result in the desirable outcome at the lowest total cost[3]. For example, drugs costs may increase, but if managed appropriately, total costs will decrease as effective drug use will decrease general practitioner consultations, emergency visits or hospitalisation and this approach is widely adopted especially in light of the managed care concept, which entails a holistic view of all health care elements. The challenge to an appropriate pharmaceutical management programme is to control costs without adversely affecting the quality of care and, equally important,

providers' and recipients' perceptions of the quality of care[4]. This managed care concept was developed on a model from the United States. It focuses primarily on appropriate and cost-effective care as well as the access to quality care. The concept also stresses on the importance of data collection and analysis of data as it is an 'information driven" concept. Southern Healthcare (SHC) defines managed care as "the appropriate care, at the appropriate time, at the appropriate place, done right." The data from SHC were used for this research report.

With regards to the pharmaceutical benefit in the managed care setting, members have access to quality medicine with no limits imposed on both acute and chronic medication benefits, unlike conventional medical aids. The rationale is to allow benefits if medically necessary and if care is appropriate, as outlined above. Most medical schemes in South Africa tend to focus primarily on chronic medication utilisation and in fact, do not monitor acute medication usage patterns, for example, antimicrobial usage. Southern HealthCare has identified a high utilisation of acute medication and the focus is on identifying and trending the overall medication utilisation profile of members in order to see the full picture, in terms of total medication, more clearly. Managed care models have shown that simply taking the information available via a retrospective information system, applying this information against comparable information, then documenting action taken to investigate, and change if necessary, inappropriateness in the pharmacy benefit will ensure quality[4].

In this managed care environment, and as part of its integrated "information driven" monitoring system, doctors who belong to the network, termed participating doctors, are required to submit all claims using the diagnostic coding system, developed by the World Health Organisation (WHO), known as the International Classification of Diseases, tenth edition (ICD-10). This enables managed care to focus on diseases that are prevalent, to trend their patterns of occurrence and determine the impact of these diseases on cost. This data collection plays a pivotal role in determining various factors in the organisation, including the impact of seasonal variation on diseases and health and enables areas like Underwriting and Costing to budget appropriately for medication, consultations, hospitalisation and other important areas of health care.

There are wide variations in prescribing patterns both within and among practices and an ever-increasing number of drugs available to choose from[5]. The clinician is faced with the task of choosing a useful yet cost-effective antibiotic among a rapidly increasing list of choices[6]. In the prescribing of appropriate antibiotic therapy, the physician must attempt to find the least expensive, and yet most cost-effective agent(s) available[7]. There are many factors that determine the choice of an antimicrobial agent and it is important that a logical and stepwise approach is used to select a specific antibiotic for a given patient and some of the criteria include:

1. Identifying the infecting organism
2. The organisms' antibiotic sensitivity pattern
3. Bactericidal versus bacteriostatic antibiotics

4. The site of infection
5. Host factors
6. Monotherapy versus combination antimicrobial therapy
7. Clinical pharmacology of antibiotics
8. Appropriate duration of therapy
9. Community versus Nosocomial infections
10. Cost of Therapy[7]

Often in the outpatient setting, the causative organism cannot be determined by laboratory investigations and empiric therapy is initiated. The prescribing of empirical antibiotic therapy relies on clinical judgement, often with incomplete culture and sensitivity data, and the choice of a particular regimen may be based on presumptions about the site and organisms involved, the condition of the patient and the physician's preference or formulary choices[3]. A study on empirical antibiotic prescribing in a hospital demonstrated that this is a high priority target area for medication use improvement . The impact of inappropriate antimicrobial prescribing on direct and indirect health care costs can be substantial[8]. In hospital practice, the need for an antibiotic prescribing policy is well established and policies exist in many hospitals[9]. In spite of this, there is still scope for much improvement in the area of antibiotic use. In contrast to a relatively large amount of studies in hospitals and clinics, there are few community-based data describing the pattern of antibiotic usage in the general population[10]. Several groups have experimented with methods to evaluate appropriate use of antimicrobial agents in ambulatory practice but this is somewhat more difficult to assess than it is in hospitals because of the widely dispersed nature of office practice[11].

Thus, the use of antimicrobial drugs in the outpatient setting is an area that urgently requires research. This lack of studies in the field, where medicines are actually consumed, prevents us from understanding the problems perceived by consumers and hampers the development of adequate policies[10], and clearly, adequate antimicrobial drug policies in the outpatient setting is lacking.
A further reason for establishing an effective antibiotic policy in general practice is to limit the emergence of resistance organisms resulting from the selection pressure exerted by the type, and more importantly, amount of a particular agent used[9].

The responsibility of reducing resistance lies with the physician who uses antimicrobial agents and with patients who demand antibiotics when the illness is viral and when antibiotics are not indicated[12]. It is also critical for the pharmaceutical industry not to promote inappropriate use of antibiotics for humans and for animals because this select pressure has brought us to this crisis[12].
In a number of countries, many antimicrobial drugs are freely available without prescription[13]. In South Africa, this is not the scenario, since all antimicrobial drugs carry a schedule four status and may only be obtained on prescription from a doctor. Clearly, more responsibility regarding antimicrobial prescribing lies with the prescriber, as self-medication with antibiotics is not an option for patients.

A recent survey by the Centres of Disease Control and Prevention documented increasing use of broad-spectrum, more expensive antimicrobial drugs by office based physicians in the United States to treat otitis media, sinusitis and other

common infections[13]. The development of some resistance is almost certainly an inevitable consequence of the clinical use of antimicrobial drugs[13], although there is clear evidence that it need not occur to the degree that it now does[14].

Misuse and overuse of antibiotics are now threatening to undo all their early promises and success in curing disease[15]. It is a fruitless option to blame and a more productive route is to recognise the problem and agree strategies to slow down the loss of important drugs from our therapeutic armamentarium[16]. Development of resistance is directly related to the use of a particular antimicrobial and it is for this reason that the use of broad-spectrum antimicrobials should be limited[17]. In addition, potent broad-spectrum antibiotics initially directed towards hospital use, for example, the quinolones, are now available in oral form and are being promoted for use in the community[9]. The extensive use of antibiotics in the community and hospitals has fuelled the crisis in antibiotic resistance[12].

The extraordinary impact of antibiotics in the treatment of bacterial infections, the continued increase in drug resistance and the considerable resources spent on antibiotics world wide are all compelling reasons for concern about the prudent use of these powerful agents[10]. The responsibility lies with all individuals concerned with the utilisation of antimicrobials.

Many attempts have been made to minimise, rationalise and encourage proper antimicrobial use. An antibiotic audit itself cannot be expected to alter a

physician's prescribing patterns[24]. Other measures such as formulary restriction or the requirement of specific treatment approved by a pharmacist or infectious diseases clinician, have been successful in altering patterns of antibiotic use[24].

While traditionally passive forms of education are not powerful means of changing prescribing behaviour, innovative approaches, including person-to-person tutorials can improve the quality of antibiotic prescribing[24]. This is particularly relevant to this managed care approach, where prescribers are visited on a one-on-one basis by the Pharmacy Benefit Manager, and their prescribing profile is shown to them. This increases the prescriber's awareness of his prescribing pattern, with the intention to educate and encourage prescribers to improve areas like antimicrobial utilisation and control drug expenditure associated with high cost prescribing, without being prescriptive. This rationale is in accordance with adequate evidence that exists to prove that the more successful of these managed care plans are those that motivate (rather than force) healthcare providers to provide quality care[25].

In the United States, antimicrobial agents are the second most commonly used class of drugs[1]. Oral antimicrobial drugs represented twelve to fourteen percent of all drugs prescribed by office-based physicians in the United States[1].

In England, there has been a steady annual increase in the number of prescriptions for antibiotics, which has been the greatest for the quinolones[21]. This study also raised the question, 'Why has antibiotic prescribing increased

inexorably over the past decade[21]?". The authors believed that the overall increase in antibiotic prescribing is due in part to a gradual increase in the use of antibiotics for respiratory symptoms, but the hypothesis could not be tested from Scottish or English prescribing databases because they contain no information about indications for prescribing[21].

Another study has indicated that Acute Respiratory Infection (ARI) is a major cause of morbidity in developing countries, being responsible for twenty percent of medical consultations, thirty percent of absenteeism, and seventy-five percent of all antibiotic prescriptions[22]. Studies in India, Bangladesh, Thailand and Tanzania estimate that twenty four to fifty percent of the total pharmaceutical budget is spent on antimicrobial agents[23].

The literature clearly indicates that antimicrobials, as a class of drugs, are a particularly important area of drug use. There is sufficient evidence that antimicrobials are used frequently, there is undoubted a problem of antimicrobial resistance and thus the ever-increasing need for new drugs, as well as the high cost associated with antimicrobial prescribing. There are thus pressing medical and economic reasons to focus on antimicrobial drug use and to improve our understanding of antimicrobial prescribing in a managed care setting.

This study will determine the frequency of prescriptions for oral antimicrobial drugs in the outpatient setting, in the managed care environment. This prescribing frequency will be compared to documented literature on the frequency of

outpatient antimicrobial prescribing in the United States, as this data is not available for South Africa. In addition, the medical conditions or diagnoses for which these antimicrobial agents were received will be obtained and this will help to identify a trend of oral antimicrobial agents used for specific medical conditions. This data will be compared to the Essential Drugs Programme for South Africa for guidelines on antimicrobial use in certain clinical settings to determine if similar trends are used in this managed care environment. Currently, the managed care concept has not developed standard treatment guidelines for outpatient antimicrobial use and this study will help to determine whether treatment guidelines are needed.

The concept of an essential drug list policy involved the selection of a list of medication that would meet the health care needs of the majority of the population as stated in the World Health Organisation's (WHO) publication on the use of essential drugs (1990):

"Essential drugs are those that satisfy the needs of the majority of the population; they should therefore be available at all times in an adequate amount and in the appropriate dosage form[24]" Other general issues include appropriate availability and appropriate use of antibiotics[25] and care is called for in selecting antibiotics for use.

The implementation of an Essential Drug List and Standard Treatment Guidelines is aimed at rational drug use, having an impact on prescribing habits, reduction of costs and improved drug management[24], and this correlates with the managed care idea.

CHAPTER 2

MATERIALS AND METHODS

A report was generated reflecting all prescriptions dispensed for the period 01 May 1998 to 31 May 1998. These prescriptions were for members who belonged to a managed care plan. This report consisted of 2711 prescriptions dispensed over the one month evaluation period. Each prescription was reviewed to identify oral antimicrobial drugs contained in these prescriptions. Oral antimicrobial agents in the following drug categories were identified :

1. Penicillins
2. Cephalosporins
3. Beta-lactams : Other (example Loracaracef)
4. Erythromycins and other macrolides
5. Tetracyclines
6. Sulphonamides
7. Quinolones
8. Other antimicrobial agents

Antimicrobial drugs in each of the categories above were identified by reference to the MIMS classification. All antimicrobial prescriptions identified were logged onto a Microsoft Excel® Worksheet and each prescription was assigned a study number to maintain patient confidentiality. The total number of antimicrobial prescriptions identified was determined. This was calculated as a percentage of the total number of prescriptions generated over the one month evaluation period to determine the frequency of oral antimicrobial prescriptions.

In the United States, about fifteen percent of the outpatient prescriptions are

for antimicrobial drugs. The antimicrobial prescribing frequency determined in this managed care environment was compared to the documented literature on the frequency on antimicrobial prescribing in the outpatient setting in the United States to determine if there is any correlation with the managed care data.

The managed care environment has a network of doctors who sign up contracts with the organisation, and part of the criteria as per the contract, is that all claims submitted must contain diagnosis codes, as collection of data is vital to the organisation. These doctors submit diagnosis codes according to the International Statistical Classification of Diseases and Related Health Problems (ICD - 10) coding system. This data is then captured per claim onto a Medical Management System for each patient. However, members on the managed care plan are not exclusively restricted to using network doctors only, and may consult any doctor of their choice. Non-network doctors do not submit claims with ICD codes. Hence, it is not possible to obtain a diagnosis on every claim received.

The diagnosis or related problem for which the antimicrobial drug was received, was thus obtained for each member, where available. In addition, the patient's age and geographic location in terms of city or suburb and province were also obtained from the Medical Management subsystem. This data was assigned to the corresponding study number on the Microsoft Excel® Worksheet. The active ingredient of each antimicrobial drug was logged onto the Microsoft Excel® Worksheet and the drug was classified in terms of an antimicrobial drug class as indicated above. The price of each antimicrobial course was obtained

from the original prescription report.

The data was further analysed to determine the different antimicrobial drug classes used in the managed care environment and the corresponding active ingredients used within each drug class. All diagnoses were analysed to determine the disease conditions prevalent in this managed care setting and the frequency of occurrence of these disease conditions.

The Top 10 diagnoses or disease conditions, in terms of frequency, were analysed to determine the trend of antimicrobial drug usage for each diagnosis. This data was compared to the 1998 EDL recommendations on antimicrobial drug use in these disease conditions to determine if similar trends were used in the managed care environment. For each of the Top 10 diagnoses, the average "Blue Book retail" price per antimicrobial prescription was also determined for managed care. Based on the EDL drug and dosage recommendations, the price of an antimicrobial drug prescription for each of the Top 10 diagnoses was also calculated from the "Blue Book retail" pricing structure. The price of the managed care prescription was then compared to the prescription cost that would have been generated in the managed care environment should the EDL drug recommendations be implemented.

The research report protocol was approved by the Post-Graduate Committee and the Committee for Research on Human Subjects (Medical) of the University of Witwatersrand. The relevant approval documentation appear in Appendix A and Appendix B respectively.

CHAPTER 3

RESULTS

3.1 Oral Antimicrobial Prescribing Frequency

The main aim of the study was to determine the frequency of prescriptions for oral antimicrobial drugs in the outpatient setting in the managed care environment, received over a one month evaluation period and this is reflected in Table 3.1

Total number of Prescriptions Evaluated for the period 01 May 1998 to 31 May 1998	**2711**
Total Number of Oral Antimicrobial Prescriptions Identified	**788**
Oral Antimicrobial Prescribing Frequency	**29.07%**

Table 3.1 Determination of the Frequency of Prescriptions for Oral Antimicrobial Drugs in the outpatient setting in the Managed Care environment

The oral antimicrobial prescribing frequency determined was 29.07% for the period 01 May 1998 to 31 May 1998. This prescribing frequency will be compared to the frequency of oral antimicrobial drugs prescribed by office-based physicians in the United States to determine if similar trends are used in the managed care environment in South Africa.

3.2 Antimicrobial Drug Classes

All antimicrobial drugs identified were classified, as per their active ingredients, into corresponding drug classes. Table 3.2 below lists an overview of all antimicrobial active ingredients classified into their respective drug classes.

	Antimicrobial Drug Classes							
Antimicrobial Active Ingredient	Penicillins	Cephalosporins	Erythromycin and other macrolides	Quinolones	Tetracyclines	Beta- lactam: others	Sulphonamides and combinations	other antimicrobial agents
amoxycillin/clavulanic	113							
amoxycillin/flucloxacillin	26							
amoxycillin	134							
ampicillin	1							
ampicillin/cloxacillin	3							
azithromycin			36					
cefaclor		45						
cefadroxil		5						
cefixime		12						
cefpodoxime		43						
cefprozil		7						
ceftibuten		4						
cefuroxime		47						
cephalexin		23						
ciprofloxacin				34				
clarithromycin			73					
clindamycin								6
cloxacillin	1							
doxycycline					14			
enoxacin				1				
erythromycin			28					
Lincomycin								1
Lomefloxacin				2				
Loracarbef						27		
Minocycline					14			
Norfloxacin				1				
Ofloxacin				7				
oxytetracycline					10			
phenoxymethylpenicillin	1							
roxithromycin			47					
tetracycline,nyst,vit					1			
TMP/SMX							21	
Grand Total	279	186	184	45	39	27	21	7

Table 3.2 Overview of Antimicrobial Active ingredients classified into respective Drug Classes

Oral antimicrobial drugs identified were classified into 8 different drug classes as reflected in Table 3.2. Figure 3.1 is a pie-chart representation of each drug class as a percentage of the total drug classes

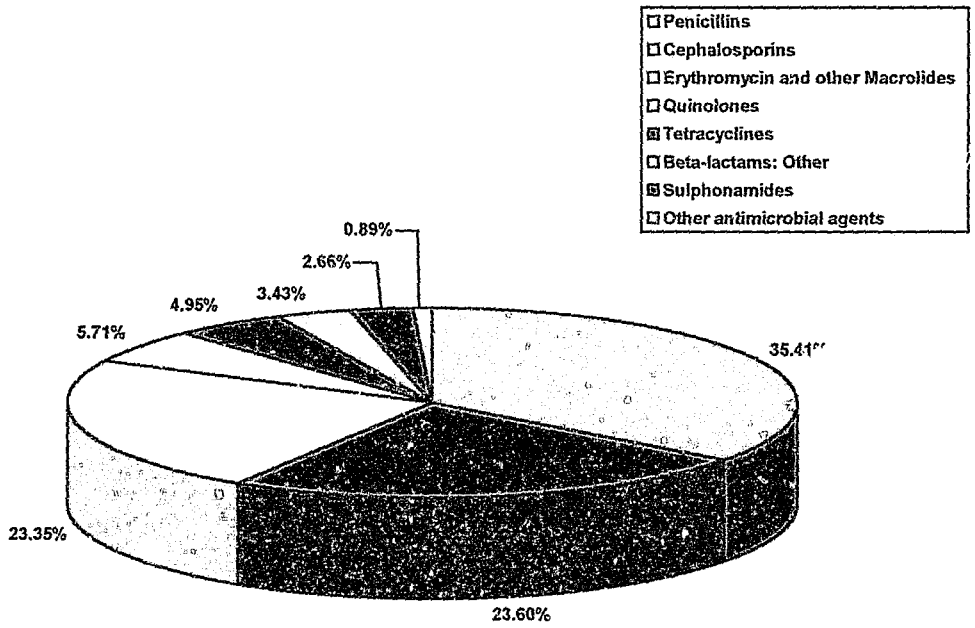

Figure 3.1 Antimicrobial Drug Classes expressed as a percentage of the total drug classes

3.3. Diagnoses Classified as per Body System

In May 1998, 788 antimicrobial prescriptions were obtained. The diagnosis or medical condition, for which the antimicrobial drugs were used, was obtained for each prescription, where available. Diagnoses were obtained for 606 (76.90%) of all antimicrobial prescriptions. No diagnoses were available for 182 (23.10%) prescriptions, as doctors who are not contracted to the provider network are not compelled to submit the ICD codes with their claims. These individual diagnoses

were classed into their respective Body systems. Figure 3.2 is a pie chart representation of the Body Systems expressed as a percentage.

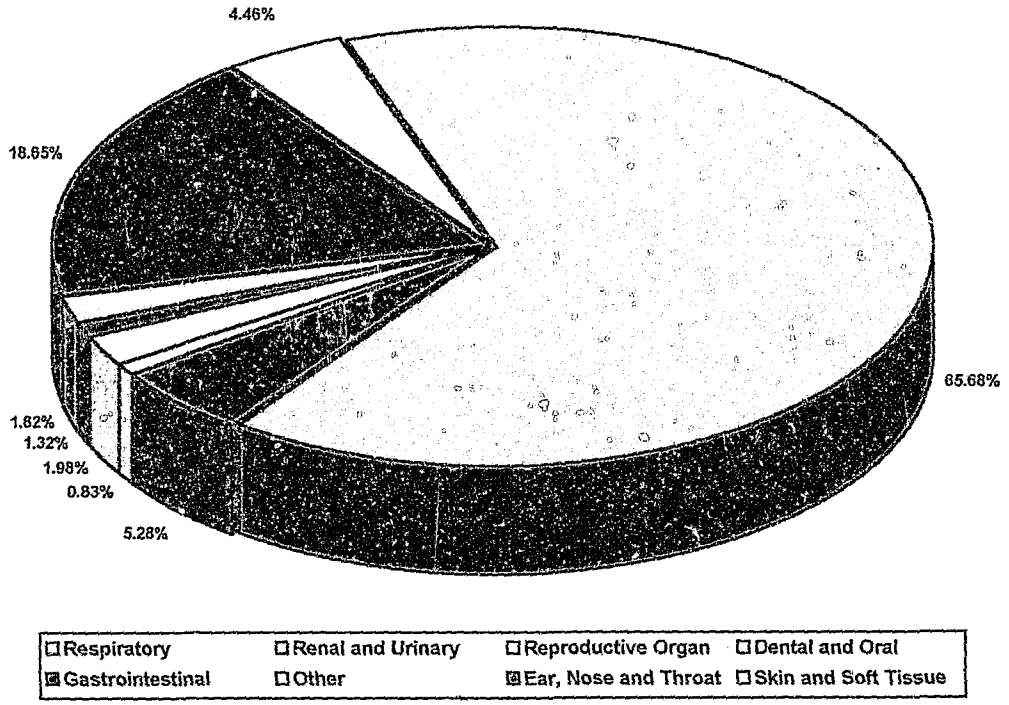

Figure 3.2 Classification of Diagnoses into respective Body Systems

3.4. Diagnoses or Medical Conditions associated with Antimicrobial Use

Diagnoses were obtained for 606 antimicrobial drug prescriptions. In total, there were 42 different diagnoses obtained. The Top 10 diagnoses, in terms of frequency, accounted for 87.23% of the total diagnoses. Hence, the results focus primarily on the Top 10 diagnoses due to their significant frequency and the ability to establish trends associated with antimicrobial use for these diagnoses. Figure

3.3 is a pie-chart representation of the Top 10 diagnoses as a percentage of the total diagnoses. A description of all diagnoses and corresponding frequencies, as well as the classification of each diagnosis per body system, is summarised in Appendix C.

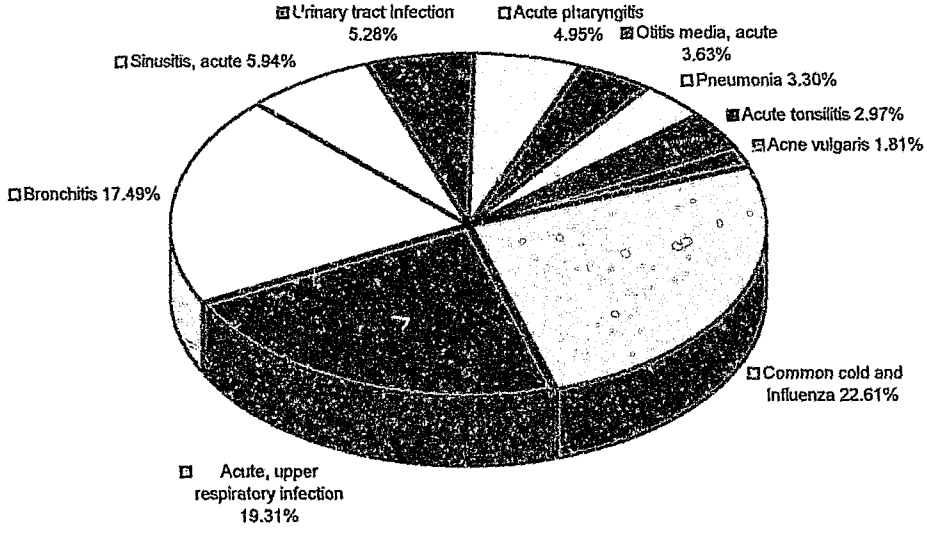

Figure 3.3 Top 10 Diagnoses by Frequency, expressed as a percentage of the total diagnoses

3.5 Trends in Antimicrobial Drug Use in Managed Care compared to the Essential Drug List (EDL) Programme for South Africa

The Top 10 diagnoses were analysed to determine the trend of antimicrobial drug usage for each diagnosis in the managed care environment. Table 3.3 reflects the most frequently prescribed antimicrobial agent within the drug class, for each diagnosis and a comparison with treatment guidelines documented in the 1998 Essential Drug List Programme for South Africa.

TOP 10 Diagnoses	Trend of Antimicrobial Drug use in the Managed Care Environment	Guidelines on Antimicrobial Drug use from the 1998 EDL programme for South Africa[26]
Common cold and Influenza	Amoxycillin	Antibiotics have no value for the common cold and influenza and could have serious side effects
Acute, upper respiratory infection	Amoxycillin	Viral condition[27] – antibiotics not required
Bronchitis	Amoxycillin/clavulanic	Doxycycline or Amoxycillin. In penicillin allergic patients: Erythromycin
Sinusitis, acute	Amoxycillin	Amoxycillin. In penicillin allergic patients: Trimethoprim / Sulphamethoxazole (TMP/SMX)
Urinary tract Infection	Ciprofloxacin	Trimethoprim / Sulphamethoxazole or Amoxycillin
Acute pharyngitis	Amoxycillin	Viral condition - should not be treated with antibiotics
Otitis media, acute	Amoxycillin or Amoxycillin/clavulanic	Amoxycillin. In penicillin allergic patients: Trimethoprim / Sulphamethoxazole
Pneumonia	Cefpodoxime	Pneumonia in adults: Initial treatment is benzylpenicillin IM, followed by amoxycillin. In penicillin allergic patients, Erythromycin stearate Pneumonia in children: Amoxycillin. In penicillin allergic patients: Erythromycin
Acute tonsilitis	Amoxycillin or Amoxycillin/clavulanic	Phenoxymethylpenicillin oral or single dose of benzathine penicillin IM, if compliance with oral course is difficult. In penicillin allergy : Erythromycin
Acne vulgaris	Minocycline	Doxycycline

Table 3.3 Comparison of trend of oral antimicrobial drugs used in the Managed Care environment with the 1998 EDL treatment guidelines

3.6 Age Distribution of Patients receiving Antimicrobial Drugs

The age of each patient who received an antimicrobial agent during the period 01 May 1998 to 31 May 1998 was obtained from a medical management system. These patients were then grouped into different age categories. Figure 3.4 indicates the age distribution and corresponding counts of patients who received antimicrobial drugs in May 1998.

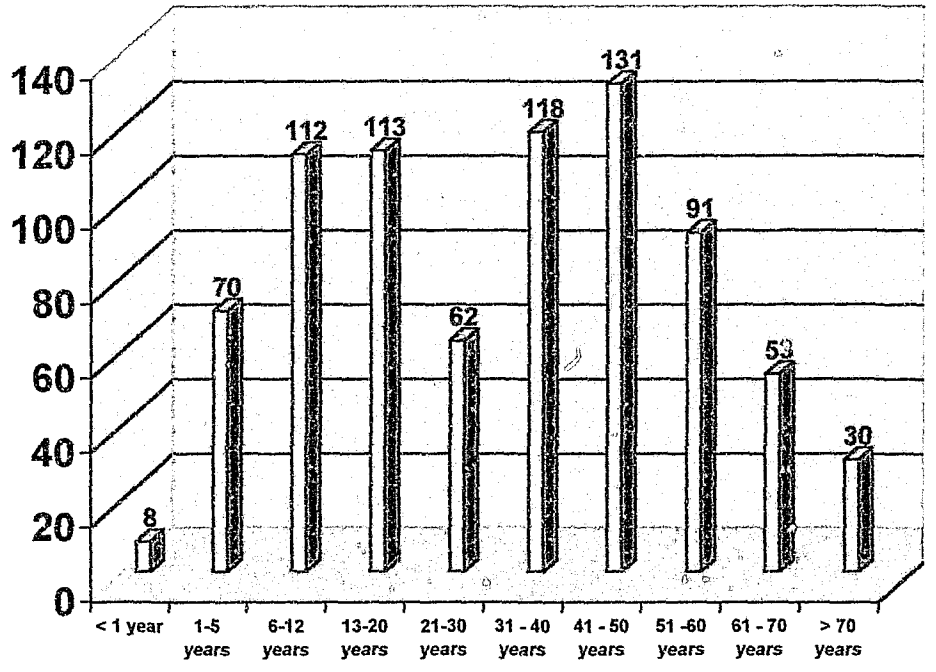

Figure 3.4 Age Distribution of Patients receiving Antimicrobial Drugs

The age distribution of patients who received antimicrobial drugs for the Top 10 diagnoses were also analysed and this is reflected in Table 3.4

Age Distribution	Common cold and influenza	Acute, upper respiratory infection	Bronchitis	Sinusitis, acute	Urinary Tract Infection	Acute pharyngitis	Otitis media, acute	Pneumonia	Acute tonsilitis	Acne vulgaris
< 1 year	2	1	3	0	0	0	0	0	0	0
1-5 years	9	11	9	2	0	3	8	6	9	0
6-12 years	22	31	8	4	3	3	5	4	6	1
13-20 years	22	15	19	5	3	5	1	1	0	7
21-30 years	9	7	6	5	4	3	1	1	0	3
31-40 years	26	18	8	8	6	4	1	2	1	0
41-50 years	22	10	21	7	6	5	3	1	3	0
51-60 years	13	9	14	4	6	7	3	1	1	0
61-70 years	8	12	9	0	4	0	0	4	0	0
> 70 years	4	3	9	1	0	0	0	0	0	0

Table 3.4 Age Distribution of patients for the Top 10 Diagnoses

3.7 Geographic Distribution of Patients Receiving Antimicrobial Drugs

The geographic distribution of patients receiving antimicrobial drugs was determined by obtaining the city or suburb as well as the province in which each patient resided. Figure 3.5 is a pie-chart representation of the geographic distribution of patients receiving antimicrobial drugs, reflected per province. The summary of all cities or suburbs in which patients resided in each of the provinces is in Appendix D.

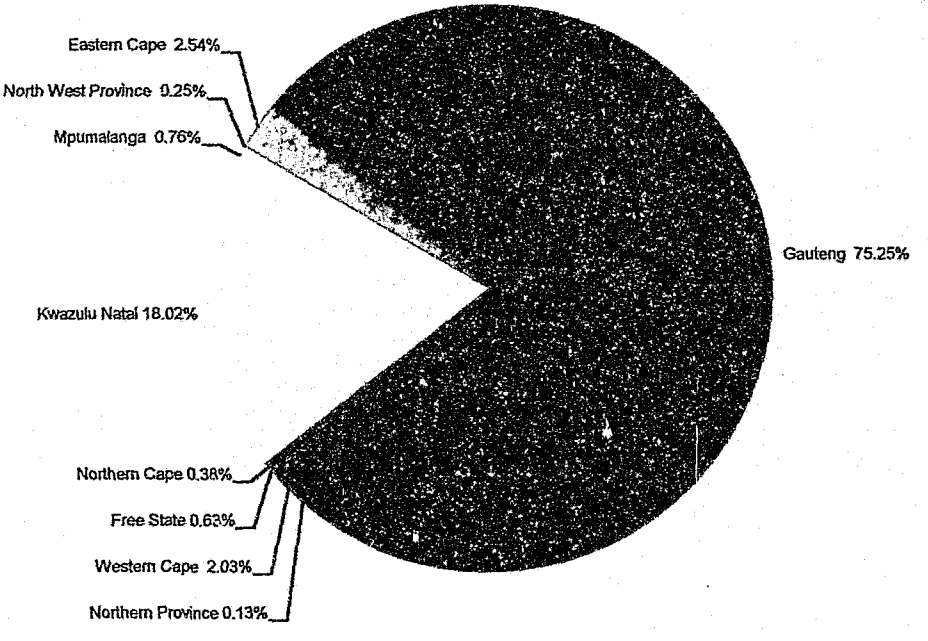

Figure 3.5 Geographic Distribution of Patients receiving Antimicrobial Drugs

The geographic distribution of patients receiving antimicrobial drugs, per province, for the Top 10 diagnoses was also analysed, and this is reflected in Table 3.5 below.

Province	Common cold and influenza	Acute, upper respiratory infection	Bronchitis	Sinusitis, acute	Urinary Tract Infection	Acute pharyngitis	Otitis media, acute	Pneumonia	Acute tonsilitis	Acne vulgaris
Gauteng	112	73	91	28	26	21	17	13	13	6
Kwazulu Natal	15	34	9	7	4	9	4	7	2	5
Eastern Cape	5	3	1	0	1	0	0	0	3	0
Western Cape	2	5	5	0	1	0	1	0	0	0
Mpumalanga	1	2	0	0	0	0	0	0	0	0
Free State	0	0	0	0	0	0	0	0	0	0
Northern Cape	2	0	0	0	0	0	0	0	0	0
North West Province	0	0	0	1	0	0	0	0	0	0
Northern Province	0	0	0	0	0	0	0	0	0	0

Table 3.5 Geographic Distribution of Patients, per province, for the Top 10 Diagnoses

3.8 Antimicrobial Drug Costs

The expenditure on antimicrobial drugs, for all given diagnoses, for May 1998 was R58 338.41. Antimicrobial drug costs for the Top 10 diagnoses amounted to R51 208. This accounts for 87.78% of the total costs. Figure 3.6 is a pie chart representation of the antimicrobial drug costs for the Top 10 diagnoses.

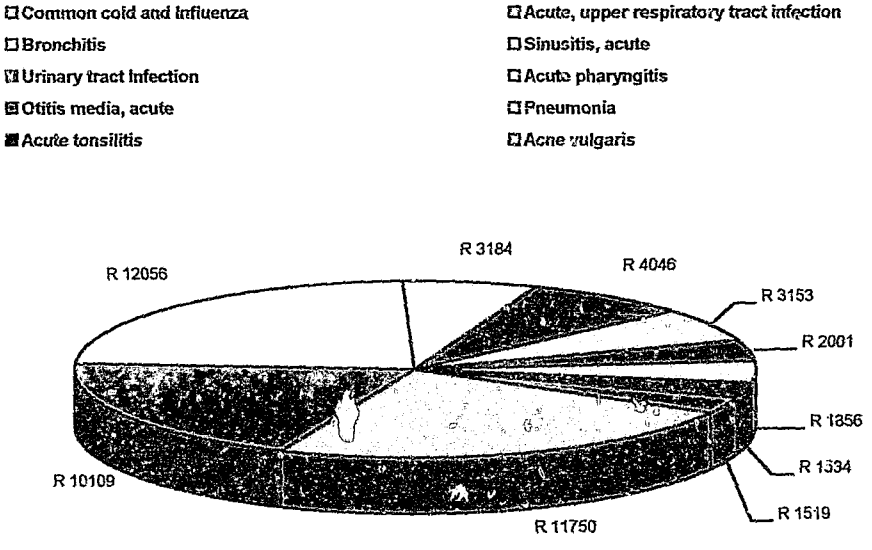

Figure 3.6 Antimicrobial Drug Costs per Top 10 Diagnoses

3.8.1 Comparison of Antimicrobial Drug Costs in Managed Care with Costs associated with Antimicrobial Drugs recommended by the EDL Programme.

The average cost per prescription for the Top 10 diagnoses in managed care was determined from prescription cost analysis. Antimicrobial costs were also obtained for recommended antimicrobial drug courses, according to the EDL Programme for South Africa, for the corresponding Top 10 diagnoses. The comparative drug prices are reflected in Table 3.6 below.

Top 10 Diagnoses	Average Cost per Prescription in Managed Care	EDL recommended antimicrobial drug and dose per prescription	Antimicrobial Cost per Prescription as per the EDL guidelines
Common cold and Influenza	R85.76	Antimicrobial drug use not recommended	R0.00
Acute, upper respiratory infection	R86.40	Antimicrobial drug use not recommended	R0.00
Bronchitis	R113.74	Doxycycline 100 mg (10) or Amoxycillin 250mg (15)	R60.00 or R25.62
Sinusitis, acute	R88.46	Amoxycillin 250mg (15)	R25.62
Urinary tract Infection	R127.01	TMP/SMX 160/800mg (20) or Amoxycillin 250mg (15)	R30.42 or R25.62
Acute pharyngitis	R105.11	Antimicrobial drug use not recommended	R0.00
Otitis media, acute	R90.94	Amoxycillin 250mg (15)	R25.62
Pneumonia	R92.81	Amoxycillin 500mg (21)	R64.09
Acute tonsilitis	R85.25	Phenoxymethylpenicillin 500mg (40)	R15.16
Acne vulgaris	R138.10	Doxycycline 50mg (30)	R100.03

Table 3.6 Comparison of Antimicrobial Drug Prices between Managed Care and EDL recommendations

CHAPTER 4

DISCUSSION

4.1 Antimicrobial Prescribing Frequency

In the outpatient setting in the managed care environment, the antimicrobial prescribing frequency determined was 29.07% for May 1998. In the United States, antimicrobial drugs are the second most commonly used class of drugs and represent 12-14% of all drugs prescribed by office based physicians[1]. Thus, the prescribing frequency determined in the managed care environment was high and showed no trend or correlation with data available in the United States. This could be attributed to the high antimicrobial prescribing frequency for the common cold and influenza during this period. In addition, antimicrobial prescribing was common in conditions classified as viral conditions, where clearly, antimicrobial therapy is not indicated. These conditions included acute, upper respiratory infections as well as acute pharyngitis. Based on the results, if antimicrobial prescribing is decreased in these viral conditions, the antimicrobial prescribing frequency can be decreased significantly.

4.2 Overview of Antimicrobial Drug Classes and the Trend of Antimicrobial Agents Used.

Penicillins were the most frequently prescribed drug class, accounting for 35.41% of all prescriptions. Although amoxycillin was the most frequently prescribed active ingredient (134 prescriptions) (Refer to Table 3.2) within the penicillin drug class, the use of amoxycillin/clavulanic acid was also significant (113 prescriptions) Clearly, the cost factor associated with the use of

amoxycillin/clavulanic acid is far greater than amoxycillin itself, especially since there are many more cost-effective amoxycillin generics available on the South African market. Cephalosporins were the second most frequently prescribed drug class in the outpatient setting, with cefuroxime being used most frequently (47 prescriptions), followed by cefaclor (45 prescriptions). The use of cefpodoxime (43 prescriptions) was also significant. Thus in the cephalosporin drug class, the results showed a trend of usage of 2nd and 3rd generation cephalosporins predominantly. Although it was notable that erythromycin and other macrolides ranked third in the frequency of antimicrobial drug usage, it was clear that there was a trend towards prescribing the newer agents in this drug class, with clarithromycin being the most frequently used agent (73 prescriptions), followed by roxithromycin (47 prescriptions) and azithromycin (36 prescriptions). Potent broad-spectrum antibiotics initially directed towards hospital use, for example the quinolones, are now available in oral form and are being promoted for use in the community[9]. In this study, the quinolone drug class ranked 4th in terms of frequency of use, and accounted for 5.71% of all prescriptions. However, the trend was towards the use of ciprofloxacin, which accounted for 82.22% (34 out of 45 prescriptions) of quinolone antimicrobials.

4.3 Diagnoses or Medical Conditions classified into respective Body Systems

This data clearly indicated that antimicrobial drugs are predominantly prescribed for respiratory disorders and symptoms, accounting for 65.68% of all diagnoses. (Refer to Figure 3.2) This is interesting to note, as authors in a study in England believed that the overall increase in antimicrobial prescribing is due in part to the

gradual increase in the use of antimicrobials for respiratory symptoms, but could not test their hypothesis due to a lack of data about indications for prescribing[21]. Diagnoses classified into the Ear, Nose and Throat system accounted for 18.65% of all diagnoses. Thus, it was evident that antimicrobial prescriptions, in the managed care environment, were issued mainly for Respiratory and Ear, Nose and Throat conditions, which jointly accounted for 84.33% of all prescriptions.

4.4 Diagnoses or Medical Conditions associated with Antimicrobial Use

The ICD-10 Coding System is an excellent tool in a managed care environment in order for information to be accurate and easily accessible. This system needs to be introduced in both the public and private sectors in South Africa in order for information to be standardised and thus integrated to positively impact and improve drug use. Availability of appropriate and timeous information in the public and private health sectors will determine the extent to which the health care delivery systems can be restructured to promote access to cost effective care of high quality[28].

One of the limitations of this study was that diagnoses were not available for all antimicrobial prescriptions received. However, diagnoses were available for 76.90% of prescriptions (606 out of 788 prescriptions). The diagnoses for the remaining 23.10% of prescriptions were not available as the ICD coding system is not the standard in South Africa, and doctors who were not contracted to the managed care network were not compelled to submit ICD codes.

In total, the ICD-10 codes represented 42 diagnoses for which antimicrobial drugs were used in the managed care data. The Top 10 diagnoses, namely common cold and influenza; acute, upper respiratory infection; bronchitis; sinusitis,acute; urinary tract infection; acute pharyngitis; otitis media,acute; pneumonia; acute tonsillitis; and acne vulgaris accounted for 87.29% of the total diagnoses. These 10 diagnoses, classified into their respective body systems, represented the Respiratory System 62.71%, Ear, Nose and Throat 17.49%, Renal and Urinary System 5.28% and Skin and Soft Tissue 1.82%. This trend in the use of use of antimicrobials for the Top 10 diagnoses correlated with the overall antimicrobial usage for all diagnoses, with a predominance of antimicrobials for Respiratory and ENT systems.

4.5 Comparison of Antimicrobial Drug Use in the Managed Care environment with guidelines in the EDL Programme of South Africa for Relevant Diagnoses

The managed care data reflected antimicrobial prescribing for the common cold and influenza. (Refer to Table 3.3) The EDL guidelines clearly indicate that colds and influenza are self-limiting viral conditions; colds begin to clear within 3 days and influenza within 7 days; although it may last up to 14 days[26]. Thus, antimicrobial drugs have no role in these viral conditions and are not indicated. This is a particularly important area for prescriber and patient awareness and education.

Acute, upper respiratory infection; is not reflected as a diagnosis on its own in the EDL guidelines as it is non-specific. It is however, classified as a viral infection of

the respiratory tract and may be classed with the common cold[27]. Acute pharyngitis, as indicated in the EDL guidelines is a viral condition and should not be treated with antibiotics.

Thus, the use of antimicrobials in self-limiting, viral conditions was significant and is an important area to target in the managed care environment. The study did not aim to assess the appropriateness of antimicrobial therapy in the managed care setting, but rather to observe trends in usage and compare this to documented data guidelines. In the EDL, however, antimicrobial drug selection includes appropriate availability and appropriate use of antibiotics.

In the managed care data, antimicrobial drug use for sinusitis and otitis media were similar to the recommendations of the EDL guidelines. However, in managed care, the trend was to use either amoxycillin only or the combination of amoxycillin/clavulanic acid for otitis media, since the frequency of prescriptions for these two products were equal. The EDL guidelines recommend the use of amoxycillin only. Amoxycillin/clavulanic acid is a more expensive option, and if not clearly indicated, may be an area of cost rationalisation. Amoxycillin/clavulanic acid was the trend used in managed care for the treatment of bronchitis, whereas the EDL recommends the use of amoxycillin only or doxycycline.

The use of quinolone antimicrobials for urinary tract infections in the managed care environment was evident. The EDL guidelines recommend the use of trimethoprim/sulphamethoxazole or amoxycillin.

In the outpatient setting in managed care, the trend of antimicrobial usage for pneumonia was the use of cefpodoxime, a 3rd generation cephalosporin. The oral antimicrobial agent recommended in the EDL guidelines is amoxycillin. Thus, there was a trend towards the use of newer, broader spectrum, more expensive agents in the managed care environment.

The EDL guidelines in the treatment of acute tonsilitis and acne vulgaris recommend the use of phenoxymethylpenicillin and doxycycline respectively. The managed care trend was towards the use of amoxycillin or amoxycillin/clavulanic acid for acute tonsilitis and the use of minocycline for acne vulgaris.

The managed care data showed that there was a predominance of variation in trends of antimicrobial drug use in specified medical diagnoses or conditions compared to the EDL recommendations. The reasons for this could be various, for example, practioners' perceptions that antibiotics will cure faster or prevent the complications of nonbacterial diseases, overreliance on empirical personal experience versus scientific data[10], pressure from patients for drug prescriptions regardless of indication, a tendency to treat with the newer, broad spectrum agents that will cure the disease anyway but no consideration on issues of cost and resistance. These factors are not intended to substantiate, justify or place judgement on managed care trends but rather to indicate that there is scope for prescriber and patient education and awareness, the need for protocols and importantly, the need for constant evaluation in the area of antimicrobial use in managed care.

4.6 Age Distribution of Patients Receiving Antimicrobial Agents

The highest frequency of patients who received antimicrobial drugs during May 1998 were in the 41-50 age distribution (131 patients) (refer to Figure 3.4) There were 118 patients in the 31-40 year age distribution, followed by 113 and 112 patients in the 13-20 and 6-12 year range, respectively.

On further analysis of the age distribution of patients receiving antimicrobial drugs for the Top 10 diagnoses, the trend for the common cold and influenza followed the overall trend with a predominance of patients in the 31-50 and 6-20 age groups. (Refer to Table 3.4) Acute, upper respiratory infection was predominant in the 6-12 year age group (31 out of 117 patients). Acute respiratory infection (ARI) is a major cause of death in children worldwide[22]. This is important to note as it is an area that requires further research in the managed care arena, to ensure appropriate disease and drug management in acute respiratory infections in children.

Bronchitis was predominant in the 41-50 age group. Irritating substances like air pollution and cigarette smoking can precipitate attacks of acute bronchitis. Patient characteristics like cigarette smoking were beyond the scope of this study but could well be contributory to this condition, especially in this age group of patients.

Urinary tract infections occurred most frequently in patients between the ages of 31-60 years of age. The highest incidence of pneumonia and acute tonsillitis

occurred in the 1-5 year age group, followed by the 6-12 year. Thus, pneumonia and acute tonsillitis were most common in children under 13 years of age.
The incidence of acne vulgaris was the greatest in the 13-20 age group, and this is expected, as acne is more common in adolescence[26].

4.7 Geographic Distribution of Patients receiving Antimicrobial Drugs

The majority of patients receiving antimicrobial agents resided in the Gauteng Province (refer to Figure 3.5) accounting for 75.25% of all patients (593 out of 788 patients). 18.02% of the patients resided in the Kwazulu Natal region (142 out of 788 patients).

Although there was a spread of patients in all other 7 provinces in South Africa, the percentages were small, ranging from 2.54% (20 patients) in the Eastern Cape, to 0.13% (1 patient) in the Northern Province. This trend was also evident for the Top 10 diagnoses, in terms of geographic distribution, with a predominance of patients in the Gauteng and Kwazulu Natal areas. (Refer to Table 3.5)

4.8 Antimicrobial Drug Costs

Of the Top 10 diagnoses in terms of frequency, bronchitis was associated with the greatest antimicrobial cost. (Refer to Figure 3.6) This is interesting to note as the trend of antimcrobial usage for bronchitis in managed care was the use of amoxycillin/clavulanic acid, which is an expensive option compared to costs associated with amoxycillin or doxycycline as recommended by the EDL guidelines.

Other areas of high antimicrobial costs were the common cold and influenza, followed by acute, upper respiratory infection. Clearly, antimicrobial prescribing in viral conditions needs to be targeted and is an area in which cost rationalisation can be achieved.

With respect to the average prescription costs for the Top 10 diagnoses, the single highest prescription cost was for acne vugaris. (Refer to Table 3.6) Although acne vulgaris had the lowest ranking in the Top 10 diagnoses, in terms of frequency, and was associated with the lowest overall antimicrobial costs in May 1998, a single prescription for this condition was of the greatest cost to the managed care environment. This could be attributed to the trend of minocycline use in acne vulgaris as opposed to the EDL recommendation of doxycycline.

The average cost per prescription to treat urinary tract infections, ranked second in terms of cost. The managed care trend was towards the use of ciprofloxacin. This agent is associated with greater costs than other agents like trimethoprim/sulphamethoxazole or amoxycillin. Attempts can be made to optimise antimicrobial usage in this area and encourage use of other therapeutic agents especially in uncomplicated urinary infections, thus decreasing costs associated with antimicrobial therapy for urinary tract infections.

A comparison of antimicrobial drug costs in managed care with the EDL recommendations on antimicrobial drug use for the same diagnoses, indicated a far greater cost in managed care. Thus, the implementation of the EDL guidelines can significantly decrease costs in this managed care organisation.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

The concept of a managed care model emphasises areas of cost-effective drug therapy without compromising the quality of the patient's care. The area of antimicrobial prescribing is important as overuse of antimicrobial drugs and the high frequency of prescribing is a worldwide problem. Infectious diseases have increased within populations and the world wide use of antimicrobials has expanded dramatically during the last decade[29]. Thus, the problem of frequent antimicrobial use and the high costs associated with it are well realised, and is an important arena to investigate from a managed health care perspective.

The main aim of the study was to determine the antimicrobial prescribing frequency in this managed care organisation. This study indicates that the antimicrobial prescribing frequency in managed care is high. It also highlights that antimicrobial drugs are used frequently in viral conditions like the common cold and influenza; acute, upper respiratory infections; and acute pharyngitis. Clearly, antimicrobials have no role in viral conditions and this is an area that can be targeted in the managed care environment to decrease the unnecessary use of antimicrobials. This will impact on managed care by decreasing the antimicrobial prescribing frequency, decreasing problems like antimicrobial resistance due to overuse of these drugs, as well as decreasing costs associated with high antimicrobial utilisation.

In addition, the study aimed to determine the trend of antimicrobial drug usage, in managed care, for certain diagnoses or clinical settings and compare this to the documented literature guidelines in the EDL Programme for South Africa. The findings indicate that there is a wide variation in trends of antimicrobial usage in managed care compared to the EDL Programme. The managed care environment tends to utilise more of the newer, broader spectrum, more expensive agents. This emphasises the need for the implementation of proper treatment protocols and guidelines to optimise antimicrobial drug utilisation and once again, decrease costs associated with it.

Recommendations

1. Prescriber education and awareness of antimicrobial prescribing needs to be targeted in the managed care environment, with emphasis that antimicrobials have no role in viral conditions, with the aim of decreasing the unnecessary use of antimicrobials.

2. Evidence based treatment guidelines and protocols on antimicrobial use need to be developed and implemented for managed care. This can be done through a managed care Pharmaceutical and Therapeutics (PTC) Committee, which evaluates documented treatment guidelines like the EDL recommendations. The committee should also consist of managed care network doctors, whose input may be valuable and relevant to the patient groups that they consult. This approach may also motivate and encourage

prescribers towards more effective prescribing, rather than forcing them to implement guidelines that the managed care organisation has developed in its own capacity.

3. The concept of a drug formulary, with clinical guidelines, may be introduced in this managed care organisation. Again, clinical input from network doctors and pharmacists would be valuable. The use of certain broader spectrum antimicrobial drugs not listed on formulary or placed on reserve to prevent overuse of these agents or decrease antimicrobial resistance may be motivated for by prescribers for individual patients, as its use may be warranted in certain clinical settings for a specific patient.

4. Constant monitoring of drug therapy in areas like antimicrobial utilisation, in the managed care environment, is essential. It is a process that needs to be ongoing in order to properly monitor prescribing and usage trends and regularly update treatment protocols and guidelines

5. The ICD-10 coding system is an excellent tool for accurate and easily accessible data collection. This coding system needs to be implemented urgently across the public and private sectors in South Africa. This will enable us to properly monitor antimicrobial drug use in order to positively impact and improve antimicrobial use.

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09 February 1999

Dr N Bhimsan
Department of Pharmacy

Dear Dr Bhimsan

MPharm CANDIDATURE - APPROVAL OF PROTOCOL ENTITLED "TRENDS IN ORAL ANTIMICROBIAL DRUG PRESCRIPTIONS IN THE OUT-PATIENT SETTING

I have pleasure in advising you that the assessor group of the Postgraduate Committee has approved the amended protocol for confirmation of admission to candidature.

Yours sincerely

MR A C SPARKS
ACTING FACULTY OFFICER (POSTGRADUATE)
FACULTY OF HEALTH SCIENCES

cc. Professor A Gous

APPENDIX A : Post-Graduate Committee Research Protocol Approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

COMMITTEE FOR RESEARCH ON HUMAN SUBJECTS (MEDICAL)
Ref: R14/49 Bhimsan

CLEARANCE CERTIFICATE PROTOCOL NUMBER M990310

PROJECT Trends In Oral Antimicrobial Drug Prescriptions In The Out Patient Setting

INVESTIGATORS Mrs N Bhimsan

DEPARTMENT Southern Healthcare JV, Southern Healthcare JV

DATE CONSIDERED 990326

DECISION OF THE COMMITTEE *

Approved unconditionally

DATE 990329 CHAIRMAN.....(Professor P E Cleaton-Jones)

* Guidelines for written "informed consent" attached where applicable.

c c Supervisor: Prof AGS Gous
Dept of Department of Pharmacy, Baragwanath Hospital

Work2\lain0015\JumEth97 wdbM 990310

APPENDIX B : Committee for Research on Human Subjects Approval

DIAGNOSIS DESCRIPTION	FREQUENCY	BODY SYSTEM
Common cold and influenza	137	Respiratory
Acute, upper respiratory infection	117	Respiratory
Bronchitis	106	Respiratory
Sinusitis, acute	36	Ear, Nose and Throat
Urinary Tract Infection	32	Renal and Urinary
Acute pharygitis	30	Ear, Nose and Throat
Otitis media, acute	22	Ear, Nose and Throat
Pneumonia	20	Respiratory
Acute tonsilitis	18	Ear, Nose and Throat
Acne vulgaris	11	Skin and Soft Tissue
Disorder of the teeth	9	Dental and Oral
Acute, lower respiratory infection	7	Respiratory
Diarrhoea and gastroenteritis	6	Gastrointestinal
Non-specific lymphadenitis	4	Other
Acute tracheitis	4	Respiratory
Acute vaginitis	4	Reproductive
Open wound of unspecified body region	4	Skin and Soft Tissue
Chronic rhinitis	3	Ear, Nose and Throat
COPD, with acute exacerbation	3	Respiratory
Bitten or struck by a dog	3	Skin and Soft Tissue
Viral infection, unspecified	2	Other
Otitis externa	2	Ear, Nose and Throat
Allergic rhinitis	2	Ear, Nose and Throat
Acute laryngitis	2	Respiratory
Asthma	2	Respiratory
Mouth ulcers	2	Dental & oral
Cutaneous abscess, furuncle and carbuncle	2	Skin and Soft Tissue

DIAGNOSIS DESCRIPTION	FREQUENCY	BODY SYSTEM
Cellulitis	2	Skin and Soft Tissue
Tick bite fever	1	Other
Phlebitis and thrombophlebitis of unspecified site	1	Other
Sialodenitis	1	Dental and Oral
Oesophagitis	1	Gastrointestinal
Acute pancreatitis	1	Gastrointestinal
Impetigo	1	Skin and Soft Tissue
Dermatitis, unspecified	1	Skin and Soft Tissue
Nail disorder	1	Other
Follicular cysts of skin and subcutaneous tissue	1	Skin and Soft Tissue
Pain in joint	1	Other
Orchitis and epididymitis	1	Reproductive
Rash and other nonspecific skin eruptions	1	Skin and Soft Tissue
Allergy, unspecified	1	Other
Bitten by an insect	1	Skin and Soft Tissue

APPENDIX C : Diagnoses Description and Frequency classified per Body System

GAUTENG			
ALBERTON	66	MALVERN EAST	2
ALBERTON NORTH	4	MEYERTON	1
ALRODE	2	MINNEBRON	2
ARCADIA	2	MORNINGSIDE	1
BEDFORDVIEW	1	NIGEL	2
BENONI	24	NORTHCLIFF	2
BEREA	1	NORWOOD	2
BLYVOORUITZICHT	1	OBERHOLZER	1
BOKSBURG	51	OBSERVATORY	2
BOKSBURG NORTH	3	PINEGOWRIE	1
BOOYSENS	1	PRETORIA	13
BRACKENHURST	7	PRETORIA NORTH	2
BRAKPAN	25	PRIMROSE	11
BRITS	1	RANDBURG	8
BRYANSTON	5	RANDFONTEIN	7
CENTURION	2	RIVERFIELD	1
CLEVELAND	12	ROODEPOORT	5
CRESTA	1	SANDTON	4
DASPOORT	1	SOUTH HILLS	3
DEDEUR	2	SPRINGS	26
DELMORE	4	THE HILL	1
DENLEE	1	TURFFONTEIN	3
DERSLEY PARK	1	VANDERBIJLPARK	52
DUNNOTTAR	1	VEREENIGING	17
EDENVALE	6	VERWOERD PARK	2
ELSBURG	13	VORNA VALLEY	1
ELSPARK	1	VOSLOORUS	2
FISHERS HILL	1	WADEVILLE	3
FLORIDA	2	WIERDA PARK	1
FLORIDA HILLS	1	ZUURFONTEIN	1
FOURWAYS	1	Grand Total	593
GALLO MANOR	1		
GARDENVIEW	1		
GERMISTON	89		
GERMISTON SOUTH	1		
GRANT PARK	2		
HEIDELBERG	1		
HOMESTEAD	1		
JOHANNESBURG	53		
KATLEHONG	2		
KEMPTON PARK	7		
KENILWORTH	1		
KENSINGTON	2		
LENASIA	5		
LENASIA SOUTH	2		
LYNDHURST	1		
MALVERN	1		

MPUMALANGA	
EVANDER	1
MIDDELBURG	1
NELSPRUIT	2
WITBANK	2
Grand Total	6
NORTHERN CAPE	
KIMBERLEY	1
KURUMAN	2
Grand Total	3
NORTHERN PROVINCE	
PIETERSBURG	1
Grand Total	1
NORTH WEST	
KLERKSDORP	2
Grand Total	2

FREE STATE	
SASOLBURG	3
WELKOM	2
Grand Total	5
KWAZULU NATAL	
AMANZIMTOTI	2
ASSAGAY	1
ATHLONE PARK	1
BLUFF	1
CHATSWORTH	6
DUNESIDE	1
DURBAN	59
EMPANGENI	1
ESTON	1
HILLCREST	1
ISIPINGO	1
JACOBS	2
MALVERN	3
MOBENI	1
NATAL	4
NEW GERMANY	1
NEWCASTLE	5
PENNINGTON	3
PHOENIX	2
PIETERMARITZBURG	21
PINETOWN	6
PORT SHEPSTONE	2
RICHARDS BAY	2
SCOTTBURGH	2
SCOTTBURGH SOUTH	1
TONGAAT	2
UMKOMAAS	3
YELLOWWOOD PARK	7
Grand Total	142
EASTERN CAPE	
ARCADIA	1
DESPATCH	4
EAST LONDON	5
GONUBIE	3
PORT ELIZABETH	7
Grand Total	20
WESTERN CAPE	
BELLVILLE	1
CAPE TOWN	7
DIEP RIVER	1
DURBANVILLE	3
GEORGE	1
HREMANUS	1
STEENBERG	1
STRAND	1
Grand Total	16

APPENDIX D : Summary of Cities or Suburbs per Province

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