MINISTRY OF HEALTH MALAYSIA

MALAYSIAN STATISTICS ON MEDICINES 2007

Edited by:

Faridah AMY, Sivasampu S, Lian LM, Hazimah H, Kok LC, Chinniah RJ

With contributions from

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A publication of the Pharmaceutical Services Division and the Clinical Research Centre, Ministry of Health Malaysia

October 2010

Published jointly by:

THE NATIONAL MEDICINES USE SURVEY

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This report is also published electronically on the website of the Clinical Research Centre at: http://www.crc.gov.my and the website of the Pharmaceutical Services Division at: http://www.pharmacy.gov.my

Funding:
The National Medicines Use Survey is funded by a grant from the Ministry of Health Malaysia (MRG Grant Number 00126) and Operational Budget from Pharmaceutical Services Division, Ministry of Health.

ISSN 1823-8300

Please note that there is potential for revision of the data in this report.
Please check the latest edition of Malaysian Statistics on Medicines report for any amendments at
www.crc.gov.my or **www.pharmacy.gov.my**

PREFACE

Ensuring access to quality and affordable medicines is an important objective of Malaysia's National Medicines Policy. The National Medicines Use Survey (NMUS) was conducted with the intent to continuously and systematically collect data on medicines in the hope to further improve their use as well as to provide a tool for better decision making in the allocation of healthcare resources for the Malaysian population.

The NMUS is into its fifth year and we are glad to announce the successful publication of its fourth report, the Malaysian Statistics on Medicines (MSOM) 2007. The first MSOM 2004 report presented results largely from pilot surveys. In 2005, we scaled up the survey with larger sample size and wider distribution and also refined data processing and statistical methods. For MSOM 2006, the data processing was further enhanced to improve quality and the statistical methods reviewed to take into consideration, stratification of hospitals which gives more accurate estimates as hospitals of different sizes may have different drug use profiles. We move a step forward for MSOM 2007, where the drug utilisation data is tabulated in such a way as to allow comparison of utilisation between 2006 and 2007 as the data for both years were analysed using the same statistical methods.

The comparison of two years data also allowed better detection of discrepancies in the data. As a result, some corrections have been made to the 2006 statistics. We are optimistic that as NMUS matures and the data processing methodology fine-tuned, future MSOM reports will continue to produce accurate and reliable statistics on Malaysian medicines consumption at all times.

We hope that this MSOM 2007 report will be useful to relevant healthcare professionals, serving as a source of reference and baseline for embarking in future research or clinical audits towards promoting rational prescribing and effective medicines use.

We would like to thank all staff who had worked very hard in ensuring the success of the NMUS, all agencies and institutions that had helped in providing data, all expert panel members for their enthusiasm and contributions in completing the chapter reports and each and everyone who has in one way or another contributed to the success of the NMUS and the publication of this report.

Pharmaceutical Services Division
Clinical Research Centre
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ACKNOWLEDGEMENTS

The National Medicines Use Survey would like to thank the following for their participation, assistance, support or contributions:

- Director General of Health, Malaysia
- Deputy Director General of Health (Research and Technical Support), Ministry of Health (MOH)
- Deputy Director General of Health (Medical Services), MOH
- Deputy Director General of Health (Public Health), MOH
- Senior Director of Pharmaceutical Services Division, MOH
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- Director, National Pharmaceutical Control Bureau, MOH
- Director, Clinical Research Centre, MOH
- Heads of Clinical Services, MOH
- Procurement and Privatisation Division, MOH
- All medical doctors, pharmacists and support personnel who participated in the NMUS surveys
- All participating public and private hospitals, clinics and other institutions which provided or allowed access to their medicines procurement data
- University Malaya Medical Centre, Hospital Universiti Kebangsaan Malaysia, Hospital Universiti Sains Malaysia, Lumut Armed Forces Hospital, Terendak Armed Forces Hospital
- Members of the NMUS Expert Panels who contributed to writing this report
- Association of Private Hospitals Malaysia, Malaysian Organisation of Pharmaceutical Industries (MOPI) and Pharmaceutical Association of Malaysia (PhAMA)
- Malaysian Medical Council, Malaysian Medical Association, Malaysian Pharmaceutical Society, The Academy of Family Physicians, Primary Care Doctors Association Malaysia, Malaysian Dental Association, Malaysian Private Dental Practitioners Association
- Pharmaniaga Logistics Sdn Bhd. and Forte Tech Solutions Sdn. Bhd.
- All who have in one way or another supported and/or contributed to the success of the NMUS and this report

Mdm. Hasnah binti Ismail
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Dr. Lim Teck Onn
Co-Chairman

National Medicines Use Survey,
Ministry of Health Malaysia

ABOUT THE NATIONAL MEDICINES USE SURVEY

The National Medicines Use Survey (NMUS) is a project initiated and supported by the MOH to collect information on the supply, procurement, prescription, dispensing and use of drugs in Malaysia. The NMUS is designed to support the implementation of our National Medicines Policy (NMP). The objectives of NMP are to ensure only safe, efficacious and good quality medicines are available for use in Malaysia, as well as to promote equitable access to, and rational and cost-effective use of these medicines, ultimately leading to improved health for all Malaysians. In supporting this, the NMUS provides the functional capacity for the collection, analysis, reporting and dissemination of data on drug utilisation in Malaysia.

The NMUS is jointly sponsored by:

- Pharmaceutical Services Division, Ministry of Health
- Clinical Research Centre, National Institutes of Health, Ministry of Health

Purpose of the NMUS

The availability of high quality, reliable and timely information on medicines use is crucial for any discussion on improving the use of medicines in Malaysia.

The objective of the NMUS is therefore to quantify the present state and time trends of medicines utilisation at various levels of our health care system, whether national, regional, local or institutional.

Routinely compiled statistics on medicines utilisation have many uses, such as:

1. Estimate the consumption of medicines and describe pattern of medicines use through assessing which alternative drugs are being used for particular conditions and to what extent.
2. Estimate the number of medicine users overall, by age, sex and geography and over time.
3. Estimate on the basis of known disease epidemiology, to what extent medicines are under or over-used.
4. Relate the number of adverse drug reactions reported to our pharmacovigilance system to the number of people exposed to the drug in order to assess the magnitude of the problem, or to estimate the degree of under-reporting of adverse events.
5. Provide a crude estimate of disease prevalence based on the medicines utilisation rate.
6. Estimate expenditure on pharmaceuticals, which constitutes a significant proportion of our healthcare expenditure.
7. Monitor and evaluate the effects of interventions to improve the use of medicines. These interventions may be educational effort, promotional campaign, formulary restriction, medicines reimbursement scheme or regulatory measures.

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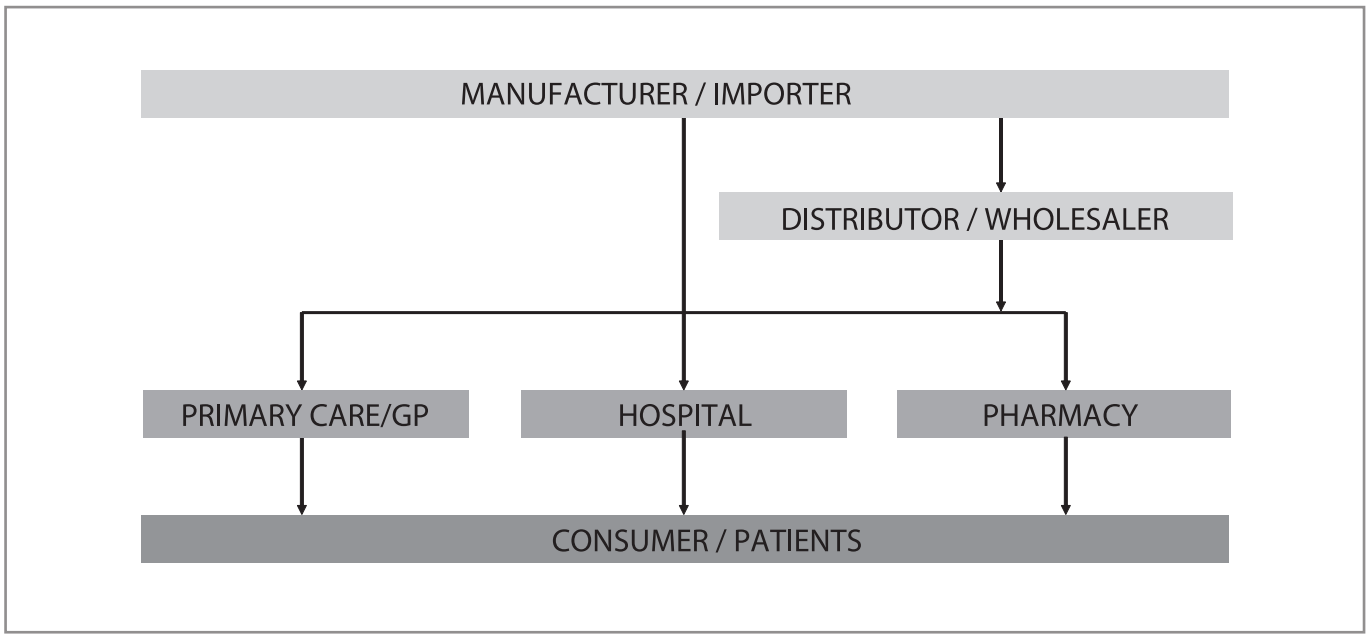
Introduction

The NMUS is designed, broadly speaking, to estimate the quantity and pattern of use of medicines in Malaysia, as well as to estimate our expenditure on pharmaceuticals. This is an ambitious project which requires multiple surveys at the various levels of the medicines supply and distribution chain in the country (Figure 1) in order to capture all the required data to meet its purpose. Due to limitations of manpower and resources, this project must of necessity be undertaken in phases. We have realistically targeted data sources that are absolutely critical and accessible, leaving the most inaccessible data sources for the future, hoping to build on the foundations laid by earlier surveys and capitalise on their successes.

FIG. 1 MEDICINES SUPPLY & DISTRIBUTION SYSTEM AND SOURCES OF DATA



Hence, the statistics on medicines use and expenditure in this report are estimated from data from a limited number of surveys (which were essential and critical) that could be successfully completed nation-wide. The scope was also deliberately limited to "Prescription- Only Medicines" (obviously the pharmaceuticals of greatest interest) and excludes Over-the-Counter (OTC) medicines, traditional or herbal products and food supplements. "Prescription-Only Medicines" include all drugs classified as "poisons" under the Poisons Act 1952 (revised 1989). [1]

As the NMUS matures, we should be able to provide more accurate and reliable estimates, as well as more informative and detailed analyses.

NMUS Surveys

The NMUS 2007 conducted several surveys in order to capture data at the various levels of the medicines supply and distribution system in the country. The sources of data, data collection surveys, data availability and comments on data inclusion in this report are summarised in the table below:

No.	Data sources and Surveys	Year data available	Inclusion in present report
1.	**Medicines import or production data**		
1.1	Medicines import data from Royal Malaysian Custom	Data not collected	No
1.2	Local pharmaceutical manufacture	Data not collected	No
2.	**Domestic sales data**		
2.1	Domestic sales data from local pharmaceutical companies	Data not collected	No
3.	**Medicines procurement data**		
3.1	Public hospitals medicines procurement data from several sources:		
	a. MOH procurement through central tender (APPL)	2006, 2007	Yes
	b. MOH individual hospital local purchase (NonAPPL)	2006, 2007	Yes
	c. University and Armed Forces hospitals procurement	2006, 2007	Yes
3.2	Private hospitals procurement	2006, 2007	Yes
3.3	Private GPs procurement	Data not collected	No
3.4	Private specialist practice procurement	Data not collected	No
3.5	Private pharmacies procurement	Data not collected	No
4.	**Medicines prescription data**		
4.1	Public (MOH) primary care practice prescription	Data not collected	No
4.2	Private GP prescription	2006, 2007	Yes
4.3	Private specialist practice prescription of highly specialised medicines	Data not collected	No
4.4	Hospital practice prescription	Data not collected	No
5.	**Medicines dispensing data**		
5.1	Public hospital pharmacy dispensing	Data not collected	No
5.2	Private free-standing pharmacy dispensing	2006, 2007	Yes
6.	**Household medicines consumption data**		
6.1	Household survey on medicines consumption	Data not collected	No

In summary:

- Of the 6 theoretical data sources, NMUS primarily targeted data sources on public and private hospital medicines procurement and private practice prescription/dispensing. This adequately reflects the total utilisation of all medicines in the country.
- Collection of prescription data was limited to general clinic practices, while hospital prescription is assumed to be included in hospital procurement data.
- Similarly, hospital dispensing data are assumed to be included in hospital procurement data, except of course for private free-standing pharmacies. Dispensing survey is therefore limited to the latter only. Given that private medical practitioners in Malaysia retain dispensing rights, prescription is a far more important source of data than dispensing, unlike say in Australia.
- Many private medical specialists may self-procure and dispense, rather than use hospital pharmacy dispensing service. Thus, in so far that prescription of highly specialised medicines for a particular condition is concentrated in private ambulatory specialist practices (which are unlikely as most such drugs are probably prescribed in hospital setting), they will be under-estimated in this report. Separate procurement and prescription surveys on such highly specialised medicines (if any) are required.
- It is well known that consumers do access medicines through both formal as well as informal channels. Household surveys will be required to obtain information on such use of medicines in the community.
- Finally, medicines import and sales data from pharmaceutical companies, where available, are not used for statistical estimation, but are used for reference only, and for cross-checking the reliability of results estimated from the other data sources.

Survey population, sampling and response or coverage rate

The surveys conducted by NMUS 2007, the survey population and sampling unit, sample size and survey response or coverage rates are summarised in the table below:

No.	Surveys	Survey population and sampling unit	Sample size	Coverage or response rate, and completeness
1.	MOH Pharmaceutical procurement	133 MOH hospitals a. APPL b. Non APPL	133 122	100%
2.	Private hospitals pharmaceutical procurement	142 Private hospitals	33	23.2 %
3.	University and Armed Forces hospital pharmaceutical procurement	3 University hospitals 2 Armed Forces hospitals	3 University 2 Armed Forces hospitals	100% for University 100% for Armed Forces
4.	Private GP prescription	6013	393	6.54%
5.	Private pharmacy dispensing	1663	34	2.04%

Data collection

The surveys conducted by NMUS collected data either by

1. Download from existing databases
2. Primary data collection

These are described below:

No.	Surveys	Data download from existing databases
1.	MOH pharmaceutical procurement	Pharmaniaga pharmaceutical procurement databases, central database as well as individual hospitals' local purchase databases
2.	Private hospitals pharmaceutical procurement	Individual hospitals' pharmaceutical procurement databases
3.	University and Armed Forces hospital pharmaceutical procurement	Individual hospitals' pharmaceutical procurement databases
4.	Private GP prescription	A sample of GPs collected prescription data in a randomly selected week. The sample being distributed over 3 four-monthly cycle
5.	Private Pharmacy dispensing	A sample of pharmacies with resident pharmacist collected dispensing data in a randomly selected week. The sample being distributed over 3 four-monthly cycle

Data management

The collected data, whether in databases or in paper or electronic data collection form, was compiled into a single database, appropriately processed and coded prior to statistical analysis.

The NMUS database was created in Ms SQL Server 2000. The application has 3 modules: Contact Management, Data Entry and Data Processing.

- Contact Management module was used to collect the establishments' survey details, log and track all the correspondence documents with SDP, and forecast, plan and schedule the conduct of the survey.
- Data Entry module was used to collect the data submitted by the SDP in paper form. It has been designed to collect data from GP prescription survey and pharmacy dispensing survey using paper CRF or prescription booklets.
- Data Processing module was used to clean, manage and process the medicines data prior to statistical analysis. The automated data processing functionalities included ATC coding, DDD Assignment, Total Dosage Calculation and Unit Conversions.

The database server was running on Windows 2003 R2 server. The server environment was Intel processor 2.33 Mhz, with a total of 8GB RAM memory and 800GB hard disk drive.

The data processing steps were as follows:

No.	Data processing for downloaded database
1.	Data were downloaded from the existing database of the following data sources • MOH APPL Procurement • MOH Non-APPL Procurement • Private Hospital Procurement • University Procurement • Armed Forces Procurement • GP Prescription • Private Pharmacy Dispensing The data downloaded could be in flat file format, e.g. TXT/ XLS and etc, or database files such as Access/ Oracle/ SQL and etc.
2.	The structure of each of the downloaded database/ data file were studied and analysed to identify the required data fields/ variables. The required variables were registration number, drug description, packaging description, supplier name, value procured, quantity procured, year procured and etc.
3.	Next, the required fields/ variables were extracted using SQL queries. The extracted data were then normalised by separating into multiple, related tables in a single compiled database.
4.	Some of the data required aggregation, e.g. total a few transactions on the same drug into 1 record, to speed up subsequent query performance.
5.	The data were then be linked to the respective SDP in the main contact table.

No.	Data processing for primary survey data
1.	*Data entry* Data was entered into the Data Entry module of the database. Prior to data entry, data entry personnel were briefed on how to use the application and enter the data. Necessary precautions were given verbally, for example, to check each clinic by office id and name, as they are clinics with many branches of the same name. A demonstration was done on data entry during the briefing. Personnel were supervised while doing the first few entries to make sure they know how to do it correctly. A standard document on steps/ precautions for data entry was given to each personnel. They were also given a softcopy of the list of pharmaceutical products (scheduled poison and non-scheduled poison) obtained from National Pharmaceuticals Control Bureau, to cross-check the spelling of drugs when the writing is less legible.
2.	*Edit checks* Survey forms were cross-checked against the database. Selection of survey form was by data entry personnel, randomly by survey date. If number of drug entries for selected date was not sufficient, more survey dates were included. Items checked: a. Number of patients were same in survey form and database b. Number of drug entry/ drug prescribed was same in survey form and database c. Age, sex of patient was entered correctly d. Drug particulars were entered correctly
3.	*Calculations and Derived variables* • Dose per day was obtained by Dosage*frequency • Dose per visit was obtained by Dosage*frequency* duration
4.	Visual review and manual assessment of entries if there were misspellings.

No.	Common data processing steps
1.	*BPFK Registered Product List* An estimated 7,028 'prescription' products from 11,400 products registered with BPFK were coded to ATC INN (Level 5). The coded BPFK drugs list served as an internal drug dictionary for medicines data coding.
2.	*Data Parsing by programming* The variables 'Drug Description' and 'Packaging Description' in medicines (procurement/ prescription/ dispensing) data were parsed into smaller parts using a specially written computer program. Parsing facilitated the auto-coding process and dosage calculation later. The variable 'Drug Description' was parsed into 'Brand', 'INN', 'Dosage', 'Unit' and 'Route' e.g. Zocor Tab 80 mg Brand – Zocor Inn – none Dosage – 80 Unit – mg Route – Tab The variable 'Packaging Description' was parsed into 'Big Unit', 'Small Unit' and 'Factor' e.g. Pack of 10 tabs Big Unit – Pack Small Unit – tabs Factor – 10
3.	*ATC Coding* • The parsed 'Brand' was then linked to the coded BPFK drug list to obtain the ATC, INN and DDD. However, if a certain brand had more than 1 DDD, the administration route had to be considered when assigning the DDD. • On the other hand, any parsed 'INN' was linked directly to the ATC Level 5 to obtain the standard INN and DDD. Similarly, if a certain INN had more than 1 DDD, the administration route had to be considered when assigning the DDD. • Visual review and manual coding of residual medicines data to ATC was carried out for residual data which were not auto-processed due to incompleteness or inconsistencies.
4.	*Drug Description Dosage and Unit* The 'Drug Description Dosage and Unit' were parsed into 'Dosage' and 'Unit' unless more than 1 dosage exists, e.g. 2MG/ML 100ML. The latter type of data would require further processing. The results of this step were 'Total Drug Description Dosage' and 'Total Drug Description Unit'. Remaining residual were handled manually.
5.	*Packaging Description Dosage* The 'Packaging Description' was parsed 'Pack Description' and 'Factor' and the 'Packaging Description Dosage' calculated with reference to the 'SKU' or 'UOM'. The result of this step is the 'Total Packaging Description Dosage'. Remaining residual has been handled manually.
6.	*Total Dosage Calculation* Total Dosage = Total Drug Description Dosage * Total Packaging Description Dosage * Quantity procured Total Dosage Unit = Total Drug Description Unit

Statistical report

This statistics on use of medicines in this report are presented using the Anatomical Therapeutic Chemical (ATC) classification system and the unit of measurement is expressed in defined daily dose (DDD).[2] This system is recommended by the WHO to be used for drug utilisation research and for purpose of comparisons of drug consumption statistics between countries, between regions or population groups within country and to evaluate trends in drug use over time.

Structure of the ATC Classification system

In this system, medicines are divided into different groups according to the organ or system on which they act, and on their chemical, pharmacological and therapeutic properties.

Medicines are classified in groups at 5 different levels as follows:

Level	Group and subgroups
1	Anatomical main group. There are 14 of these, eg. C cardiovascular, M musculo-skeletal, R respiratory, etc.
2	Therapeutic main group
3	Therapeutic subgroup
4	Chemical or Therapeutic subgroup
5	Drug chemical substance

For example, Simvastatin is coded C10AA01. The structure of its code is as follows:

Level	Code	Group and subgroups
1	C	Cardiovascular system
2	C10	Serum lipid reducing agents
3	C10A	Cholesterol or triglyceride reducers
4	C10AA	HMG CoA reductase inhibitors
5	C10AA01	Simvastatin

Concept of the Defined Daily Dose (DDD)

The measurement unit for medicines use adopted in this report is the DDD.

The DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults. The DDD is simply a technical measure of drug utilisation; it does not necessarily agree with the recommended or prescribed daily dose. Doses for individual patients and patient groups will often differ from the DDD. The DDD is often a compromise based on review of the available information about doses used in various countries. The DDD may even be a dose rarely prescribed because it is an average of two or more commonly used doses.

Medicines use statistics in this report are presented for most drugs as numbers of DDDs per 1000 inhabitants per day. Some interpretative notes are as follows:

- The DDDs/1000 inhabitants/day provides a rough estimate of the proportion of population treated daily with certain drugs. For example, the figure 10 DDDs/1000 inhabitants/day indicates that 1% (10/1000) of the population on average might get a certain drug or group of drugs every day in the year.
- The DDDs/1000 inhabitants/day is most useful for drugs used in the treatment of chronic diseases and especially when there is a good agreement between the average prescribed daily dose and the DDD.
- For most drugs, the DDDs/1000 inhabitants/day is calculated for the total population including all age and sex groups. Where a drug use is limited to particular age or sex groups, then it will be more meaningful to express the figure for the relevant age-sex groups only. For example DDDs/1000 children age<12 /day, or DDDs/1000 women in reproductive age groups/day.

For anti-infectives (or other drugs normally used in short duration), the medicines use statistics are also presented as DDD per inhabitant per year. This gives an estimate of the number of days for which each inhabitant is, on average, treated annually. For example, 5 DDDs/inhabitant/year indicates that the utilisation is equivalent to the treatment of every inhabitant with a 5-days course in the year.

In interpreting drug utilisation statistics using DDDs as in this report; readers are cautioned to bear in mind the following limitations:

- A medicine may have several indications while the DDD is based on the main indication in adults.
- Medicines procured, prescribed or dispensed, as presented here, are assumed to be consumed (although it may not necessarily be so).
- DDDs may be difficult to assign or not assigned at all for certain medicines, for examples, medicines with multiple ingredients, topical products, anti-neoplastic drugs and anaesthetic agents.
- Medicines newly introduced into the market may yet have ATC and DDD assigned to them.
- The DDD assigned to a drug is primarily based on other countries' experience and may not reflect the commonly prescribed adult dose in Malaysia.

For most parts of this report, only drugs with WHO-assigned DDDs are included in the utilisation statistics. However, a few groups of drugs which do not have WHO-assigned DDDs, namely the Antineoplastics, Dermatologicals, Ophthalmologicals and Otologicals were given arbitrary DDDs (mainly the most common unit of measure ie. g, mg or ml) to enable us to present their national utilisation and patterns of use, relative to drugs within the respective groups only.

Statistical Methods

For this NMUS report, the quantity of use of a medicine is expressed, depending on the type of medicine, as the number of DDDs per 1000 inhabitants per day or DDDs per inhabitants per year. These statistics are calculated as follows:

$$\textit{DDD}\text{s/1000 inhabitants/day} = \frac{\hat{T} * 1000}{DDD * P * 365}$$

or

$$\textit{DDD}\text{s/1000 inhabitants/year} = \frac{\hat{T} * 1000}{ddd * P}$$

where $\hat{T}$ is an estimate of the total quantity of the drug utilised in the year under consideration,

DDD is the *DDD* assigned for the drug according to the ATC/*DDD* system,

P is the mid-year population of Malaysia (P_{2007}= 27,173,600),

365 refers to the 365 days in a year

In either case, an estimate of the total quantity of the drug being utilised in the year is required, and this must be expressed in the same unit as the *DDD* assigned for the drug.

The statistical estimation of the totals varies depending on the survey method and the sampling design employed to collect the data, and if necessary with adjustment for incomplete data. These are described on the following page.

No.	Surveys	Estimation procedure
1.	MOH pharmaceutical procurement: APPL	No sampling was employed in the survey as there was full response. Therefore, the total is the sum of all the quantities of the drug procured in all procurement records in the year. The total is $\hat{T} = \sum_{i=1}^{I} T_i$ where T_i is the value of the quantity of drug procured of the i^{th} hospital in the year.
2.	i) MOH pharmaceutical procurement : Non APPL ii) University and Armed Forces' hospital pharmaceutical procurement iii) Private hospitals pharmaceutical procurement	Data were available for only a sample of hospitals. The total is estimated by $\hat{T} = \sum_{i=1}^{I_j} \sum_{j=1}^{4} w_j T_i$ where T_i is the value of the quantity of drug procured of the i^{th} hospital in the year, j = strata according to bed strength of the hospital, j = 1: bed strength ≤ 20, j = 2: 21 ≤ bed strength ≤ 50, j = 3: 51 ≤ bed strength ≤ 100, j = 4: bed strength ≥ 101. The sampling weight of each strata, $w_j = \frac{B_j}{b_j}$ j = 1, 2, 3, and 4, B_j is total number of beds for hospitals in the population and b_j is total number of beds in the sample for strata j.
3.	i) Private GP prescription ii) Private pharmacy dispensing	Data were collected only for a sample of GP or pharmacy and for each respondent, data collected only for a sample of days in a year (working days only). The total is estimated by $\hat{T} = \sum_{i=1}^{I} \sum_{j=1}^{7} w_i T_j$ where T_{ij} is the value of the quantity of drug prescribed by the i^{th} GP or pharmacy on the j^{th} day. The sampling weight of the i^{th} GP or pharmacy, $w_i = \frac{N}{n} \times \frac{D}{d_i}$ where N is total number of GP or pharmacy in the population, n is number of responding GP or pharmacy (sample), D is the total number of working days in a year, and d_i is the number of survey days of i^{th} GP or pharmacy in a year.

Where there was sampling or where response rate of the survey was less than 100%, the procedures described above incorporated the sampling weight of the sampling unit in the estimation of total.

The sampling weight for each sampling unit or unit of analysis has the following components:

1. Probability of selection

The basic weight is obtained by multiplying the reciprocals of the probability of selection at each step of sampling design. Example, for GP prescription survey, this is GP practice and prescription day.

2. Adjustment for non-response

The response rate was less than 100% for some surveys; an adjustment to the sampling weight is required. The non-response adjustment weight is a ratio with the number of units in the population as the numerator and the number of responding sampling units as the denominator. The adjustment reduces the bias in an estimate to the extent that non-responding units have same characteristics as responding units. Where this is unlikely, some adjustments took into account differences in some relevant characteristics between responding and non-responding units that may influence drug utilisation, such as bed strength, staff strength, scope of services for hospitals etc.

To enable comparison between results for NMUS 2007 with those of NMUS 2006, the 2006 data were reviewed and total utilisation recalculated where necessary eg. where there was change in ATC code or ddd assigned by WHO, or standardisation of codes for drugs with multiple codes. There were also some corrections for 2006 data where discrepancies were detected when compared with 2007 statistics.

EXPENDITURE ESTIMATION METHODOLOGY

Study Population

The NMUS 2007 covered private & public healthcare providers in Malaysia comprising:

a. The public health sector which consists of hospitals and primary care clinics of the Ministry of Health, University Hospitals under the Ministry of Higher Education and Military Hospitals under the Ministry of Defence.
b. The private health sector consisting of private hospitals, general practitioners and private retail pharmacies in Malaysia

Methodology

The expenditure on a particular drug in a given year is the quantity of drug used in that year multiplied by the price of the drug, i.e. :

Total expenditure = Quantity of drug utilisation * Price of drug

The 'quantity of drug utilisation' is determined from the drug utilisation data presented elsewhere in this report.

'Price of drug' is the median price for each drug chemical substance (5th level ATC classification) denominated in Daily Defined Doses (DDD). The median price is determined from the data collected in NMUS, taking into account price variations for dosage forms (route of administration), and differences between prices in public and private sectors. Thus there are two sets of median prices for each drug chemical substance i.e. public and private median prices. -

Prices for the public sector were determined from procurement data of MOH, University and Armed Forces healthcare establishments whilst private sector prices were determined from procurement data of private hospitals. As GP prescriptions & retail pharmacy dispensing data obtained by NMUS did not contain any data usable for calculating prices, the prices estimated from private hospitals were applied to GP and Pharmacy data.

The expenditure for each procurement item is then calculated as $E_i = p50_i * DDD_i$ where p50 is the median price, DDD is the quantity of utilisation and "i" refers to the drug chemical substance. The total expenditure on a drug chemical substance in a particular sector is the sum of all procurement, prescription and dispensing of the item in that sector. The total expenditure for the country is the sum of total expenditure in all the sectors.

For this report, a slightly different methodology from that of MSOM 2006 was used for computation and ranking of total expenditure:

- For MSOM 2006, price and total expenditure were calculated and ranked only for drugs which appeared in the top 150 utilisation ranking. For this report (MSOM 2007), prices and total expenditure were calculated for all drugs with price information available in NMUS data irrespective of their utilisation ranking. The total expenditures were then ranked accordingly.

- In this report (MSOM 2007), weightage was given to bed strength stratification in adjusting quantity of drug utilisation by dosage form (administration route) whilst the overall drug utilisation quantity was used in *MSOM 2006.*

The total expenditures for 2006 were recalculated to enable comparison with those of 2007.

References:

1. Percetakan Nasional Malaysia Bhd. Poisons Act 1952 (revised 1989), Act 366 Laws of Malaysia. Kuala Lumpur 1989
2. WHO Collaborating Centre for Drug Statistics Methodology. Guidelines for ATC Classification and DDD Assignment 2009. Oslo December 2008.

ABBREVIATIONS

3rd GCS	Third-Generation Cephalosporins
5HT1	Serotonin
ACEI	Angiotensin Converting Enzyme Inhibitors
ACS	Acute Coronary Syndrome
ACTH	Adrenocorticotropic Hormone
AdmR	Administration Route
ADT	Androgen Deprivation Treatment
AED	Antiepileptics
Anti-HIV	Anti-Human Immunodeficiency Virus
ARB	Angiotensin II Antagonists/ Angiotensin Receptor Blocker
ASR	Age Standardised Incidence Rate
ATC	Anatomical Therapeutic Chemical
BPFK	Biro Pengawalan Farmaseutikal Kebangsaan
BPH	Benign Prostatic Hyperplasia
BSA	Body Surface Area
CCB	Calcium Channel Blockers
CNI	Calcineurin Inhibitor
CNS	Central Nervous System
COMT	Catechol-O-Methytransferase
COPD	Chronic Obstructive Pulmonary Disease
COX-2	Cyclooxygenase-2
CPG	Clinical Practice Guidelines
CTZ	Chlorothiazide
DAs	Dopamine Agonists
DCA	Drug Control Authority
DDA	Dangerous Drugs Act
DDD	Defined Daily Dose
DMARD	Disease-modifying Antirheumatic Drugs
EPS	Extrapyramidal Syndrome
ESAC	European Surveillance of Antimicrobial Consumption
ESBL	Extended Spectrum Beta-lactamase
ESRD	End-Stage Renal Disease
ESRF	End-Stage Renal Failure
FEIBA	Factor VIII Inhibitor Bypassing Activity
3rd GCS	Third-generation Cephalosporins
GORD/GERD	Gastro-Oesophageal Reflux Disease
GRACE	Global Registry of Acute Coronary Events
H_2RA	H_2 Receptor Antagonist

HAART	Highly Active Anti-Retroviral Therapy
HCTZ	Hydrochlorothiazide
HIV	Human Immunodeficiency Virus
HMG CoA	3-hydroxy-3-methylglutaryl Coenzyme A
IOP	Intraocular Pressure
LABA	Long-Acting Beta Agonists
LDL	Low Density Lipoprotein
LHRH	Luteinizing Hormone-Releasing Hormone
LUTS	Lower Urinary Tract Symptoms
LV	Left Ventricular
MG	Myasthenia Gravis
MOH	Ministry of Health
MRSA	Methicillin-resistant *Staphylococcus aureus*
MSOM	Malaysian Statistics on Medicines
MSSA	Methicillin-sensitive *Staphylococcus aureus*
NEDL	National Essential Drugs List
NHMS	National Health and Morbidity Survey
NMP	National Medicines Policy
NMUS	National Medicines Use Survey
NSAIDs	Non Steroidal Anti-Inflammatory Drugs
O&G	Obstetrics and Gynaecology
OTC	Over-the-Counter
PCOS	Polycystic Ovarian Syndrome
PD	Parkinson's Disease
PDE5	Phosphodiesterase Type-5
PPI	Proton Pump Inhibitors
rHuEPO	Recombinant Human Erythropoietin
RRMS	Remitting-Relapsing Multiple Sclerosis
RTI	Respiratory Tract Infection
SABA	Short-Acting Beta Agonists
SORMs/SERMs	Selective Oestrogen Receptor Modulators
SSRIs	Selective Serotonin Reuptake Inhibitors
STD	Sexually Transmitted Diseases
TZD	Thiazolidinediones
RTI	Respiratory Tract Infection
UTI	Urinary Tract Infection
WFH	World Federation of Haemophilia
WHO	World Health Organisation

CHAPTER 1 | USE OF MEDICINES IN MALAYSIA

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In this chapter, we report an overview of the national estimates for the use of medicines in Malaysia for year 2007. The most commonly used medicines by therapeutic groups and by specific drugs are tabulated below. More detailed statistics and analysis of medicines utilised are given in other chapters in this report.

As in previous years, the National Medicines Use Survey (NMUS) 2007 was limited to "prescription" medicines only; it excluded Over-the-Counter (OTC) medicines and Traditional Medicines. Also, utilisation data presented in this chapter included only drugs that have Defined Daily Doses (DDDs) in the World Health Organisation (WHO) Anatomical Therapeutic Chemical (ATC) classification system,[1] and the estimates are expressed as number of DDDs per 1000 population per day. Hence the discussions in relation to ranking and comparison of usage in this chapter do not include drugs which do not have WHO assigned DDD and are not prescription medicines.

However, estimates for utilisation of some medicines which do not have WHO assigned DDDs are presented, in terms of weight of active ingredient/1000 population per day (Antineoplastic drugs) or weight or volume of drug preparations per 1000 population per day (Dermatologicals, Ophthalmologicals and Otologicals), in other chapters where the utilisation of these drugs within their respective groups are discussed.

Among the therapeutic groups, drugs used in diabetes (ATC code A10) ranked highest in terms of utilisation in Malaysia for the year 2007 (Table 1.1) as was in 2006 (Table 1.2). An estimate of 3.97% of the Malaysian population was on drugs from this therapeutic group. This correlates well with the national diabetes prevalence of 4.0% in the general population reported in the Third National Health and Morbidity Survey 2006 (NHMS III).[2]

The therapeutic groups used for cardiovascular disorders, namely agents acting on the renin-angiotensin system (C09) consumed by 2.67% of the population, beta blocking agents (C07) consumed by 2.62% of the population, calcium channel blockers (C08) consumed by 2.31% of the population, diuretics (C03) consumed by 1.40% of the population and lipid-modifying agents (C10) consumed by 1.39% of the population, were ranked 2nd, 3rd,4th, 5th and 6th respectively (Table 1.1).

Drugs for obstructive airway diseases constituted the next highest ranking group of drugs. However, there was not much difference in total utilisation between 2007 (12.59 DDD/1000 population/day) and 2006 (11.73 DDD/1000 population/day).

As far as individual drugs were concerned, ranks 1 to 11 by utilisation for 2007 went to drugs for diabetes and cardiovascular disorders (Table 1.3), again reflecting the pattern for prevalence of chronic diseases reported by NHMS III where hypertension, diabetes and heart diseases ranked 1st, 2nd and 4th among the top chronic illnesses. Overall, there was not much difference in ranking for the top 5 drugs by utilisation when compared to 2006.

Metformin (consumed by 1.43% of the population), followed by glibenclamide (consumed by 1.28% of the population), were the top 2 antidiabetic drugs as well as the top 2 among all drugs utilised. Metformin was recommended as first-line therapy in the treatment of Type 2 diabetes mellitus according to the Malaysian Clinical Practice Guidelines (CPG) at that time.[3] This may reflect some improvement in terms of adherence to the guidelines compared to 2006 where usage of glibenclamide superseded metformin.

It is interesting to note that usage of amlodipine had gone up from rank 9th in 2006 to rank 6th in 2007, with almost 70% increase in utilisation. Usage in the public sector in 2007 was double that of 2006. Perindopril had also climbed up the chart from being only at rank 11th in 2006 to rank 7th in 2007, again with almost 70% increase in usage. The increase in utilisation of amlodipine and perindopril may possibly be attributed to the findings of the Anglo Scandinavian Cardiovascular Outcome Trial (ASCOT), which was published in 2005.[4] Also, generic versions of amlodipine became available following expiration of its patent.

Asthma was the 3rd highest ranking chronic disease reported in NHMS III. It is therefore not surprising that inhaled salbutamol (R03A) occupied 12th position in the 2007 utilisation ranking for individual drugs, an improvement from its 13th position in 2006, with approximately 30% increase in usage. Usage of budesonide, an inhalation steroid, however, dropped from rank 25th in 2006 (1.787 DDD/1000 population/day) to rank 38th (1.1984 DDD/1000 population/day) in 2007. Although detail statistics in other parts of this report showed general decrease in use of single-ingredient inhaled glucocorticoids, there was an overall increase in use of inhaled combination glucocorticoids with long-acting beta agonists.

It is also interesting to note the improvement in rankings of oral contraceptives. The combination levonorgestrel and oestrogen which ranked 31st in 2006 moved up to 21st in 2007, whilst the desogestrel and oestrogen combination, a third generation oral contraceptive, emerged as a new member in the top 40 drugs by utilisation list at rank 39th (2007), moving up from 49th in the previous year. In terms of utilisation, there were overall increase of 1.12 DDD/1000 population/day and 0.28 DDD/1000 population/day, respectively, for the 2 combination oral contraceptives (equivalent to an increase of 75% and 30%, respectively).

Comparing the Malaysian drug utilisation pattern with that of Australia[5] and Norway[6], whilst cardiovascular drugs dominated the top 10 drugs by utilisation in all 3 countries, ranking for individual drugs for Malaysia differed somewhat from that of Australia and Norway as shown in Table 1.6. The most significant differences are the presence of nervous system drugs in the top 10 drugs for Australia (sertraline (N06AB06) ranked 7th) and Norway (zopiclone, (N05CF01) ranked 4th); both these drugs are not even in the top 40 drugs in Malaysian ranking. Metformin, the most highly utilised drug in Malaysia did not feature among the top 10 drugs for both Australia and Norway although the consumptions were comparable - 14.28, 15.65, 11.98/1000 population/day, respectively, for Malaysia, Australia and Norway; in fact, neither did any of the other antidiabetic drugs make it to the top 10 list for Australia and Norway. Diabetes prevalence in Australia was 3.6% (2005-2006)[7] and Norway 4.7% (2007).[8] Instead, the lipid-modifying drugs, atorvastatin and simvastatin topped the Australian and Norwegian list, respectively.

The National Medicines Use Survey (NMUS), amongst other objectives, is designed to support the implementation of the National Medicines Policy which promotes equitable access to essential medicines. Hence, it is pertinent to note that 10 out of the top 40 drugs used in 2007 are not in the Malaysian National Essential Drugs List (NEDL) 2008.[9] These included amlodipine, an antihypertensive drug (rank 6th), loratadine, a commonly used non-sedative antihistamine (rank 24th), cetirizine (another antihistamine) which saw a 51% increase in usage and improved ranking from 32nd (2006) to 25th (2007), and simvastatin (a lipid-modifying drug) which has been consistently in the top 40 drugs used (rank 17th in 2006 and 16th in 2007). Based on the utilisation patterns established by NMUS, there is an apparent 'mismatch' between what is most used and what is listed in the NEDL in some therapeutic areas. Whilst the NEDL serves only as a guide to drugs which should be available in the country, there is need to regularly update the medicines selections to reflect new therapeutic options and changing therapeutic needs.

The NMUS showed that the drug utilisation patterns in Malaysia concurred with prevalence of chronic diseases reported in NHMS III. It also showed that for both 2006 and 2007, the overall drug utilisation in the public sector was twice that of the private sector for the top 30 therapeutic groups. Twenty of the thirty most utilised classes of drugs were for chronic diseases, and public sector utilisation exceeded that of private sector, indicating an imbalance in burden borne in the management of these diseases. This also concurred with the NHMS III which found that government health centres were the most frequently visited by respondents with chronic diseases followed by private clinics.

However, the pattern was reversed for drugs used for short term symptomatic relief such as antihistamines, anti-inflammatory and antirheumatic drugs, nasal preparations, drugs for gastrointestinal disorders and corticosteroids, where private sector utilisation was higher. Interestingly, the NHMS III found that among those who used ambulatory services for recent illnesses, 62.1% went to private clinics whilst 37.9% used government clinics.[10]

In conclusion, the overall utilisation pattern of medicines in the country for 2006-2007 appeared to be in accordance with the general healthcare needs.

Table 1.1 : Top 30 Therapeutic Groups by Utilisation in DDD/1000 population/day 2007

Rank	ATC	Therapeutic Group	Public	Private	Total
1	A10	Drugs used in diabetes	32.1800	7.5439	39.7240
2	C09	Agents acting on the renin-angiotensin system	19.0851	7.5894	26.6745
3	C07	Beta blocking agents	21.5089	4.7520	26.2609
4	C08	Calcium channel blockers	18.9637	4.0964	23.0601
5	C03	Diuretics	11.0801	2.9467	14.0268
6	C10	Lipid modifying agents	8.9122	5.0597	13.9719
7	R03	Drugs for obstructive airway diseases	9.8508	2.7419	12.5928
8	M01	Anti-inflammatory and antirheumatic products	4.1473	8.1637	12.3110
9	R06	Antihistamines for systemic use	4.5773	6.7152	11.2925
10	B01	Antithrombotic agents	6.4576	3.3091	9.7666
11	J01	Antibacterials for systemic use	3.6481	6.0014	9.6494
12	G03	Sex hormones and modulators of the genital system	3.1479	4.9869	8.1348
13	A02	Drugs for acid related disorders	3.1153	3.2156	6.3309
14	C01	Cardiac therapy	3.3976	1.5625	4.9601
15	N05	Psycholeptics	3.4242	1.4548	4.8790
16	H02	Corticosteroids for systemic use	1.9316	2.8135	4.7451
17	R01	Nasal preparations	1.3867	2.9747	4.3614
18	C02	Antihypertensives	3.1665	0.1879	3.3544
19	A03	Drugs for functional gastrointestinal disorders	0.7107	1.4018	2.1125
20	H03	Thyroid therapy	1.4830	0.5282	2.0112
21	N06	Psychoanaleptics	1.2457	0.5596	1.8053
22	M04	Antigout preparations	1.1464	0.6272	1.7736
23	N03	Antiepileptics	1.3751	0.2618	1.6368
24	S01	Ophthalmologicals	1.1529	0.2151	1.3680
25	N07	Other nervous system drugs	0.5723	0.5439	1.1162
26	G04	Urologicals	0.7826	0.2974	1.0800
27	J04	Antimycobacterials	0.8298	0.1292	0.9590
28	N04	Antiparkinson drugs	0.7405	0.0689	0.8094
29	A07	Antidiarrheals, intestinal anti-inflammatory /anti-infective agents	0.2738	0.4677	0.7416
30	J05	Antivirals for systemic use	0.5660	0.0698	0.6358
Total utilisation for top 30 therapeutic groups			**170.8597**	**81.2859**	**252.1456**

Table 1.2 : Top 30 Therapeutic Groups by Utilisation in DDD/1000 population/day 2006

Rank	ATC	Therapeutic Group	Public	Private	Total
1	A10	Drugs used in diabetes	32.7987	6.5362	39.3349
2	C07	Beta blocking agents	21.3322	4.3809	25.7131
3	C09	Agents acting on the renin-angiotensin system	13.8276	5.7525	19.5801
4	C08	Calcium channel blockers	15.9410	3.4243	19.3653
5	C03	Diuretics	11.7771	2.8941	14.6712
6	R03	Drugs for obstructive airway diseases	9.4693	2.2664	11.7356
7	C10	Lipid modifying agents	5.5117	4.9109	10.4226
8	M01	Anti-inflammatory and antirheumatic products	3.9514	6.0216	9.9729
9	R06	Antihistamines for systemic use	4.4889	5.4258	9.9147
10	B01	Antithrombotic agents	6.0229	3.5854	9.6084
11	J01	Antibacterials for systemic use	3.8151	5.1231	8.9383
12	G03	Sex hormones and modulators of the genital system	2.4879	3.8736	6.3615
13	A02	Drugs for acid related disorders	2.5007	2.6584	5.1590
14	C01	Cardiac therapy	2.7982	1.8947	4.6928
15	H02	Corticosteroids for systemic use	1.9061	2.5400	4.4461
16	N05	Psycholeptics	3.0499	0.9971	4.0470
17	C02	Antihypertensives	2.9987	0.2328	3.2315
18	R01	Nasal preparations	1.1736	1.9592	3.1327
19	A03	Drugs for functional gastrointestinal disorders	0.6813	1.6295	2.3107
20	H03	Thyroid therapy	1.4491	0.5443	1.9934
21	M04	Antigout preparations	1.0294	0.5053	1.5347
22	N03	Antiepileptics	1.3455	0.1569	1.5024
23	N06	Psychoanaleptics	0.8927	0.4193	1.3120
24	S01	Ophthalmologicals	1.0590	0.1936	1.2525
25	J04	Antimycobacterials	0.9993	0.1023	1.1015
26	N07	Other nervous system drugs	0.4346	0.6062	1.0408
27	N04	Antiparkinson drugs	0.8279	0.0524	0.8803
28	G04	Urologicals	0.4062	0.3194	0.7256
29	A08	Antiobesity preparations, excl. diet products	0.0162	0.7057	0.7218
30	R05	Cough and cold preparations	0.0040	0.6973	0.7013
Total utilisation for top 30 therapeutic groups			**155.2621**	**70.1247**	**225.3862**

Table 1.3 : Top 40 Drugs by Utilisation in DDD/1000 population/day 2007

Rank	ATC	Drug	Public	Private	Total
1	A10B A02	Metformin	11.9242	2.3571	14.2813
2	A10B B01	Glibenclamide	11.0430	1.7243	12.7674
3	C07A B03	Atenolol	9.4592	3.2072	12.6665
4	C07A B02	Metoprolol	11.4304	0.6546	12.0850
5	C08C A05	Nifedipine	10.6460	0.8164	11.4624
6	C08C A01	Amlodipine	6.4459	2.4894	8.9352
7	C09A A04	Perindopril	6.9654	1.0012	7.9666
8	A10B B09	Gliclazide	5.6189	1.5451	7.1640
9	B01A C06	Acetylsalicylic acid	4.7791	2.1267	6.9059
10	C09A A02	Enalapril	4.7359	1.3831	6.1190
11	C03A A04	Chlorothiazide	5.7074	0.0463	5.7537
12	R03A C02	Salbutamol	4.9464	0.7211	5.6675
13	C10A A02	Lovastatin	4.5976	0.2975	4.8952
14	C03C A01	Furosemide	3.9743	0.7494	4.7237
15	C09A A01	Captopril	4.4033	0.1485	4.5518
16	C10A A01	Simvastatin	2.4809	2.0083	4.4892
17	R06A B04	Chlorphenamine	2.6324	1.4110	4.0434
18	M01A B05	Diclofenac	1.1058	2.9248	4.0306
19	M01A G01	Mefenamic acid	1.4147	2.0612	3.4759
20	H02A B06	Prednisolone	1.1353	2.2221	3.3575
21	G03A A07	Levonorgestrel and oestrogen	1.3678	1.2585	2.6263
22	J01C A04	Amoxicillin	0.7373	1.7944	2.5317
23	C02C A01	Prazosin	2.2924	0.0682	2.3606
24	R06A X13	Loratadine	0.8946	1.4514	2.3460
25	R06A E07	Cetirizine	0.3330	1.9108	2.2438
26	R01B A52	Pseudoephedrine, combinations	0.4270	1.8116	2.2387
27	C10A A05	Atorvastatin	0.8415	1.2801	2.1216
28	C08C A02	Felodipine	1.5870	0.4541	2.0411
29	C01E B15	Trimetazidine	1.1144	0.7084	1.8229
30	A02B A02	Ranitidine	1.1472	0.6463	1.7936
31	A02B C01	Omeprazole	0.8518	0.9395	1.7913
32	R03D A04	Theophylline	1.0632	0.4774	1.5407
33	M04A A01	Allopurinol	1.0825	0.4317	1.5142
34	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	1.2479	0.1608	1.4087
35	C01D A08	Isosorbide dinitrate	1.2206	0.0991	1.3197
36	C03E A01	Hydrochlorothiazide and potassium-sparing agents	0.8510	0.4501	1.3011
37	C09C A01	Losartan	0.6054	0.6540	1.2595
38	R03B A02	Budesonide	1.0263	0.1722	1.1984
39	G03A A09	Desogestrel and oestrogen	0.4085	0.7718	1.1802
40	R03C C02	Salbutamol	0.6723	0.5031	1.1754

Table 1.4 : Top 40 Drugs by Utilisation in DDD/1000 population/day 2006

Rank	ATC	Drug	Public	Private	Total
1	A10B B01	Glibenclamide	14.0329	1.5098	15.5427
2	A10B A02	Metformin	11.1397	2.0101	13.1498
3	C07A B02	Metoprolol	11.7536	0.5828	12.3365
4	C07A B03	Atenolol	9.0770	2.9306	12.0076
5	C08C A05	Nifedipine	10.9355	0.6772	11.6127
6	B01A C06	Acetylsalicylic acid	4.8340	2.2369	7.0709
7	C03A A04	Chlorothiazide	6.2441	0.0355	6.2796
8	A10B B09	Gliclazide	4.5930	1.3667	5.9598
9	C08C A01	Amlodipine	3.2803	1.9921	5.2725
10	C03C A01	Furosemide	3.9322	0.9624	4.8946
11	C09A A04	Perindopril	4.3301	0.3796	4.7098
12	C09A A02	Enalapril	3.5113	0.9827	4.4939
13	R03A C02	Salbutamol	4.0240	0.3231	4.3471
14	C09A A01	Captopril	4.1067	0.1984	4.3051
15	M01A B05	Diclofenac	1.4652	2.1251	3.5902
16	R06A B04	Chlorphenamine	2.5648	0.9970	3.5618
17	C10A A01	Simvastatin	1.3189	1.9644	3.2833
18	C10A A02	Lovastatin	2.7005	0.3364	3.0369
19	M01A G01	Mefenamic acid	1.2609	1.4223	2.6833
20	H02A B06	Prednisolone	1.1766	1.3429	2.5194
21	C02C A01	Prazosin	2.2340	0.0961	2.3301
22	R06A X13	Loratadine	0.7417	1.4358	2.1775
23	J01C A04	Amoxicillin	0.6980	1.4019	2.0999
24	C08C A02	Felodipine	1.3805	0.4422	1.8227
25	R03B A02	Budesonide	1.5698	0.2171	1.7870
26	A02B A02	Ranitidine	1.1741	0.5389	1.7130
27	C10A A05	Atorvastatin	0.3930	1.2690	1.6620
28	R03D A04	Theophylline	1.1004	0.4886	1.5890
29	R01B A52	Pseudoephedrine, combinations	0.4124	1.1180	1.5304
30	A02B C01	Omeprazole	0.5889	0.9104	1.4994
31	G03A A07	Levonorgestrel and oestrogen	0.8155	0.6838	1.4993
32	R06A E07	Cetirizine	0.2259	1.2548	1.4807
33	C01E B15	Trimetazidine	0.6345	0.8040	1.4386
34	C01D A08	Isosorbide dinitrate	1.2768	0.0932	1.3699
35	C03E A01	Hydrochlorothiazide and potassium-sparing agents	1.0077	0.3358	1.3434
36	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	1.1299	0.1982	1.3281
37	M04A A01	Allopurinol	0.9627	0.3601	1.3227
38	R06A D02	Promethazine	0.8526	0.2776	1.1302
39	C09C A01	Losartan	0.5202	0.5978	1.1179
40	C03A A03	Hydrochlorothiazide	0.2597	0.8356	1.0953

Table 1.5 : Top 40 Drugs by Utilisation in DDD/1000 population/day 2007 versus 2006

Rank 2007	ATC	Drug	2007			2006			Rank 2006
			Public	Private	Total	Public	Private	Total	
1	A10B A02	Metformin	11.9242	2.3571	14.2813	11.1397	2.0101	13.1498	2
2	A10B B01	Glibenclamide	11.0430	1.7243	12.7674	14.0329	1.5098	15.5427	1
3	C07A B03	Atenolol	9.4592	3.2072	12.6665	9.0770	2.9306	12.0076	4
4	C07A B02	Metoprolol	11.4304	0.6546	12.0850	11.7536	0.5828	12.3365	3
5	C08C A05	Nifedipine	10.6460	0.8164	11.4624	10.9355	0.6772	11.6127	5
6	C08C A01	Amlodipine	6.4459	2.4894	8.9352	3.2803	1.9921	5.2725	9
7	C09A A04	Perindopril	6.9654	1.0012	7.9666	4.3301	0.3796	4.7098	11
8	A10B B09	Gliclazide	5.6189	1.5451	7.1640	4.5930	1.3667	5.9598	8
9	B01A C06	Acetylsalicylic acid	4.7791	2.1267	6.9059	4.8340	2.2369	7.0709	6
10	C09A A02	Enalapril	4.7359	1.3831	6.1190	3.5113	0.9827	4.4939	12
11	C03A A04	Chlorothiazide	5.7074	0.0463	5.7537	6.2441	0.0355	6.2796	7
12	R03A C02	Salbutamol	4.9464	0.7211	5.6675	4.0240	0.3231	4.3471	13
13	C10A A02	Lovastatin	4.5976	0.2975	4.8952	2.7005	0.3364	3.0369	18
14	C03C A01	Furosemide	3.9743	0.7494	4.7237	3.9322	0.9624	4.8946	10
15	C09A A01	Captopril	4.4033	0.1485	4.5518	4.1067	0.1984	4.3051	14
16	C10A A01	Simvastatin	2.4809	2.0083	4.4892	1.3189	1.9644	3.2833	17
17	R06A B04	Chlorphenamine	2.6324	1.4110	4.0434	2.5648	0.9970	3.5618	16
18	M01A B05	Diclofenac	1.1058	2.9248	4.0306	1.4652	2.1251	3.5902	15
19	M01A G01	Mefenamic acid	1.4147	2.0612	3.4759	1.2609	1.4223	2.6833	19
20	H02A B06	Prednisolone	1.1353	2.2221	3.3575	1.1766	1.3429	2.5194	20
21	G03A A07	Levonorgestrel and oestrogen	1.3678	1.2585	2.6263	0.8155	0.6838	1.4993	31
22	J01C A04	Amoxicillin	0.7373	1.7944	2.5317	0.6980	1.4019	2.0999	23
23	C02C A01	Prazosin	2.2924	0.0682	2.3606	2.2340	0.0961	2.3301	21
24	R06A X13	Loratadine	0.8946	1.4514	2.3460	0.7417	1.4358	2.1775	22
25	R06A E07	Cetirizine	0.3330	1.9108	2.2438	0.2259	1.2548	1.4807	32
26	R01B A52	Pseudoephedrine, combinations	0.4270	1.8116	2.2387	0.4124	1.1180	1.5304	29
27	C10A A05	Atorvastatin	0.8415	1.2801	2.1216	0.3930	1.2690	1.6620	27
28	C08C A02	Felodipine	1.5870	0.4541	2.0411	1.3805	0.4422	1.8227	24
29	C01E B15	Trimetazidine	1.1144	0.7084	1.8229	0.6345	0.8040	1.4386	33
30	A02B A02	Ranitidine	1.1472	0.6463	1.7936	1.1741	0.5389	1.7130	26
31	A02B C01	Omeprazole	0.8518	0.9395	1.7913	0.5889	0.9104	1.4994	30
32	R03D A04	Theophylline	1.0632	0.4774	1.5407	1.1004	0.4886	1.5890	28
33	M04A A01	Allopurinol	1.0825	0.4317	1.5142	0.9627	0.3601	1.3227	37
34	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	1.2479	0.1608	1.4087	1.1299	0.1982	1.3281	36
35	C01D A08	Isosorbide dinitrate	1.2206	0.0991	1.3197	1.2768	0.0932	1.3699	34
36	C03E A01	Hydrochloro-thiazide and potassium-sparing agents	0.8510	0.4501	1.3011	1.0077	0.3358	1.3434	35
37	C09C A01	Losartan	0.6054	0.6540	1.2595	0.5202	0.5978	1.1179	39
38	R03B A02	Budesonide	1.0263	0.1722	1.1984	1.5698	0.2171	1.7870	25
39	G03A A09	Desogestrel and oestrogen	0.4085	0.7718	1.1802	0.3506	0.5492	0.8998	49
40	R03C C02	Salbutamol	0.6723	0.5031	1.1754	0.6610	0.4139	1.0749	41

Table 1.6 : Comparison of Top 10 Drugs by Utilisation in DDD/1000 population/day 2007 Malaysia, Australia and Norway

Rank	Malaysia			Australia			Norway		
	ATC	Drug	Use	ATC	Drug	Use	ATC	Drug	Use
1	A10B A02	Metformin	14.28	C10AA05	Atorvastatin	128.90	C10AA01	Simvastatin	109.66
2	A10B B01	Glibenclamide	12.76	C10AA01	Simvastatin	53.94	B01AC06	Acetyl-salicylic acid	66.98
3	C07A B03	Atenolol	12.66	C09AA05	Ramipril	40.69	C10AA05	Atorvastatin	48.46
4	C07A B02	Metoprolol	12.08	C09A A04	Perindopril	28.32	N05CF01	Zopiclone	32.32
5	C08C A05	Nifedipine	11.46	C09CA04	Irbesartan	23.61	C08CA01	Amlodipine	30.76
6	C08C A01	Amlodipine	8.93	R03AC02, R03CC02	Salbutamol	22.80	R06AE07	Cetirizine	29.76
7	C09A A04	Perindopril	7.96	N06AB06	Sertraline	20.12	C09AA05	Ramipril	24.82
8	A10B B09	Gliclazide	7.16	B01AC06	Acetyl-salicylic acid	19.57	C07AB02	Metoprolol	24.71
9	B01A C06	Acetyl-salicylic acid	6.91	C03CA01	Furosemide	19.36	H03AA01	Levothyroxine	22.02
10	C09A A02	Enalapril	6.12	A02BC05	Esomeprazole	17.90	C03CA01	Furosemide	20.39

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CHAPTER 2 | EXPENDITURE ON MEDICINES IN MALAYSIA

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This chapter covers the drug expenditure for 2007, which was studied in comparison to that of 2006. Drug expenditure was compared by therapeutic groups as well as by individual drugs. This analysis includes all drugs in the National Medicines Use database with usable price data, including those without WHO-assigned DDDs as expenditure (total cost) is not affected by the unit of measure for drug utilisation.

There was a 14.7% increase in drug expenditure in 2007 as compared to 2006 for the top 50 drugs. This increase was mainly due to an estimated 35.9% increase in public sector expenditure compared to an estimated 3.6% increase seen in the private sector for the same period. This trend was also evident when comparing the top 150 drugs by expenditure, with the public sector expenditure increase accounting for all the growth in drug expenditure from 2006 to 2007. The pattern of drug expenditure differed between the public and private sectors as shown in Table 2.1 and Table 2.2.

Among the individual drugs, the highest expenditure was recorded for amlodipine (C08C A01) with the public sector exceeding the private sector expenditure. This was expected given the high prevalence of hypertension and high usage of this drug (utilisation rank 6th).[1] The expenditure on atorvastatin (C10A A05), diclofenac (M01A B05), and amoxicillin and enzyme inhibitor (J01C R02) have been high in the private sector consistently over the 2 years.

In 2007, antibacterials for systemic use (J01) topped the expenditure by therapeutic group list. The general trend for the top 5 therapeutic groups remains the same from 2006 to 2007, whereby drugs used in chronic diseases such as diabetes mellitus, hypertension and dyslipidaemia were in the top 5 list, as shown in Table 2.3. Expenditure on psycholeptic drugs (N05) increased significantly in 2007, in tandem with the increase in utilisation of antipsychotics (N05A).

The Malaysian statistics were compared with Australian drug expenditure trends. The high expenditure of various types of antibacterials such as amoxicillin and enzyme inhibitor (J01C R02), cefuroxime (J01D C02), ciprofloxacin (J01M A02), meropenem (J01D H02) and ceftriaxone (J01D D04) in both public and private sectors elevated this therapeutic group to the highest in Malaysia. Interestingly, this therapeutic group was not among the top 10 for Australia. The 2007 top therapeutic group by expenditure in Australia was lipid modifying agents (C10), which took only the 5th rank in Malaysia.[2] Comparatively, expenditure on atorvastatin (C10A A05) and simvastatin (C10A A01) were lower in Malaysia whereby these 2 drugs topped the list of drugs ranked by expenditure in Australia but ranked 3rd and 9^{th,} respectively, in Malaysia.[3]

In conclusion, there was a general increase in expenditure on medicines from 2006 to 2007 and the overall pattern for 2007 appears to be in accordance with the national healthcare budget and local disease prevalence patterns.

Table 2.1: Top 50 Drugs by Expenditure in RM '000 2007

Rank	ATC	Drug	Public	Private	Total
1	C08C A01	Amlodipine	62760	37859	100619
2	N05A H03	Olanzapine	33748	34602	68350
3	C10A A05	Atorvastatin	22996	40947	63943
4	M01A B05	Diclofenac	863	58318	59180
5	J01C R02	Amoxicillin and enzyme inhibitor	6779	45224	52003
6	B01A C04	Clopidogrel	11340	36914	48254
7	A10B B09	Gliclazide	15767	26624	42391
8	N05A X08	Risperidone	32379	8509	40888
9	C10A A01	Simvastatin	13706	25895	39601
10	J01D C02	Cefuroxime	16962	22504	39466
11	A10B A02	Metformin	15895	23103	38999
12	R01B A52	Pseudoephedrine, combinations	1228	30187	31415
13	C07A B02	Metoprolol	22226	9039	31265
14	A02B C01	Omeprazole	6505	23127	29632
15	R06A E07	Cetirizine	184	29060	29244
16	J01M A02	Ciprofloxacin	3254	25936	29190
17	C09A A02	Enalapril	21263	6516	27779
18	A10B G02	Rosiglitazone	6060	21388	27448
19	N05A H04	Quetiapine	14465	12729	27194
20	B03X A01	Erythropoietin	15729	10827	26556
21	C09A A04	Perindopril	10662	15534	26197
22	C08C A02	Felodipine	18832	7239	26071
23	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	20629	4394	25024
24	J01D H02	Meropenem	18256	5223	23478
25	C08C A05	Nifedipine	8689	13765	22454
26	A02B A02	Ranitidine	4532	17637	22169
27	C09C A01	Losartan	7807	13839	21645
28	J01D D04	Ceftriaxone	6408	15143	21550
29	C09A A01	Captopril	18603	2517	21120
30	A02B C02	Pantoprazole	10225	9739	19963
31	C07A B03	Atenolol	8275	11253	19528
32	A10B F01	Acarbose	6149	13011	19160
33	J05A F05	Lamivudine	17851	919	18769
34	M01A H05	Etoricoxib	2500	15903	18404
35	J05A B01	Aciclovir	1501	16092	17593
36	M01A H01	Celecoxib	9502	8077	17579
37	J01D H51	Imipenem and enzyme inhibitor	12643	4015	16658
38	L03A A02	Filgrastim	12416	3597	16013
39	J01C A04	Amoxicillin	2214	13634	15847
40	J01D D62	Cefoperazone, combinations	4656	10478	15134
41	J01F A09	Clarithromycin	214	14879	15094
42	C10A A07	Rosuvastatin	1145	13907	15052
43	B01A C05	Ticlopidine	5311	9715	15026
44	R06A X13	Loratadine	520	14453	14974
45	A02B C05	Esomeprazole	3352	11370	14722
46	N06A B08	Fluvoxamine	13350	1245	14595
47	G04B E03	Sildenafil	181	13967	14147
48	C09D A01	Losartan and diuretics	3399	10694	14093
49	B01A B05	Enoxaparin	11359	2461	13820
50	J02A C01	Fluconazole	4132	9433	13564
Total top 50 drugs by expenditure 2007			**569422**	**833438**	**1402860**
Total top 150 drugs by expenditure 2007			**952837**	**1223124**	**2175961**

Table 2.2: Top 50 Drugs by Expenditure in RM '000 2006

Rank	ATC	Drug	Public	Private	Total
1.	C10A A05	Atorvastatin	10636	58610	69246
2	C08C A01	Amlodipine	33173	31348	64521
3	C10A A01	Simvastatin	7143	48468	55611
4	B01A C04	Clopidogrel	3627	45596	49223
5	M01A B05	Diclofenac	1041	46077	47118
6	C07A B03	Atenolol	7785	33573	41357
7	J01C R02	Amoxicillin and enzyme inhibitor	9036	29944	38979
8	J01D C02	Cefuroxime	13910	24197	38107
9	B03X A01	Erythropoietin	14845	20006	34851
10	A10B B09	Gliclazide	12635	22127	34763
11	A10B A02	Metformin	14558	19293	33851
12	J01M A02	Ciprofloxacin	3862	27543	31405
13	C07A B02	Metoprolol	22406	8469	30876
14	N05A X08	Risperidone	29697	599	30296
15	R01B A52	Pseudoephedrine, combinations	1165	26004	27169
16	J01D D04	Ceftriaxone	2242	22368	24610
17	J05A B01	Aciclovir	1596	22988	24584
18	A10A D01	Insulins & analogues, intermediate-acting combined with fast-acting (human)	18311	5517	23828
19	C07A A05	Propranolol	140	23658	23798
20	C08C A02	Felodipine	16434	7017	23451
21	C09A A02	Enalapril	15455	7197	22652
22	C08C A05	Nifedipine	8750	13181	21931
23	A02B A02	Ranitidine	4510	16795	21305
24	C09A A01	Captopril	17010	3545	20555
25	G04B E03	Sildenafil	176	19841	20017
26	A02B C01	Omeprazole	5875	13857	19732
27	C09A A04	Perindopril	13052	5863	18916
28	J01D H51	Imipenem and enzyme inhibitor	12641	5317	17958
29	N07B C01	Buprenorphine	461	17403	17864
30	L04A D01	Ciclosporin	15422	1109	16531
31	C09C A01	Losartan	9104	7295	16399
32	R06A X13	Loratadine	423	15613	16036
33	A10B F01	Acarbose	12974	3024	15998
34	B01A C05	Ticlopidine	4527	11210	15738
35	D01A C20	Combinations	18	15332	15350
36	A10B B01	Glibenclamide	2513	12757	15271
37	J01D H02	Meropenem	10114	5090	15204
38	A11C C04	Calcitriol	11433	2492	13925
39	J05A H02	Oseltamivir	12739	909	13649
40	G03H B01	Cyproterone and oestrogen	113	13452	13566
41	J01F A01	Erythromycin	5706	7811	13517
42	J01D E01	Cefepime	5641	7865	13506
43	J01F A09	Clarithromycin	325	12776	13101
44	M05B A04	Alendronic acid	8995	4077	13071
45	M01A H05	Etoricoxib	728	11908	12636
46	C01E B15	Trimetazidine	2111	10411	12523
47	J01C A04	Amoxicillin	2054	10249	12303
48	A02B C05	Esomeprazole	1313	10970	12283
49	A10A C01	Insulins and analogues, intermediate-acting (human)	6078	6149	12227
50	M01A H01	Celecoxib	4397	7506	11904
Total top 50 drugs by expenditure 2006			**418903**	**804409**	**1223312**
Total top 150 drugs by expenditure 2006			**697380**	**1223734**	**1921114**

Table 2.3: Top 10 Therapeutic Groups by Expenditure in RM '000 2007

Rank	ATC	Therapeutic Groups	Public	Private	Total
1	J01	Antibacterials for systemic use	131505	243469	360586
2	A10	Drugs used in diabetes	84415	113078	195592
3	C09	Agents acting on the renin-angiotensin system	80311	99999	179596
4	N05	Psycholeptics	101591	67873	169014
5	C10	Lipid modifying agents	52936	114852	167780
6	C08	Calcium channel blockers	92048	65343	155252
7	M01	Anti-inflammatory and antirheumatic products	16978	114257	130089
8	A02	Drugs for acid related disorders	29434	81357	107295
9	B01	Antithrombotic agents	44675	61828	106503
10	L01	Antineoplastic agents	50082	55138	98251

Table 2.4: Top 10 Therapeutic Groups by Expenditure in RM '000 2006

Rank	ATC	Therapeutic Groups	Public	Private	Total
1	J01	Antibacterials for systemic use	111865	254183	339632
2	C10	Lipid modifying agents	29227	149174	178401
3	A10	Drugs used in diabetes	76641	116204	175538
4	C09	Agents acting on the renin-angiotensin system	67746	81962	148778
5	C08	Calcium channel blockers	60042	57886	116461
6	C07	Beta blocking agents	38216	77424	113667
7	B01	Antithrombotic agents	29264	80697	109892
8	M01	Anti-inflammatory and antirheumatic products	10822	88286	98262
9	A02	Drugs for acid related disorders	18413	152506	85292
10	R03	Drugs for obstructive airway diseases	41442	38773	79785

Table 2.5: Top 40 Drugs, Ranked by Expenditure for Year 2006 and 2007 in RM '000

Rank 2007	ATC	Drugs	Public		Private		Total	
			2006	2007	2006	2007	2006	2007
1	C08C A01	Amlodipine	33173	62760	31348	37859	64521	100619
2	N05A H03	Olanzapine	4348	33748	254	34602	4603	68350
3	C10A A05	Atorvastatin	10636	22996	58610	40947	69246	63943
4	M01A B05	Diclofenac	1041	863	46077	58318	47118	59180
5	J01C R02	Amoxicillin and enzyme inhibitor	9036	6779	29944	45224	38979	52003
6	B01A C04	Clopidogrel	3627	11340	45596	36914	49223	48254
7	A10B B09	Gliclazide	12635	15767	22127	26624	34763	42391
8	N05A X08	Risperidone	29697	32379	599	8509	30296	40888
9	C10A A01	Simvastatin	7143	13706	48468	25895	55611	39601
10	J01D C02	Cefuroxime	13910	16962	24197	22504	38107	39466
11	A10B A02	Metformin	14558	15895	19293	23103	33851	38999
12	R01B A52	Pseudoephedrine, combinations	1165	1228	26004	30187	27169	31415
13	C07A B02	Metoprolol	22406	22226	8469	9039	30876	31265
14	A02B C01	Omeprazole	5875	6505	13857	23127	19732	29632
15	R06A E07	Cetirizine	329	184	11257	29060	11586	29244
16	J01M A02	Ciprofloxacin	3862	3254	27543	25936	31405	29190
17	C09A A02	Enalapril	15455	21263	7197	6516	22652	27779
18	A10B G02	Rosiglitazone	1815	6060	9735	21388	11550	27448
19	N05A H04	Quetiapine	2157	14465	198	12729	2355	27194
20	B03X A01	Erythropoietin	14845	15729	20006	10827	34851	26556
21	C09A A04	Perindopril	13052	10662	5863	15534	18916	26197
22	C08C A02	Felodipine	16434	18832	7017	7239	23451	26071
23	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	18311	20629	5517	4394	23828	25024
24	J01D H02	Meropenem	10114	18256	5090	5223	15204	23478
25	C08C A05	Nifedipine	8750	8689	13181	13765	21931	22454
26	A02B A02	Ranitidine	4510	4532	16795	17637	21305	22169
27	C09C A01	Losartan	9104	7807	7295	13839	16399	21645
28	J01D D04	Ceftriaxone	2242	6408	22368	15143	24610	21550
29	C09A A01	Captopril	17010	18603	3545	2517	20555	21120
30	A02B C02	Pantoprazole	2613	10225	5530	9739	8143	19963
31	C07A B03	Atenolol	7785	8275	33573	11253	41357	19528
32	A10B F01	Acarbose	12974	6149	3024	13011	15998	19160
33	J05A F05	Lamivudine	9871	17851	1831	919	11703	18769
34	M01A H05	Etoricoxib	728	2500	11908	15903	12636	18404
35	J05A B01	Aciclovir	1596	1501	22988	16092	24584	17593
36	M01A H01	Celecoxib	4397	9502	7506	8077	11904	17579
37	J01D H51	Imipenem and enzyme inhibitor	12641	12643	5317	4015	17958	16658
38	L03A A02	Filgrastim	7863	12416	1759	3597	9622	16013
39	J01C A04	Amoxicillin	2054	2214	10249	13634	12303	15847
40	J01D D62	Cefoperazone, combinations	n/a	4656	n/a	10478	n/a	15134

*ranked according to 2007 total expenditure n/a = not available

Table 2.6: Top 10 Therapeutic Groups, Ranked by Expenditure

Rank	Malaysia, 2007			Australia, 2007-8
	Public Expenditure	Private Expenditure	Total Expenditure	Total Expenditure
1	Antibacterials For Systemic Use (J01)	Antibacterials For Systemic Use (J01)	Antibacterials For Systemic Use (J01)	Lipid Modifying Agents (C10)
2	Psycholeptics (N05)	Lipid Modifying Agents (C10)	Drugs Used In Diabetes (A10)	Drugs For Acid Related Disorders (A02)
3	Calcium Channel Blockers (C08)	Anti-inflammatory And Antirheumatic Products (M01)	Agents Acting On The Renin-Angiotensin System (C09)	Agents Acting on Renin-Angiotensin System (C09)
4	Drugs Used In Diabetes (A10)	Drugs Used In Diabetes (A10)	Psycholeptics (N05)	Psychoanaleptics (N06)
5	Agents Acting On The Renin-Angiotensin System (C09)	Agents Acting On The Renin-Angiotensin System (C09)	Lipid Modifying Agents (C10)	Drugs for Obstructive Airway Diseases (R03)
6	Antivirals For Systemic Use (J05)	Drugs For Acid Related Disorders (A02)	Calcium Channel Blockers (C08)	Psycholeptics (N05)
7	Lipid Modifying Agents (C10)	Psycholeptics (N05)	Anti-inflammatory And Antirheumatic Products (M01)	Antineoplastic Agents (L01)
8	Antineoplastic Agents (L01)	Calcium Channel Blockers (C08)	Drugs For Acid Related Disorders (A02)	Drugs Used in Diabetes (A10)
9	Drugs For Obstructive Airway Diseases (R03)	Antithrombotic Agents (B01)	Antithrombotic Agents (B01)	Antithrombotic Agents (B01)
10	Antithrombotic Agents (B01)	Antihistamines For Systemic Use (B01)	Antineoplastic Agents (L01)	Analgesics (N02)

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CHAPTER 3 | USE OF DRUGS FOR ACID RELATED DISORDERS

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The common causes of acid related disorders include peptic ulcer disease and gastro-oesophageal reflux disease (GORD). Compared to the developed nations, the prevalence of acid related disorders in Asian countries is considered low. Recent data from Malaysia suggest that the prevalence of duodenal ulcer, gastric ulcer and GORD is 9.5%, 9.4% and 8.4%, respectively.[1] A study done in Sweden showed gastro-oesophageal reflux symptoms were present in 40.0% of the study population whereas erosive oesophagitis was found in 15.5% of the population that had undergone endoscopy.[2]

H2-receptor antagonists (H_2RA) was the most common class of drug used in the management of acid related disorders in 2007 (3.3692 DDD/1000 population/day). This was followed by proton pump inhibitors (PPI) (2.955 DDD/1000 population/day). This is in contrast with the pattern in Sweden[3] where PPI (41.4 DDD/1000 population/day) was preferred over H_2RA (4.4 DDD/1000 population /day).

Ranitidine (1.7936 DDD/1000 population/day) was the most common H_2RA prescribed, followed by cimetidine (1.106 DDD/1000 population/day). Ranitidine (53.24%) and cimetidine (32.80%) accounted for 85% of H_2RA being used in year 2007. In comparison, the drug usage for cimetidine was 0.139 DDD/1000 population/day and ranitidine was 4.631 DDD/1000 population/day in a community survey in Australia.[4] The other H_2RAs such as famotidine and nizatidine were not widely prescribed in Malaysia. The preference for H_2RA may be explained by easy access to the drugs, familiarity with prescription and cheaper cost especially with the generic formulation.

In Malaysia, the most widely prescribed PPI, both in the public and private sectors, for 2007, was omeprazole. Omeprazole accounted for 60.61% of the total PPIs use in 2007 (1.7913 DDD/1000 population/day). This was followed by esomeprazole (16.14%), pantoprazole (12.55%) and lansoprazole (7.46%). In Australia, esomeprazole was the most commonly used (30.35%), followed by omeprazole (29.06%) and pantoprazole (21.03%).[4]

In the treatment of functional bowel disorders, mebeverine (0.0157 DDD/1000 population/day) was the most common synthetic anticholinergic used, followed by trimebutine (0.0073 DDD/1000 population/day) and dicycloverine (0.0065 DDD/1000 population/day). Other drugs for functional bowel disorders such as silicons and alverine combinations have experienced a drop in usage from 2006 to 2007.

The top three antispasmodic agents in Malaysia were butylscopolamine (0.8468 DDD/1000 population/day), drotaverine (0.0889 DDD/1000 population/day) and atropine (0.0573 DDD/1000 population/day). In Australia, however, mebeverine (0.420 DDD/1000 population/day) was the most popular antispasmodic, followed by propantheline (0.170 DDD/1000 population/day) and butylscopolamine (0.048 DDD/1000 population/day).[4]

In the management of motility disorders, metoclopramide was the most popular propulsive (0.5634 DDD/1000 population/day), followed by domperidone (0.377 DDD/1000 population/day).

In this survey, the total utilisation of medicines for acid related disorders in 2007 was 6.3308 DDD/1000 population/day whereas it was only 5.1591 DDD/1000 population/day in 2006.

Conclusion

H_2RAs remain the most widely prescribed drugs in the management of acid related disorders in Malaysia. This is followed by PPIs. However, this does not mirror the practice in Western countries where PPIs are preferred. This difference in prescribing practice may be attributed to the lack of proper clinical practice guidelines in the management of acid peptic disorders and GORD in Malaysia, as well as issues of cost and availability of PPIs.

While the prevalence of acid related disorders in Malaysia is in the region of 8-10%,[1] only 0.6% of the population have been prescribed drugs for acid related diseases. This suggests that there is a treatment gap. However, antacid and complementary medicines have not been taken into account in this survey. It is proposed that antacids be ascribed a local DDD so that data on antacid usage may be included in future surveys.

There is therefore a need to standardise treatment algorithms for acid related disorders in Malaysia. The role of PPIs in the management of acid related disorders needs to be clearly defined. The availability of generic PPIs may facilitate the wider usage of such drug in the future.

Table 3.1 : Use of Medicines for Acid Related Disorders by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
A02B A	H2-receptor antagonists	2.9354	3.3692
A02B C	Proton pump inhibitors	2.2124	2.9550
A02B D	Combinations for eradication of Helicobacter pylori	0.0107	0.0059
A02B X	Other drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)	0.0006	0.0007

Table 3.2 : Use of Medicines for Acid Related Disorders by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
A02B A	**H2-receptor antagonists**			
A02B A01	Cimetidine	Public	0.5150	0.5586
		Private	0.3763	0.5473
		Total	0.8913	1.1060
A02B A02	Ranitidine	Public	1.1741	1.1472
		Private	0.5389	0.6463
		Total	1.7130	1.7936
A02B A03	Famotidine	Public	0.0202	0.0136
		Private	0.3104	0.4559
		Total	0.3306	0.4695
A02B A04	Nizatidine	Public	-	-
		Private	0.0004	0.0002
		Total	0.0004	0.0002
A02B C	**Proton pump inhibitors**			
A02B C01	Omeprazole	Public	0.5889	0.8518
		Private	0.9104	0.9395
		Total	1.4994	1.7913
A02B C02	Pantoprazole	Public	0.0469	0.1823
		Private	0.0954	0.1887
		Total	0.1423	0.3710
A02B C03	Lansoprazole	Public	0.1271	0.1418
		Private	0.0775	0.0789
		Total	0.2046	0.2206
A02B C04	Rabeprazole	Public	0.0094	0.0230
		Private	0.0565	0.0723
		Total	0.0659	0.0953
A02B C05	Esomeprazole	Public	0.0190	0.1971
		Private	0.2812	0.2797
		Total	0.3002	0.4768
A02B D	**Combinations for eradication of *Helicobacter pylori***			
A02B D04	Pantoprazole, amoxicillin and clarithromycin	Public	-	-
		Private	0.0107	0.0059
		Total	0.0107	0.0059
A02B X	**Other drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)**			
A02B X05	Bismuth subcitrate	Public	-	-
		Private	0.0006	0.0007
		Total	0.0006	0.0007

Table 3.3 : Use of Medicines for Gastrointestinal Disorders by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
A03A A	**Synthetic anticholinergics, esters with tertiary amino group**			
A03A A04	Mebeverine	Public	0.0143	0.0157
		Private	0.0628	0.0547
		Total	0.0771	0.0704
A03A A05	Trimebutine	Public	-	-
		Private	0.0054	0.0073
		Total	0.0054	0.0073
A03A A07	Dicycloverine	Public	-	-
		Private	0.0062	0.0065
		Total	0.0062	0.0065
A03A B	**Synthetic anticholinergics, quaternary ammonium compounds**			
A03A B02	Glycopyrronium	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	0.0001	0.0002
A03A B05	Propantheline	Public	-	-
		Private	0.0007	0.0017
		Total	0.0007	0.0017
A03A D	**Papaverine and derivatives**			
A03A D01	Papaverine	Public	-	0.0001
		Private	-	0.0002
		Total	-	0.0003
A03A D02	Drotaverine	Public	-	-
		Private	0.0682	0.0889
		Total	0.0682	0.0889
A03A E	**Drugs acting on serotonin receptors**			
A03A E02	Tegaserod	Public	0.0009	0.0006
		Private	0.0083	0.0032
		Total	0.0092	0.0038
A03A X	**Other drugs for functional bowel disorders**			
A03A X13	Silicones	Public	-	-
		Private	0.0618	0.0287
		Total	0.0618	0.0287
A03A X58	Alverine, combinations	Public	0.0017	0.0001
		Private	0.0813	0.0589
		Total	0.0830	0.0590
A03B A	**Belladonna alkaloids, tertiary amines**			
A03B A01	Atropine	Public	0.0550	0.0501
		Private	0.0190	0.0072
		Total	0.0740	0.0573
A03B A03	Hyoscyamine	Public	0.0015	-
		Private	-	-
		Total	0.0015	-

ATC	Drug Class and Agents	Sector	2006	2007
A03B B	**Belladonna alkaloids, semisynthetic, quaternary ammonium compounds**			
A03B B01	Butylscopolamine	Public	0.3793	0.3828
		Private	0.3857	0.4640
		Total	0.7649	0.8468
A03B B03	Methylscopolamine	Public	-	-
		Private	-	0.0003
		Total	-	0.0003
A03F A	**Propulsives**			
A03F A01	Metoclopramide	Public	0.1856	0.2229
		Private	0.5952	0.3406
		Total	0.7808	0.5634
A03F A02	Cisapride	Public	-	-
		Private	0.0064	0.0008
		Total	0.0064	0.0008
A03F A03	Domperidone	Public	0.0429	0.0383
		Private	0.3284	0.3387
		Total	0.3713	0.3770

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CHAPTER 4 | USE OF ANTIOBESITY DRUGS

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The total consumption of antiobesity agents in Malaysia for 2007 was 0.62 DDD/1000 population/day. The 2007 data collected showed a decline in the use of antiobesity drugs compared to 2006. Centrally acting antiobesity agents were the most commonly prescribed, representing 91.0 % of total drugs used. Among the centrally acting agents used, phentermine was favoured (77.5% of all centrally acting antiobesity drugs) and this trend is similarly seen in Australia. However, the peripherally acting drug, orlistat, had seen an increase in use (38%) compared to 2006, which was inversely related to the trend seen in Australia.[1] Mazindol has not been used as it is not registered in Malaysia.[2]

Of the antiobesity agents utilised, consumption in the private sector was higher (97.8%) compared to public sector (2.2%). The differing utilisation rates could be influenced by the drug cost and availability of the drugs. There was a reduction in the total usage of antiobesity agents comparing 2006 to 2007 (13.5% reduction – from 0.7218 in 2006 to 0.6241 in 2007). Even though the prevalence of overweight and obesity has increased as evidenced by the National Health Morbidity Survey 2006 (43.1%), compared to 1996 (21.0%), the decline in the use of antiobesity drugs was probably due to unavailability of these drugs in the government healthcare system and higher price in the private health sector.[3]

The rate of overweight and obesity in Malaysia was comparable to Australia (43.1% versus 49.0%, respectively).[4] However, the consumption of antiobesity agents in Australia was more than four-fold higher than in Malaysia, most probably due to the availability and Medicare coverage for antiobesity agents.

Table 4.1: Use of Antiobesity Agents by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
A08A	Antiobesity preparations, excl. diet products	0.7218	0.6241
A08A A	Centrally acting antiobesity products	0.6811	0.5680
A08A B	Peripherally acting antiobesity products	0.0407	0.0562

Table 4.2 : Use of Antiobesity Agents by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
A08A A	**Centrally acting antiobesity products**			
A08A A01	Phentermine	Public	0.0019	0.0006
		Private	0.4553	0.4394
		Total	0.4572	0.4400
A08A A05	Mazindol	Public	-	-
		Private	-	-
		Total	-	-
A08A A10	Sibutramine	Public	0.0112	0.0083
		Private	0.2127	0.1197
		Total	0.2239	0.1280
A08A B	**Peripherally acting antiobesity products**			
A08A B01	Orlistat	Public	0.0030	0.0046
		Private	0.0377	0.0516
		Total	0.0407	0.0562

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CHAPTER 5 | USE OF ANTIDIABETIC DRUGS

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In the year 2007, the total consumption of antidiabetic medications was 39.70 DDD/1000 population/day which was almost similar to 2006 (39.33 DDD/1000 population/day).[1]

Oral Hypoglycaemic Agents

The use of biguanides has increased by 1.13 DDD/1000 population/day while sulphonylurea usage has decreased by 1.64 DDD/1000 population/day. This trend is in line with current recommendations which promote the use of metformin as the first line oral medication.[2] Fixed-dose combinations have been advocated to improve compliance. Not surprisingly, the usage of the fixed-dose combination of metformin and sulfonylurea has increased within the last year. There was almost a two fold increase in the use of the alpha glucosidase inhibitors. This may have been due to the reluctance of poorly controlled patients to start on insulin and a third oral drug was prescribed instead. It is also available as an affordable generic form now and this may also account for its increased usage. Glibenclamide remained the most widely prescribed sulphonylurea, followed by gliclazide. However, gliclazide usage has increased while glibenclamide usage has decreased – a welcome trend as glibenclamide has a higher risk of hypoglycaemia. Thiazolidinediones (TZD) usage has increased both in public and private sectors, but with the current controversy surrounding the use of rosiglitazone, we expect this trend to reverse. The use of repaglinide and nateglinide remained minimal.

Insulin

The use of insulin has also gone up marginally, from 3.16 to 3.24 DDD/1000 population/day. As expected, insulin usage in the public sector has increased. However, we observed that there was an overall drop in insulin usage among private patients. The most widely prescribed insulin is still premixed insulin, followed by the intermediate acting and the fast acting insulins. The overall analogue use was low, probably attributable to cost. Long acting insulin (glargine) usage has doubled in the public sector.

Total metformin utilisation in Malaysia was comparable with Australia (15.65 DDD/1000 population/day) and Sweden (13.90 DDD/1000 population/day).[3,4] Glibenclamide use in Australia (1.08 DDD/1000 population/day) was substantially less than Malaysia (12.77 DDD/1000 population/day).[3] Gliclazide usage in Malaysia was 7.16 DDD/1000 population/day while in Australia it was 6.57 DDD/1000 population/day, which is quite comparable.[3] The only oral antidiabetic agent used more widely in Australia (2.53 DDD/1000 population/day) and Sweden (1.10 DDD/1000 population/day) compared to Malaysia (0.45 DDD/1000 population/day) was the TZDs.[3,4]

Insulin usage in Sweden (24.20 DDD/1000 population/day), Denmark (15.20 DDD/1000 population/day) and Australia (15.75 DDD/1000 population/day) were substantially higher than in Malaysia (3.24 DDD/1000 population/day).[3,4] Although these countries have a higher prevalence of type 1 diabetes, this cannot account for the vast difference in the DDD/1000 population/day. We suspect that this is due to both physician and patient factors, resulting in a lower acceptance rate of insulin usage among Malaysian diabetics.

Conclusion

In Malaysia, the overall use of antidiabetic medications was lower (39.70 DDD/1000 population/day) in comparison to Sweden (47.30 DDD/1000 population/day) and Australia (49.21 DDD/1000 population/day).[3,4] This is of concern since the prevalence of diabetes in Malaysia (14.9% in 2006, age > 30 years old) was much higher compared to Australia (4.0% in 2007)[5,6] and suggests that many patients may be undertreated or not receiving treatment at all.

When comparing 2007 with 2006 data, there was an encouraging trend of medication usage –increased use of metformin and insulin, while glibenclamide usage was decreasing.

The use of insulin was low in Malaysia in comparison to Australia and Sweden.

Table 5.1: Use of Antidiabetics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
A10A	Insulins and analogues	3.1601	3.2376
A10B A	Biguanides	13.1498	14.2813
A10B B	Sulfonamides, urea derivatives	22.0942	20.4585
A10B D	Combinations of oral blood glucose lowering drugs	0.2144	0.3791
A10B F	Alpha glucosidase inhibitors	0.4542	0.8369
A10B G	Thiazolidinediones	0.2057	0.4498
A10B X	Other blood glucose lowering drugs, excl. Insulins	0.0565	0.0560

Table 5.2: Use of Antidiabetics by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
A10A B	**Insulins and analogues for injection, fast-acting**			
A10A B01	Insulins and analogues, fast-acting (human)	Public	0.6719	0.7485
		Private	0.1407	0.0556
		Total	0.8126	0.8041
A10A B02	Insulins and analogues, fast-acting (bovine)	Public	-	-
		Private	-	-
		Total	-	-
A10A B03	Insulins and analogues, fast-acting (porcine)	Public	-	-
		Private	-	-
		Total	-	-
A10A B04	Insulins and analogues, fast-acting; insulin lispro	Public	0.0060	0.0008
		Private	0.0057	0.0047
		Total	0.0117	0.0055
A10A B05	Insulins and analogues, fast-acting; Insulin aspart	Public	0.0065	0.0107
		Private	0.0059	0.0034
		Total	0.0124	0.0141
A10A B06	Insulins and analogues, fast-acting; Insulin glulisine	Public	-	-
		Private	-	-
		Total	-	-
A10A C	**Insulins and analogues for injection, intermediate-acting**			
A10A C01	Insulins and analogues, intermediate-acting (human)	Public	0.7004	0.7814
		Private	0.2227	0.1035
		Total	0.9231	0.8849
A10A C04	Insulins and analogues, intermediate-acting; Insulin lispro	Public	-	-
		Private	-	-
		Total	-	-
A10A D	**Insulins and analogues for injection, intermediate-acting combined with fast-acting**			
A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	Public	1.1299	1.2479
		Private	0.1982	0.1608
		Total	1.3281	1.4087
A10A D03	Insulins and analogues, intermediate-acting combined with fast-acting (porcine)	Public	-	-
		Private	-	-
		Total	-	-
A10A D05	Insulins and analogues, intermediate-acting combined with fast-acting; Insulin aspart	Public	0.0003	0.0117
		Private	0.0281	0.0504
		Total	0.0284	0.0621

ATC	Drug Class and Agents	Sector	2006	2007
A10A E	**Insulins and analogues for injection, long-acting**			
A10A E02	Insulins and analogues, long-acting (bovine)	Public	-	-
		Private	-	-
		Total	-	-
A10A E04	Insulins and analogues, long-acting; Insulin glargine	Public	0.0119	0.0304
		Private	0.0318	0.0267
		Total	0.0437	0.0571
A10A E05	Insulins and analogues, long-acting; Insulin detemir	Public	-	-
		Private	-	0.0011
		Total	-	0.0011
A10A E30	Insulins and analogues, long-acting; Combinations	Public	-	-
		Private	-	-
		Total	-	-
A10B A	**Biguanides**			
A10B A01	Phenformin	Public	-	-
		Private	-	-
		Total	-	-
A10B A02	Metformin	Public	11.1397	11.9242
		Private	2.0101	2.3571
		Total	13.1498	14.2813
A10B A03	Buformin	Public	-	-
		Private	-	-
		Total	-	-
A10B B	**Sulfonamides, urea derivatives**			
A10B B01	Glibenclamide	Public	14.0329	11.0430
		Private	1.5098	1.7243
		Total	15.5427	12.7674
A10B B02	Chlorpropamide	Public	0.0238	0.0066
		Private	0.0245	0.0264
		Total	0.0482	0.0330
A10B B04	Glibornuride	Public	-	-
		Private	-	-
		Total	-	-
A10B B06	Carbutamide	Public	-	-
		Private	-	-
		Total	-	-
A10B B07	Glipizide	Public	0.0255	0.0204
		Private	0.0721	0.0651
		Total	0.0975	0.0855
A10B B09	Gliclazide	Public	4.5930	5.6189
		Private	1.3667	1.5451
		Total	5.9598	7.1640
A10B B12	Glimepiride	Public	0.0261	0.0477
		Private	0.4199	0.3609
		Total	0.4460	0.4086
A10B D	**Combinations of oral blood glucose lowering drugs**			
A10B D02	Metformin and sulfonamides	Public	0.0127	0.0572
		Private	0.1571	0.2762
		Total	0.1698	0.3333
A10B D03	Metformin and rosiglitazone	Public	0.0014	0.0051
		Private	0.0431	0.0406
		Total	0.0446	0.0457

ATC	Drug Class and Agents	Sector	2006	2007
A10B F	**Alpha glucosidase inhibitors**			
A10B F01	Acarbose	Public	0.3652	0.4725
		Private	0.0891	0.3644
		Total	0.4542	0.8369
A10B G	**Thiazolidinediones**			
A10B G01	Troglitazone	Public	-	-
		Private	-	-
		Total	-	-
A10B G02	Rosiglitazone	Public	0.0407	0.1321
		Private	0.1634	0.3049
		Total	0.2041	0.4370
A10B G03	Pioglitazone	Public	-	0.0010
		Private	0.0016	0.0118
		Total	0.0016	0.0128
A10B H	**Dipeptidyl peptidase 4 (DPP-4) inhibitors**			
A10B H01	Sitagliptin	Public	-	-
		Private	-	0.0248
		Total	-	0.0248
A10B X	**Other blood glucose lowering drugs, excl. insulins**			
A10B X02	Repaglinide	Public	0.0099	0.0194
		Private	0.0150	0.0106
		Total	0.0249	0.0300
A10B X03	Nateglinide	Public	0.0009	0.0005
		Private	0.0109	0.0036
		Total	0.0118	0.0041
A10B X04	Exenatide	Public	-	-
		Private	-	-
		Total	-	-
A10B X06	Benfluorex	Public	-	-
		Private	0.0198	0.0219
		Total	0.0198	0.0219

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CHAPTER 6 | USE OF ANTIANAEMIC DRUGS

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The most commonly prescribed antianaemic in 2007 were erythropoietin injection (0.156 DDD/1000 population/day) and parenteral iron (less than 0.0001 DDD/1000 population/day), both in the public and private sectors. Erythropoietin is also known as recombinant human erythropoietin (rHuEPO), which is a protein hormone, produced by specialised cells in the kidneys. Erythropoietin is released as a response to low haemoglobin to stimulate the bone marrow to produce more red blood cells.

In Malaysia, erythropoietin is the standard of care for many patients with end stage renal disease (ESRD) except for those who develop antibodies to the erythropoietin and develop pure red cell aplasia or those who develop uncontrolled arterial hypertension. It is also used to treat anaemia resulting from treatment of cancer and certain diseases like myelodysplastic syndrome. When the hidden costs of the complications of blood transfusion are taken into account, erythropoietin would be a potential and cost effective alternative to transfusion. In some cases, intravenous iron without erythropoietin was just as effective in treating the anaemia related to iron deficiency.

For erythropoietin to be effective, it should be supplemented with iron. Parenteral iron was used in cases where the intake of oral iron was inadequate and absorption was not reliable.[1] However, there was no data on iron dextran or ferric sucrose but on trivalent parenteral iron, namely saccharated iron oxide. Saccharated iron oxide was only used in the private sector while the public sector used more of iron dextran and ferric sucrose where parenteral iron is required. Oral iron was more used than parenteral iron and the usage of oral and parenteral iron was about the same; with both oral and parenteral forms remaining relatively the same over the year too. Australia used iron polymaltose complex as the trivalent parenteral iron compound in the amount of 0.030 DDD/1000 population/day.[2] Malaysia used much less parenteral iron compared to Australia.

Erythropoietin use in Australia in 2007 was 0.054 DDD/1000 population/day and consumption of darbepoetin alpha was more favoured with the use of 3.35 times higher (0.181 DDD/1000 population/day).[3] Erythropoietin utilisation in Malaysia in 2007 was higher, being 0.156 DDD/1000 population/day, which indicated that 0.016% of the population used erythropoietin on a daily basis. The fact that darbepoetin alpha has not been introduced into the Ministry of Health Drug Formulary, may account for this difference in prescribing preference between Malaysia and Australia. Usage in the government sector was 2.8 times higher than the private sector.

This consumption data was based on assumption that all erythropoietin purchased were consumed in that year and that the prescribed daily dose in the main indication used was the same as the Defined Daily Dose.

Table 6.1: Use of Antianaemics, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
B03	Antianaemic preparations	0.1780	0.1559

Table 6.2.1: Use of Antianaemics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
B03A	Iron preparations	<0.0001	<0.0001
B03A C	Iron trivalent, parenteral preparations	<0.0001	<0.0001
B03X	Other antianaemic preparations	0.1780	0.1559
B03X A	Other antianaemic preparations	0.1780	0.1559

Table 6.2.2: Use of Antianaemics by Drug Class and Agents, in DDD/1000 population/day 2006

ATC	Drug Class and Agents	Sector	2006	2007
B03A A02	Ferrous fumarate	Public	-	-
		Private	-	-
		Total	-	-
B03A B03	Sodium feredetate	Public	-	-
		Private	-	-
		Total	-	-
B03A C	**Iron trivalent, parenteral preparations**			
B03A C02	Saccharated iron oxide	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B03X A	**Other antianaemic preparations**			
B03X A01	Erythropoietin	Public	0.1094	0.1147
		Private	0.0686	0.0412
		Total	0.1780	0.1559

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CHAPTER 7 | USE OF ANTIHAEMORRHAGICS

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Antihaemorrhagics did not differ much in usage trends from 2006 to 2007. The most used class of antihaemorrhagics was still the class of amino acids, namely tranexamic acid (0.07 DDD/1000 population/day), owing to its safety profile, readily available forms as capsules and injection ampoules as well as cheap price. Tranexamic acid was used for local fibrinolysis and menorrhagia. The Australian data showed a higher consumption for tranexamic acid with 0.11 DDD/1000 population/day in 2007.[1] Aprotinin, a proteinase inhibitor (0.0003 DDD/1000 population/day), was indicated for the reduction or prevention of blood loss in patients undergoing open heart surgeries only.[2] Aprotinin was apparently more used in the private sector than in the public sector as so happened in reality.

Although recombinant Factor VIIa or eptacog alfa (activated) was one of the few agents available for haemophilia A or B patients with inhibitors to coagulation factors VIII or IX, recent years had seen it being used in excessive bleeding incidences unmanageable by conservative treatments or blood coagulation factors during minor or major surgical even critical neuro-surgical or obstetrics-gynaecological procedures.[3] However, its overall usage was still very minimal at 0.0001 DDD/1000 population/day, perhaps due to its exorbitant price tag of ~RM 2700 per vial of 1.2mg. The length of stay in critically ill patients that need reversal of coagulopathy and the costs of hospitalisation should be added to the total charges that would count to the cost-effectiveness of eptacog alfa.[4] In fact, eptacog alfa (activated) was little used in both sectors of the healthcare industry. This DDD was similar to its longer acting counterpart, Factor VIII inhibitor bypassing activity (FEIBA). This FEIBA had hardly any usage reported in 2006, being relatively new in the market and minimally used in both sectors in 2007.

The blood coagulation factors VII, Von Willebrand Factor Concentrate, and FEIBA, as well as Factor IX concentrate, were not used in private sector in both years 2006 and 2007 while recording a low DDD in the public sector.

The World Federation of Haemophilia (WFH) estimated the prevalence of Haemophilia A of developing countries as a mean 6.6 SD 4.8 per 100,000 males in 2004.[5] For the severe forms of haemophilia, treatment was required regularly and throughout the patients' entire lifetime, to avoid target joints damage, deformity, disability or even early death. Factor concentrates are normally given as on-demand basis, as opposed to primary or secondary prophylaxis in the West. Without insurance coverage due to its nature as a congenital disease, apparently haemophilia patients largely obtain factor concentrates from the public hospitals at no cost. There was little difference between the year 2006 and 2007 in the usage of coagulation factor concentrates.

Table 7.1: Use of Antihaemorrhagics, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
B02	Antihaemorrhagics	0.0720	0.0697

Table 7.2.1: Use of Antihaemorrhagics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
B02A	Antifibrinolytics	0.0702	0.0681
B02A A	Amino acids	0.0695	0.0678
B02A B	Proteinase inhibitors	0.0006	0.0003
B02B	Vitamin K and other haemostatics	0.0018	0.0016
B02B D	Blood coagulation factors	0.0018	0.0016

Table 7.2.2 : Use of Antihaemorrhagics by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
B02A A	**Amino acids**			
B02A A02	Tranexamic acid	Public	0.0524	0.0535
		Private	0.0172	0.0143
		Total	0.0695	0.0678
B02A A03	Aminomethylbenzoic acid	Public	-	-
		Private	-	-
		Total	-	-
B02A B	**Proteinase inhibitors**			
B02A B01	Aprotinin	Public	<0.0001	0.0001
		Private	0.0006	0.0002
		Total	0.0006	0.0003
B02B D	**Blood coagulation factors**			
B02B D02	Coagulation factor VIII	Public	0.0007	0.0006
		Private	<0.0001	<0.0001
		Total	0.0007	0.0006
B02B D03	Factor VIII inhibitor bypassing activity	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
B02B D04	Coagulation factor IX	Public	0.0011	0.0008
		Private	-	-
		Total	0.0011	0.0008
B02B D05	Coagulation factor VII	Public	-	0.0001
		Private	-	-
		Total	-	0.0001
B02B D06	Von Willebrand factor and coagulation factor VIII in combination	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
B02B D08	Eptacog alfa (activated)	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

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CHAPTER 8 | USE OF DRUGS FOR CARDIOVASCULAR DISORDERS

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The most commonly used antithrombotic agents in 2007 were the platelet aggregation inhibitors (8.98 DDD/1000 population/day), almost similar to the year 2006. Acetylsalicylic acid (aspirin) remained the most widely used, accounting for approximately 50% of the total usage. Surprisingly, there is a decrease in the usage of acetylsalicylic acid for both sectors but more marked in the private sector in 2007 compared to 2006. This may be explained by an increase in clopidogrel usage.

The use of clopidogrel increased over 200% in the public sector for the same time period. This may have been due to updated recommendations from the results of several outcome studies that include Clopidogrel as Adjunctive Reperfusion Therapy–Thrombolysis in Myocardial Infarction (CLARITY-TIMI28),[1] Clopidogrel and Metoprolol in Myocardial Infarction Trial / Second Chinese Cardiac Study (COMMIT-CCS2)[2] and Clopidogrel in Unstable Angina to prevent Recurrent Events (CURE)[3], and Percutaneous Coronary Intervention (PCI) studies e.g. Clopidogrel for Reduction of Events During Observation (CREDO)[4]. Overall in Malaysia, ticlopidine is still used more than clopidogrel, most likely due to cost considerations — the generic version of which is much cheaper.

In 2007, the heparin group showed an 8.8% increase in utilisation rates compared to 2006. This is mostly due to increase usage of heparin and enoxaparin (almost twice more) in the public sector. Despite not listed in the Ministry of Heatlh Drug Formulary during the period 2006-2007, the use of fondaparinux in the public sector has increased. This may be explained by the drug being utilised in the context of clinical trials, its non-porcine architecture, its once daily administration and potentially more cost-effective in the long-term.

The use of more expensive antithrombotic agents/intravenous platelet aggregation inhibitors with its touted additional “endothelial passivation” properties (e.g. abciximab, tirofiban, eptifibatide) are low, consistent with global trends, with most having a DDD less than 0.0001. Their very expensive costs over the perceived benefits in adverse outcomes may still be prohibitive in Malaysia, especially with the advent of relatively cheaper oral antithrombotics such as clopidogrel and subcutaneous use with enoxaparin and fondaparinux.

Overall use of antiarrhythmic drugs, especially Class I agents, remained almost consistently low (0.0001 - 0.0113) for both years. Throughout 2006 and 2007, the usage of lidocaine showed a marked decrease which may be due to newer research data showing minimal to neutral effects for antiarrhythmic prophylaxis following myocardial infarction. The exception is that of amiodarone, a Class III agent, which showed stable use, with a DDD/1000 population/day at around 0.127 – 0.129. Most other antiarrhythmic agents are less used probably as a result of setbacks in major antiarrhythmic trials in the late 1990’s (Cardiac Arrhythmia Suppression Trial (CAST),[5] etc.)

The use of positive inotropic agents e.g. adrenergic and dopaminergic agents has remained the same for 2006 and 2007 (0.001 - 0.005). Indirectly this may imply that the proportion of patients suffering from cardiogenic shock has remained the same.

Among them, milrinone which is mainly used in the private sector has shown a drastic decrease in 2007 compared to 2006, due to evidence that it does not show sustained and long-term improvement in the prognosis of severe acute heart failure in Prospective Randomised Milrinone Survival Evaluation (PROMISE) trial.[6] Despite the emergence of new variations of such prostaglandin inhibitors with similar action, these classes of drugs are unlikely to be more used in the future.

With slight variations, the use of the different nitrate drugs has also not shown significant changes in 2007 compared to 2006. However, compared to Australia, the usage of nitrates in Malaysia is very low (e.g. Glyceryl trinitrate – Malaysia 0.27 versus Australia 4.70).

Diuretics remained the top cardiovascular drugs used amongst the group with DDD/1000 population/day of more than 14. The situation was also similar with the different classes of diuretics with no significant changes in 2007 compared to 2006. The top three diuretics used in 2007 were chlorothiazide (CTZ) (5.75), furosemide (4.74) and hydrochlorothiazide (HCTZ) (1.07). We expect this will change in the coming years as public sector healthcare providers are switching from chlorothiazide to hydrochlorothiazide. Of note, the use of bumetanide was higher in the public sector compared to the private sector – most probably explained by the higher use among nephrologists in the public sector for patients with refractory hypertension in chronic kidney disease.

We also felt that some classes of the antihypertensive drugs are also utilised for cardiac indications and therefore have included the following drug classes in our analysis i.e. beta blocking agents, calcium channel blockers, angiotensin-converting enzyme inhibitors (ACEI) and angiotensin II receptor blockers (ARB).

Beta blockers are also used for the management of tachycardia/arrhythmias, secondary prevention post myocardial infarction and now increasingly in heart failure, as supported by various studies such as The Cardiac Insufficiency Bisoprolol Study (CIBIS I and CIBIS II),[7] Metoprolol CR/XL Randomised Intervention Trial in Congestive Heart Failure (MERIT-HF),[8] Carvedilol Prospective Randomised Cumulative Survival (COPERNICUS),[9] Carvedilol Post-Infarct Survival Control in Left Ventricular Dysfunction (CAPRICORN)[10] and Carvedilol or Metoprolol European Trial (COMET)[11]. The use of carvedilol, bisoprolol and atenolol has increased in 2007 compared to 2006 – however it has not yet been ascertained as to their contribution for the use for heart failure in this context. Importantly, the use of atenolol should be reviewed as it has not been shown to be particularly useful in primary cardiovascular disease prevention or in heart failure when compared to other newer and more efficacious beta-blockers. The use of amlodipine and felodipine for primary prevention against cardiovascular disease and myocardial infarction was supported by several studies e.g. Hypertension Optimal Treatment (HOT)[12], Anglo-Scandinavian Cardiac Outcomes Trial (ASCOT)[13], Anglo-Scandinavian Cardiac Outcomes Trial – Conduit Artery Function Evaluation (ASCOT-CAFÉ), and Valsartan Antihypertensive Long-term Use Evaluation (VALUE)[14].

Similarly, with the greater dissemination and implementation/adherence recommendations of our National Clinical Practice Guidelines[15-18], data from our National Cardiovascular Disease – Acute Coronary Syndrome Registry[19] has shown good compliance usage of ACEI and/or ARB usage following ST-elevation acute coronary syndrome (>90%) for ameliorating left ventricular (LV) remodelling and also for LV functional preservation during heart failure therapy.

Table 8.1 : Use of Drugs for Cardiovascular Disorders, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
B01	Antithrombotic agents	9.6084	9.7666
C01A	Cardiac glycosides	0.6509	0.6510
C01B	Antiarrhythmics, class I and III	0.1467	0.1411
C01C	Cardiac stimulants excl. cardiac glycosides	0.2490	0.2032
C01D	Vasodilators used in cardiac diseases	2.2065	2.1407
C01E	Other cardiac preparations	1.4398	1.8241
C03	Diuretics	14.6712	14.0268
C04	Peripheral vasodilators	0.0745	0.0694
C07	Beta blocking agents	25.7131	26.2609
C08	Calcium channel blockers	19.3653	23.0601
C09A	ACE inhibitors, plain	15.2120	20.5872
C09B	ACE inhibitors, combinations	0.0738	0.0940
C09C	Angiotensin II antagonists, plain	2.7291	4.2937
C09D	Angiotensin II antagonists, combinations	1.5652	1.6996

Table 8.2.1 : Use of Antithrombotic Drugs by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
B01A A	Vitamin K antagonists	0.3755	0.3946
B01A B	Heparin group	0.3558	0.3871
B01A C	Platelet aggregation inhibitors excl. heparin	8.8760	8.9839
B01A D	Enzymes	0.0009	0.0008
B01A E	Direct thrombin inhibitors	-	-
B01A X	Other antithrombotic agents	0.0003	0.0003

Table 8.2.2 : Use of Antithrombotic Drugs by Drug Class and Agents, in DDD/1000 population/day 2006-2007 Heparin group

ATC	Drug Class and Agents	Sector	2006	2007
B01A A	**Vitamin K antagonists**			
B01A A03	Warfarin	Public	0.2582	0.2954
		Private	0.1173	0.0993
		Total	0.3755	0.3946
B01A B	**Heparin group**			
B01A B01	Heparin	Public	0.1704	0.1824
		Private	0.0518	0.0261
		Total	0.2222	0.2085
B01A B05	Enoxaparin	Public	0.0701	0.1231
		Private	0.0297	0.0238
		Total	0.0998	0.1469
B01A B06	Nadroparin	Public	0.0035	0.0033
		Private	0.0018	0.0012
		Total	0.0054	0.0045
B01A B10	Tinzaparin	Public	0.0005	0.0006
		Private	0.0019	0.0008
		Total	0.0024	0.0014
B01A B11	Sulodexide	Public	<0.0001	0.0010
		Private	0.0259	0.0247
		Total	0.0260	0.0257
B01A C	**Platelet aggregation inhibitors excl. heparin**			
B01A C04	Clopidogrel	Public	0.0678	0.2079
		Private	0.6699	0.6758
		Total	0.7377	0.8837
B01A C05	Ticlopidine	Public	0.5478	0.8016
		Private	0.4434	0.3265
		Total	0.9912	1.1281
B01A C06	Acetylsalicylic acid	Public	4.8340	4.7791
		Private	2.2369	2.1267
		Total	7.0709	6.9059
B01A C07	Dipyridamole	Public	0.0697	0.0620
		Private	0.0062	0.0039
		Total	0.0759	0.0659
B01A C11	Iloprost	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A C13	Abciximab	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A C16	Eptifibatide	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
B01A C17	Tirofiban	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

ATC	Drug Class and Agents	Sector	2006	2007
B01A D	**Enzymes**			
B01A D01	Streptokinase	Public	0.0007	0.0007
		Private	0.0001	<0.0001
		Total	0.0009	0.0008
B01A D02	Alteplase	Public	-	<0.0001
		Private	-	<0.0001
		Total	-	<0.0001
B01A D04	Urokinase	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A D10	Drotrecogin alfa (activated)	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
B01A D11	Tenecteplase	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A X	**Other antithrombotic agents**			
B01A X05	Fondaparinux	Public	<0.0001	0.0002
		Private	0.0002	0.0001
		Total	0.0003	0.0003

Table 8.3.1: Use of Cardiac Glycosides by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C01A	**Cardiac glycosides**			
C01A A05	Digoxin	Public	0.4195	0.4177
		Private	0.2314	0.2332
		Total	0.6509	0.6510

Table 8.4.1 : Use of Antiarrhythmics by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C01B A	**Antiarrhythmics, class Ia**			
C01B A05	Ajmaline	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
C01B B	**Antiarrhythmics, class Ib**			
C01B B01	Lidocaine	Public	0.0002	<0.0001
		Private	-	-
		Total	0.0002	<0.0001
C01B B02	Mexiletine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001

ATC	Drug Class and Agents	Sector	2006	2007
C01B C	**Antiarrhythmics, class Ic**			
C01B C03	Propafenone	Public	0.0006	0.0004
		Private	0.0056	0.0045
		Total	0.0062	0.0049
C01B C04	Flecainide	Public	0.0020	0.0019
		Private	0.0093	0.0067
		Total	0.0113	0.0086
C01B D	**Antiarrhythmics, class III**			
C01B D01	Amiodarone	Public	0.0318	0.0465
		Private	0.0972	0.0810
		Total	0.1290	0.1275
C01B D05	Ibutilide	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001

Table 8.5.1 : Use of Cardiac Stimulants by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C01C A	**Adrenergic and dopaminergic agents**			
C01C A02	Isoprenaline	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C01C A03	Norepinephrine	Public	0.0206	0.0333
		Private	0.0029	0.0017
		Total	0.0235	0.0350
C01C A04	Dopamine	Public	0.0055	0.0054
		Private	0.0053	0.0038
		Total	0.0108	0.0092
C01C A06	Phenylephrine	Public	0.0045	0.0014
		Private	0.0033	0.0023
		Total	0.0077	0.0037
C01C A07	Dobutamine	Public	0.0115	0.0104
		Private	0.0018	0.0013
		Total	0.0133	0.0116
C01C A24	Epinephrine	Public	0.1495	0.1283
		Private	0.0436	0.0149
		Total	0.1931	0.1433
C01C E	**Phosphodiesterase inhibitors**			
C01C E02	Milrinone	Public	<0.0001	<0.0001
		Private	0.0004	0.0003
		Total	0.0005	0.0004
C01C X	**Other cardiac stimulants**			
C01C X08	Levosimendan	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

Table 8.6.1 : Use of Vasodilators in Cardiac Diseases by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C01D A	**Organic nitrates**			
C01D A02	Glyceryl trinitrate	Total	0.1705	0.2593
		Public	0.1188	0.1962
		Private	0.0517	0.0631
C01D A05	Pentaerithrityl tetranitrate	Total	0.0024	-
		Public	-	-
		Private	0.0024	-
C01D A08	Isosorbide dinitrate	Total	1.3699	1.3197
		Public	1.2768	1.2206
		Private	0.0932	0.0991
C01D A14	Isosorbide mononitrate	Total	0.6637	0.5616
		Public	0.1214	0.2198
		Private	0.5423	0.3418

Table 8.6.2 : Use of Other Cardiac Preparations in Cardiac Diseases by Drug Class and Agents, in DDD/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C01E A	**Prostaglandins**			
C01E A01	Alprostadil	Public	<0.0001	0.0002
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0002
C01E B	**Other cardiac preparations**			
C01E B10	Adenosine	Public	0.0009	0.001
		Private	0.0002	0.0001
		Total	0.0011	0.0011
C01E B15	Trimetazidine	Public	0.6345	1.1144
		Private	0.8040	0.7084
		Total	1.4386	1.8229

Table 8.7.1: Use of Diuretics by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C03A	**Low-ceiling diuretics, thiazides**			
C03A A03	Hydrochlorothiazide	Public	0.2597	0.1982
		Private	0.8356	0.8697
		Total	1.0953	1.0680
C03A A04	Chlorothiazide	Public	6.2441	5.7074
		Private	0.0355	0.0463
		Total	6.2796	5.7537
C03B	**Low-ceiling diuretics, excl. thiazides**			
C03B A04	Chlortalidone	Public	-	-
		Private	0.0212	0.0361
		Total	0.0212	0.0361
C03B A08	Metolazone	Public	0.0017	<0.0001
		Private	-	0.0003
		Total	0.0017	0.0003
C03B A11	Indapamide	Public	0.0557	0.0551
		Private	0.5507	0.6970
		Total	0.6064	0.7521

ATC	Drug Class and Agents	Sector	2006	2007
C03C	**High-ceiling diuretics**			
C03C A01	Furosemide	Public	3.9322	3.9743
		Private	0.9624	0.7494
		Total	4.8946	4.7237
C03C A02	Bumetanide	Public	0.0219	0.0266
		Private	0.0172	0.0167
		Total	0.0391	0.0432
C03D	**Potassium-sparing agents**			
C03D A01	Spironolactone	Public	0.2517	0.2663
		Private	0.1286	0.0778
		Total	0.3803	0.3441
C03D B01	Amiloride	Public	0.0024	0.0012
		Private	0.0071	0.0032
		Total	0.0095	0.0044
C03E	**Diuretics and potassium-sparing agents in combination**			
C03E A01	Hydrochlorothiazide and potassium-sparing agents	Public	1.0077	0.8510
		Private	0.3358	0.4501
		Total	1.3434	1.3011

Table 8.8.1: Use of Peripheral Vasodilators by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C04A A	**2-amino-1-phenylethanol derivatives**			
C04A A01	Isoxsuprine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
C04A B	**Imidazoline derivatives**			
C04A B01	Phentolamine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
C04A C	**Nicotinic acid and derivatives**			
C04A C01	Nicotinic acid	Public	-	-
		Private	-	0.0067
		Total	-	0.0067
C04A D	**Purine derivatives**			
C04A D03	Pentoxifylline	Public	0.0485	0.0448
		Private	0.0136	0.0116
		Total	0.0622	0.0564
C04A E	**Ergot alkaloids**			
C04A E01	Ergoloid mesylates	Public	-	<0.0001
		Private	0.0123	0.0060
		Total	0.0123	0.0061
C04A X02	Phenoxybenzamine	Public	<0.0001	<0.0001
		Private	-	<0.0001
		Total	<0.0001	<0.0001

Table 8.9.1: Use of Beta Blocking Agents by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C07A	**Beta blocking agents**			
C07A A05	Propranolol	Public	0.2550	0.3050
		Private	0.1813	0.1697
		Total	0.4363	0.4747
C07A A07	Sotalol	Public	-	0.0025
		Private	0.0146	0.0151
		Total	0.0146	0.0177
C07A B02	Metoprolol	Public	11.7536	11.4304
		Private	0.5828	0.6546
		Total	12.3365	12.085
C07A B03	Atenolol	Public	9.0770	9.4592
		Private	2.9306	3.2072
		Total	12.0076	12.6665
C07A B04	Acebutolol	Public	-	-
		Private	0.0019	0.0011
		Total	0.0019	0.0011
C07A B05	Betaxolol	Public	0.0004	0.0001
		Private	0.0703	0.0763
		Total	0.0708	0.0764
C07A B07	Bisoprolol	Public	0.0349	0.0710
		Private	0.1517	0.1576
		Total	0.1866	0.2286
C07A B09	Esmolol	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C07A G01	Labetalol	Public	0.1303	0.1263
		Private	0.0190	0.0163
		Total	0.1493	0.1426
C07A G02	Carvedilol	Public	0.0808	0.1142
		Private	0.2633	0.2289
		Total	0.3441	0.3431
C07C	**Beta blocking agents and other diuretics**			
C07C A03	Pindolol and other diuretics	Public	-	-
		Private	0.0021	0.0006
		Total	0.0021	0.0006
C07C B02	Metoprolol and other diuretics	Public	-	-
		Private	0.0167	0.0014
		Total	0.0167	0.0014
C07C B03	Atenolol and other diuretics	Public	<0.0001	-
		Private	0.1466	0.2231
		Total	0.1467	0.2231

Table 8.10.1: Use of Calcium Channel Blockers by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C08C	**Selective calcium channel blockers with mainly vascular effects**			
C08C A01	Amlodipine	Public	3.2803	6.4459
		Private	1.9921	2.4894
		Total	5.2725	8.9352
C08C A02	Felodipine	Public	1.3805	1.5870
		Private	0.4422	0.4541
		Total	1.8227	2.0411
C08C A03	Isradipine	Public	-	-
		Private	0.0067	0.0039
		Total	0.0067	0.0039
C08C A04	Nicardipine	Public	<0.0001	<0.0001
		Private	0.0050	0.0041
		Total	0.0050	0.0041
C08C A05	Nifedipine	Public	10.9355	10.6460
		Private	0.6772	0.8164
		Total	11.6127	11.4624
C08C A06	Nimodipine	Public	0.0005	0.0011
		Private	0.0002	0.0015
		Total	0.0007	0.0026
C08C A09	Lacidipine	Public	-	-
		Private	0.0140	0.0048
		Total	0.0140	0.0048
C08C A13	Lercanidipine	Public	-	-
		Private	0.0679	0.1204
		Total	0.0679	0.1204
C08D	**Selective calcium channel blockers with direct cardiac effects**			
C08D A01	Verapamil	Public	0.0378	0.0278
		Private	0.0442	0.0489
		Total	0.0821	0.0768
C08D B01	Diltiazem	Public	0.3064	0.2559
		Private	0.1747	0.1529
		Total	0.4811	0.4088

Table 8.11.1: Use of ACEI Inhibitors by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C09A	**ACE inhibitors, plain**			
C09A A01	Captopril	Public	4.1067	4.4033
		Private	0.1984	0.1485
		Total	4.3051	4.5518
C09A A02	Enalapril	Public	3.5113	4.7359
		Private	0.9827	1.3831
		Total	4.4939	6.1190
C09A A03	Lisinopril	Public	0.1591	0.0879
		Private	0.5872	0.7888
		Total	0.7463	0.8766
C09A A04	Perindopril	Public	4.3301	6.9654
		Private	0.3796	1.0012
		Total	4.7098	7.9666
C09A A05	Ramipril	Public	0.3409	0.5287
		Private	0.5856	0.4987
		Total	0.9264	1.0274
C09A A06	Quinapril	Public	-	-
		Private	0.0014	0.0020
		Total	0.0014	0.0020
C09A A09	Fosinopril	Public	0.0009	0.0011
		Private	0.0058	0.0089
		Total	0.0067	0.0100
C09A A16	Imidapril	Public	0.0012	0.0036
		Private	0.0211	0.0300
		Total	0.0223	0.0336
C09B	**ACE inhibitors, combinations**			
C09B A04	Perindopril and diuretics	Public	0.0066	0.0070
		Private	0.0672	0.0870
		Total	0.0738	0.0940

Table 8.12.1: Use of Angiotensin II Antagonists by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C09C	**Angiotensin II antagonists, plain**			
C09C A01	Losartan	Public	0.5202	0.6054
		Private	0.5978	0.6540
		Total	1.1179	1.2595
C09C A03	Valsartan	Public	0.1532	0.2624
		Private	0.2177	0.4461
		Total	0.3709	0.7085
C09C A04	Irbesartan	Public	0.1988	0.4753
		Private	0.3641	0.4976
		Total	0.5629	0.9728
C09C A06	Candesartan	Public	-	0.0026
		Private	0.2164	0.2771
		Total	0.2164	0.2797
C09C A07	Telmisartan	Public	0.2054	0.5622
		Private	0.2053	0.4428
		Total	0.4107	1.0050
C09C A08	Olmesartan medoxomil	Public	-	-
		Private	0.0503	0.0682
		Total	0.0503	0.0682

ATC	Drug Class and Agents	Sector	2006	2007
C09D	**Angiotensin II antagonists, combinations**			
C09D A01	Losartan and diuretics	Public	0.1154	0.2178
		Private	0.4050	0.4621
		Total	0.5204	0.6799
C09D A03	Valsartan and diuretics	Public	0.0891	0.1150
		Private	0.4154	0.3594
		Total	0.5045	0.4744
C09D A04	Irbesartan and diuretics	Public	0.0686	0.0794
		Private	0.2336	0.2361
		Total	0.3022	0.3155
C09D A06	Candesartan and diuretics	Public	0.0006	0.0006
		Private	0.1233	0.0871
		Total	0.1239	0.0878
C09D A07	Telmisartan and diuretics	Public	0.0195	0.0314
		Private	0.0947	0.1108
		Total	0.1142	0.1422

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CHAPTER 9 | USE OF ANTIHYPERTENSIVES

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Overall, the ranking of the five most commonly used antihypertensives remained unchanged in 2007 as compared to 2006. Beta blockers were the most commonly prescribed antihypertensive medication (26.3 DDD/1000 population/day) in 2007, followed by the calcium channel blockers (CCBs) (23.1), angiotensin converting enzyme inhibitors (ACEI) (20.7), diuretics (7.6) and angiotensin receptor blockers (ARBs) (6.0). Overall use had increased for all these groups except for diuretics where there was a downward trend for prescription. From 2006 to 2007, the largest increase was for ARBs by 40%, ACEIs by 20% and CCBs by 19%. The increase in use of ACEIs, particularly perindopril, may be attributed to the results of the Anglo Scandinavian Cardiovascular Outcome Trial (AS COT) published in 2005.[1] Usage of alpha antagonists and centrally acting drugs was low. The use of doxazosin, however, has doubled in 2007. This could be attributed to an increased utilisation of the drug to treat benign prostatic hyperplasia (BPH). Doxazosin is only indicated for treatment of BPH in the Ministry of Health (MOH) since 2005.

Among the beta blockers, the most commonly used were atenolol and metoprolol. They were favoured over the older generation beta blocker, propranolol. In the category of beta blockers, a small proportion of the prescription was combination therapy with diuretics.

The second largest category in antihypertensive use was the CCBs which included those with vascular effects (e.g. amlodipine and nifedipine) and those with cardiac effects (e.g. diltiazem). Among the CCBs, nifedipine and amlodipine were most commonly used. Nifedipine was the most extensively used CCB, 93% was used in the public sector. Amlodipine was popular in both the public and private sectors in spite of its high cost. The increase in amlodipine use was 69.5% between 2006 and 2007 despite no change in price. This is probably due to the publication of the ASCOT study. In addition, its daily dosing is an advantage for patient compliance over the three-times-a-day dosing of nifedipine. It is a long acting dihydropyridine CCB and is not contraindicated in cardiovascular disease, unlike the short acting nifedipine.

Among the ACEIs, perindopril was the most commonly used ACEI, followed by enalapril and captopril. Use of perindopril increased by 69% from 4.7 in 2006 to 8.0 DDD/1000 population/day in 2007. Perindopril is relatively cheap and its daily dosing is an advantage. The use of ACEIs should be encouraged as they have cardio- and renoprotective effects. They are the first-line treatment of choice for patients with diabetes who are hypertensive.[2] In the early stages of diabetic nephropathy, ACEIs and ARBs may help to prevent progression to end-stage renal failure (ESRF). This is an important treatment objective in Malaysia where the incidence of diabetes mellitus in new patients with ESRF was 58% in 2007.[3]

The most commonly used ARB (with or without combination with diuretics) was losartan, followed by irbesartan, valsartan and telmisartan. These drugs are expensive and the cost could have limited their widespread use.

Diuretics were prescribed alone (7.6 DDD/1000 population/day) or in combination with other drugs (beta blocker or ACEI or ARB or potassium sparing agents) in the same tablet (3.3 DDD/1000 population/day) which made its overall usage quite high (total 10.9 DDD/1000 population/day). Among the diuretics, chlorothiazide (CTZ) and hydrochlorothiazide (HCTZ) were the most commonly prescribed. The former was mainly used by the public sector, the latter by the private sector. Their usage was low despite the recommendation in the Malaysian Clinical Practice Guidelines (CPG) on Management of Hypertension (2nd edition) which positioned them as one of the first line drugs for hypertension.[4]

The alpha antagonists were not popular although they may be useful in hypertensive men with BPH who are not at high risk of heart failure. The use of centrally acting agents was low and this may be due to their unpleasant side effects. They are still useful as a third line drug and methyldopa is used in hypertension during pregnancy. Hydralazine should continue to be listed in the MOH Drug Formulary as it is useful in severe hypertension during pregnancy. Minoxidil is a third line drug that sometimes is used to control severe hypertension although there are side effects. Nitroprusside is an intravenous drug which was rarely used.

There were 3 drugs whose contribution each made up more than 10% of the total utilisation – atenolol (12.9 DDD/1000 population/day), metoprolol (12.1 DDD/1000 population/day), and nifedipine (11.5 DDD/1000 population/day). Of these two are beta blockers and one is a CCB. These 3 drugs were used mainly in the public sector (87 %).

Overall, 79% of all antihypertensives were utilised in the public sector, 21% in the private sector. The most popular drugs in the private sector were atenolol (3.4 DDD/1000 population/day), amlodipine (2.5 DDD/1000 population/day) and enalapril (1.4 DDD /1000 population/day). There was a tendency to use more expensive drugs in the private sector. The use of antihypertensives should be encouraged in the private sector to reduce the burden of prescribing in the public sector. Economic considerations about treating a chronic disease in the private sector may be a deterring factor. Hypertension is a silent killer and without counselling and education, the public may not be willing to pay for its long term control. Generic drugs which are efficacious should be the ones of choice. The drug prescribing pattern may have been unduly influenced by aggressive marketing by the pharmaceutical industry.

The total utilisation of antihypertensives had increased from 77.2 DDD/1000 population/day in 2006 to 88.3 DDD/1000 population/day in 2007. From general practice prescribing data, we estimated a patient with hypertension was prescribed a median of only one antihypertensive medication. The vast majority of patients (81%) in Malaysia were on mono-therapy. Thus, the utilisation statistic of 88.3 DDD/1000 population/day suggests about 8% of the population were on drug treatment for hypertension in 2007. Since about 40% of the Malaysian adult population was aged $\geq$ 30 years in 2006,[5] if we assume the entire 8% of those on drug treatment came from this group, this means that about 20% of the population aged 30 and above was taking an antihypertensive drug in 2007.

According to the Third National Health and Morbidity Survey,[5] there is a high prevalence of hypertension in Malaysia i.e. 43% in those aged $\geq$30 years in 2006. Only 36% of people with hypertension were aware of their disease. Eighty eight percent of those who were aware were treated.[5] However, despite this impressive figure, only 26% of those treated achieved target blood pressure. It may imply that patients with hypertension in Malaysia need more drug treatment. Many on treatment need more than one category of drug to control their blood pressure to the recommended target. Indeed, the National Essential Hypertension Audit of 2006 in MOH Hospitals and Health Centres showed that most of the patients with hypertension were only on 1 drug. The overall blood pressure control rate in this audit was only 28.5%.[6]

Overall, compared to the Nordic countries,[7] the use of beta blockers, agents acting on the renin-angiotensin system and CCBs was low in Malaysia. Beta blocker use in 2007 ranged between 19.3 DDD/1000 population/day in Greenland and 70.5 in Finland as compared with 26.3 in Malaysia. For drugs acting on the renin-angiotensin system, the usage in Malaysia was 26.7 compared to the Nordic countries where this ranged between 47.8 DDD/1000 population/day in Greenland and 166 in Finland. For CCBs, the range was 25.8 in Greenland and 62.7 in Denmark as compared to 23.1 locally. The use of thiazides alone ranged between 6.3 DDD/1000 population/day in Finland and 50.4 in Denmark in 2007 as compared with 6.8 in Malaysia.

The 3rd edition of the CPG on Management of Hypertension was published in 2008 and hence is not used as the standard for comparison for drug utilisation in 2007. The available local CPG on hypertension at that time[4] recommended beta blockers or diuretics as being among drugs of first choice for control of uncomplicated hypertension. The drug utilisation pattern for 2007 was not consistent with the second edition of the CPG as CCBs and ACEIs were the next most commonly used drugs after beta blockers. Diuretics lagged behind in fourth place. Many of the drugs in the top 4 categories are generic and the order of preference may reflect economic considerations. However, in 2007, the CCB most commonly used in both public and private sectors was amlodipine while the ACEI most commonly prescribed was perindopril, both of which were patented products at the time.

ACEIs and ARBs may be prescribed due to their effects beyond blood pressure lowering, particularly in subgroups of patients. These include cardioprotection post myocardial infarction, reduction of proteinuria and renoprotection in diabetic and non-diabetic renal disease. The incidence of diabetes mellitus in Malaysia has almost doubled over the last 10 years from 8.9% in 1996 to 14.9% in 2006[5], and more than three-quarters of people with type 2 diabetes are hypertensive.[8] The CCBs have few side effects and are efficacious. Diuretics may be used less in spite of their low cost due to a lack of promotion compared to other drugs or their perceived side effects.

Table 9.1: Use of Antihypertensives by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
C02A	Antiadrenergic agents, centrally acting	0.6553	0.5744
C02C A	Alpha-adrenoreceptor antagonists	2.5693	2.7715
C02D	Arteriolar smooth muscle, agents acting on	0.0063	0.0079
C02K	Other antihypertensives	0.0006	0.0006
C03A	Low-ceiling diuretics, thiazides	7.3749	6.8217
C03B	Low-ceiling diuretics, excl. thiazides	0.6293	0.7885
C03E	Diuretics and potassium-sparing agents in combination	1.3434	1.3011
C07	Beta blocking agents	25.7132	26.2609
C08	Calcium channel blockers	19.3653	23.0601
C09A	ACE inhibitors, plain	15.2120	20.5872
C09B	ACE inhibitors, combinations	0.0738	0.0940
C09C	Angiotensin II antagonists, plain	2.7291	4.2937
C09D	Angiotensin II antagonists, combinations	1.5652	1.6996

Table 9.2: Use of Antihypertensives by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C02A	**Antiadrenergic agents, centrally acting**			
C02A B01	Methyldopa (levorotatory)	Public	0.5827	0.5133
		Private	0.0180	0.0192
		Total	0.6007	0.5326
C02A C01	Clonidine	Public	<0.0001	<0.0001
		Private	-	-
		Total	<0.0001	<0.0001
C02A C05	Moxonidine	Public	0.0002	0.0024
		Private	0.0544	0.0394
		Total	0.0545	0.0418
C02C A	**Alpha-adrenoreceptor antagonists**			
C02C A01	Prazosin	Public	2.2340	2.2924
		Private	0.0961	0.0682
		Total	2.3301	2.3606
C02C A04	Doxazosin	Public	0.1764	0.3525
		Private	0.0628	0.0585
		Total	0.2393	0.4110
C02D	**Arteriolar smooth muscle, agents acting on**			
C02D B01	Dihydralazine	Public	0.0004	0.0001
		Private	-	<0.0001
		Total	0.0004	0.0001
C02D B02	Hydralazine	Public	-	0.0003
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0003
C02D C01	Minoxidil	Public	0.0047	0.0054
		Private	0.0002	0.0013
		Total	0.0049	0.0068
C02D D01	Nitroprusside	Public	0.0001	<0.0001
		Private	0.0008	0.0006
		Total	0.0010	0.0007

ATC	Drug Class and Agents	Sector	2006	2007
C02K	**Other antihypertensives**			
C02K X01	Bosentan	Public	<0.0001	-
		Private	0.0006	0.0006
		Total	0.0006	0.0006
C03A	**Low-ceiling diuretics, thiazides**			
C03A A03	Hydrochlorothiazide	Public	0.2597	0.1982
		Private	0.8356	0.8697
		Total	1.0953	1.0680
C03A A04	Chlorothiazide	Public	6.2441	5.7074
		Private	0.0355	0.0463
		Total	6.2796	5.7537
C03B	**Low-ceiling diuretics, excl. thiazides**			
C03B A04	Chlortalidone	Public	-	-
		Private	0.0212	0.0361
		Total	0.0212	0.0361
C03B A08	Metolazone	Public	0.0017	<0.0001
		Private	-	0.0003
		Total	0.0017	0.0003
C03B A11	Indapamide	Public	0.0557	0.0551
		Private	0.5507	0.6970
		Total	0.6064	0.7521
C03E	**Diuretics and potassium-sparing agents in combination**			
C03E A01	Hydrochlorothiazide and potassium-sparing agents	Public	1.0077	0.8510
		Private	0.3358	0.4501
		Total	1.3434	1.3011
C07A	**Beta blocking agents**			
C07A A05	Propranolol	Public	0.2550	0.3050
		Private	0.1813	0.1697
		Total	0.4363	0.4747
C07A A07	Sotalol	Public	-	0.0025
		Private	0.0146	0.0151
		Total	0.0146	0.0177
C07A B02	Metoprolol	Public	11.7536	11.4304
		Private	0.5828	0.6546
		Total	12.3365	12.0850
C07A B03	Atenolol	Public	9.0770	9.4592
		Private	2.9306	3.2072
		Total	12.0076	12.6665
C07A B04	Acebutolol	Public	-	-
		Private	0.0019	0.0011
		Total	0.0019	0.0011
C07A B05	Betaxolol	Public	0.0004	0.0001
		Private	0.0703	0.0763
		Total	0.0708	0.0764
C07A B07	Bisoprolol	Public	0.0349	0.0710
		Private	0.1517	0.1576
		Total	0.1866	0.2286

ATC	Drug Class and Agents	Sector	2006	2007
C07A	**Beta blocking agents**			
C07A B09	Esmolol	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C07A G01	Labetalol	Public	0.1303	0.1263
		Private	0.0190	0.0163
		Total	0.1493	0.1426
C07A G02	Carvedilol	Public	0.0808	0.1142
		Private	0.2633	0.2289
		Total	0.3441	0.3431
C07C	**Beta blocking agents and other diuretics**			
C07C A03	Pindolol and other diuretics	Public	-	-
		Private	0.0021	0.0006
		Total	0.0021	0.0006
C07C B02	Metoprolol and other diuretics	Public	-	-
		Private	0.0167	0.0014
		Total	0.0167	0.0014
C07C B03	Atenolol and other diuretics	Public	<0.0001	-
		Private	0.1466	0.2231
		Total	0.1467	0.2231
C08C	**Selective calcium channel blockers with mainly vascular effects**			
C08C A01	Amlodipine	Public	3.2803	6.4459
		Private	1.9921	2.4894
		Total	5.2725	8.9352
C08C A02	Felodipine	Public	1.3805	1.5870
		Private	0.4422	0.4541
		Total	1.8227	2.0411
C08C A03	Isradipine	Public	-	-
		Private	0.0067	0.0039
		Total	0.0067	0.0039
C08C A04	Nicardipine	Public	<0.0001	<0.0001
		Private	0.0050	0.0041
		Total	0.0050	0.0041
C08C A05	Nifedipine	Public	10.9355	10.646
		Private	0.6772	0.8164
		Total	11.6127	11.4624
C08C A06	Nimodipine	Public	0.0005	0.0011
		Private	0.0002	0.0015
		Total	0.0007	0.0026
C08C A09	Lacidipine	Public	-	-
		Private	0.0140	0.0048
		Total	0.0140	0.0048
C08C A13	Lercanidipine	Public	-	-
		Private	0.0679	0.1204
		Total	0.0679	0.1204

ATC	Drug Class and Agents	Sector	2006	2007
C08D	**Selective calcium channel blockers with direct cardiac effects**			
C08D A01	Verapamil	Public	0.0378	0.0278
		Private	0.0442	0.0489
		Total	0.0821	0.0768
C08D B01	Diltiazem	Public	0.3064	0.2559
		Private	0.1747	0.1529
		Total	0.4811	0.4088
C09A	**ACE inhibitors, plain**			
C09A A01	Captopril	Public	4.1067	4.4033
		Private	0.1984	0.1485
		Total	4.3051	4.5518
C09A A02	Enalapril	Public	3.5113	4.7359
		Private	0.9827	1.3831
		Total	4.4939	6.1190
C09A A03	Lisinopril	Public	0.1591	0.0879
		Private	0.5872	0.7888
		Total	0.7463	0.8766
C09A A04	Perindopril	Public	4.3301	6.9654
		Private	0.3796	1.0012
		Total	4.7098	7.9666
C09A A05	Ramipril	Public	0.3409	0.5287
		Private	0.5856	0.4987
		Total	0.9264	1.0274
C09A A06	Quinapril	Public	-	-
		Private	0.0014	0.0020
		Total	0.0014	0.0020
C09A A09	Fosinopril	Public	0.0009	0.0011
		Private	0.0058	0.0089
		Total	0.0067	0.0100
C09A A16	Imidapril	Public	0.0012	0.0036
		Private	0.0211	0.0300
		Total	0.0223	0.0336
C09B	**ACE inhibitors, combinations**			
C09B A04	Perindopril and diuretics	Public	0.0066	0.0070
		Private	0.0672	0.0870
		Total	0.0738	0.0940

ATC	Drug Class and Agents	Sector	2006	2007
C09C	**Angiotensin II antagonists, plain**			
C09C A01	Losartan	Public	0.5202	0.6054
		Private	0.5978	0.6540
		Total	1.1179	1.2595
C09C A03	Valsartan	Public	0.1532	0.2624
		Private	0.2177	0.4461
		Total	0.3709	0.7085
C09C A04	Irbesartan	Public	0.1988	0.4753
		Private	0.3641	0.4976
		Total	0.5629	0.9728
C09C A06	Candesartan	Public	-	0.0026
		Private	0.2164	0.2771
		Total	0.2164	0.2797
C09C A07	Telmisartan	Public	0.2054	0.5622
		Private	0.2053	0.4428
		Total	0.4107	1.0050
C09C A08	Olmesartan medoxomil	Public	-	-
		Private	0.0503	0.0682
		Total	0.0503	0.0682
C09D	**Angiotensin II antagonists, combinations**			
C09D A01	Losartan and diuretics	Public	0.1154	0.2178
		Private	0.4050	0.4621
		Total	0.5204	0.6799
C09D A03	Valsartan and diuretics	Public	0.0891	0.1150
		Private	0.4154	0.3594
		Total	0.5045	0.4744
C09D A04	Irbesartan and diuretics	Public	0.0686	0.0794
		Private	0.2336	0.2361
		Total	0.3022	0.3155
C09D A06	Candesartan and diuretics	Public	0.0006	0.0006
		Private	0.1233	0.0871
		Total	0.1239	0.0878
C09D A07	Telmisartan and diuretics	Public	0.0195	0.0314
		Private	0.0947	0.1108
		Total	0.1142	0.1422

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CHAPTER 10 | USE OF LIPID MODIFYING DRUGS

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The incidence of acute coronary syndrome (ACS) admission to Coronary Care Unit (CCU) in Malaysia was 47 per 100,000 populations in 2006. An approximate incidence of Coronary Heart Disease in Malaysia is 141 per 100,000 populations.[1] These patients were younger (59 years) compared to the Global Registry of Acute Coronary Events (GRACE) Registry.[2] 96% of these patients had at least 1 cardiovascular risk factor, and 50% had 3 or more risk factors. About 60% of the patient had a diagnosis of dyslipidaemia prior to the presentation of ACS.[1] From 2000, between 21% - 25% of certified death in government hospitals are due to cardiovascular disease. Systematic reviews and large randomised clinical trials have found that lowering cholesterol in people at high risk of cardiovascular events substantially reduces the risk of overall mortality, cardiovascular mortality and non-fatal cardiovascular events. Lipid modifying agents remain the mainstay in the management of dyslipidaemia. The 3-hydroxy-3-methylglutaryl coenzyme A (HMG Co A) reductase inhibitor, or widely known as statin, is the most commonly prescribed lipid modifying agent. Primary and secondary prevention trials have found that statins constitute the single most effective type of treatment for reducing cholesterol and reducing cardiovascular risk.[3,4] The treatment target and therapy guideline regarding the use of statins in various cardiovascular presentations have been well documented.[5,6] The lower the low-density lipoprotein (LDL), the better the outcome.[7,8]

The percentage of the overall statins utilised has increased by 40.9%. The most prescribed statin in Malaysia was lovastatin (40%), mainly in the public sector and the reason being, it is readily available. The second most (37%) commonly used statin was simvastatin, that was equally distributed in both public and private sector, followed by atorvastatin, which was more commonly used in the private sector. The newer available statin in Malaysia is rosuvastatin, mainly prescribed in the private sector because it was not listed in the Ministry of Health Drug Formulary. There was an 86% increment in its usage from 2006 to 2007. As for pravastatin, the consumption has reduced equally in both public and private sector.

The fibrate group constituted 9.1% of lipid modifying agents. The most prescribed fibrate was gemfibrozil as it is the only fibrate available in public hospitals. However, the overall usage in 2007 has decreased by 21.4%, but there was an increasing trend in the consumption of fenofibrate (10.9%), which was more commonly prescribed in private sector.

The other lipid modifying agent that acts by decreasing absorption in intestine (cholesterol absorption inhibitor) is ezetimibe. There was an increase in consumption of ezetimibe by 79.4% in 2007. Similarly, the usage of combination of simvastatin and ezetimibe has also increased by 19.9%.

Despite patients with ACS in Malaysia being younger and more than 90% of them had cardiovascular risk factors,[1] our utilisation of lipid modifying agents compared to other developed countries were much lower. For example, Australia had a statin usage of 110.62 DDD/1000 population/day in 2007 compared to 12.85 DDD/1000 population /day in Malaysia.[9] This implies that we still have more room for improvements in the treatment of dyslipidaemia in both primary and secondary prevention. This is vital in reducing our cardiovascular health burden and escalating healthcare cost in the future.

Table 10.1 : Use of Lipid Modifying Drugs by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
C10A A	HMG CoA reductase inhibitors	8.7043	12.2615
C10A B	Fibrates	1.3854	1.2676
C10A C	Bile acid sequestrants	0.0019	0.0028
C10A D	Nicotinic acid and derivatives	-	<0.0001
C10A X	Other lipid modifying agents	0.0722	0.1295
C10B A	HMG CoA reductase inhibitors in combination with other lipid modifying agents	0.2588	0.3104

Table 10.2 : Use of Lipid Modifying Drugs by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
C10A A	**HMG CoA reductase inhibitors**			
C10A A01	Simvastatin	Public	1.3189	2.4809
		Private	1.9644	2.0083
		Total	3.2833	4.4892
C10A A02	Lovastatin	Public	2.7005	4.5976
		Private	0.3364	0.2975
		Total	3.0369	4.8952
C10A A03	Pravastatin	Public	0.1304	0.1607
		Private	0.1689	0.1141
		Total	0.2993	0.2749
C10A A04	Fluvastatin	Public	-	0.0010
		Private	0.1923	0.0477
		Total	0.1923	0.0487
C10A A05	Atorvastatin	Public	0.3930	0.8415
		Private	1.2690	1.2801
		Total	1.6620	2.1216
C10A A06	Cerivastatin	Public	-	-
		Private	-	-
		Total	-	-
C10A A07	Rosuvastatin	Public	0.0062	0.0393
		Private	0.2244	0.3926
		Total	0.2306	0.4319
C10A B	**Fibrates**			
C10A B01	Clofibrate	Public	-	-
		Private	0.0002	-
		Total	0.0002	-
C10A B02	Bezafibrate	Public	-	-
		Private	0.0002	0.0012
		Total	0.0002	0.0012
C10A B04	Gemfibrozil	Public	0.7413	0.5615
		Private	0.0285	0.0436
		Total	0.7698	0.6051
C10A B05	Fenofibrate	Public	0.1990	0.1615
		Private	0.3695	0.4692
		Total	0.5684	0.6307
C10A B08	Ciprofibrate	Public	0.0122	0.0141
		Private	0.0346	0.0165
		Total	0.0468	0.0307

ATC	Drug Class and Agents	Sector	2006	2007
C10A C	**Bile acid sequestrants**			
C10A C01	Colestyramine	Public	0.0005	0.0008
		Private	0.0014	0.0018
		Total	0.0019	0.0025
C10A C02	Colestipol	Public	-	-
		Private	-	0.0003
		Total	-	0.0003
C10A D	**Nicotinic acid and derivatives**			
C10A D01	Niceritrol	Public	-	-
		Private	-	-
		Total	-	-
C10A D02	Nicotinic acid	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
C10A X	**Other lipid modifying agents**			
C10A X09	Ezetimibe	Public	0.0077	0.0409
		Private	0.0645	0.0887
		Total	0.0722	0.1295
C10B A	**HMG CoA reductase inhibitors in combination with other lipid modifying agents**			
C10B A02	Simvastatin and ezetimibe	Public	0.0021	0.0124
		Private	0.2567	0.2979
		Total	0.2588	0.3104

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CHAPTER 11 | USE OF DERMATOLOGICALS

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Dermatology practice has always been dominated by the use of topical over systemic or physical agents.[1-3] From the data collected in this survey, we analysed the trends of use of dermatological agents by practitioners in both private and public sectors. The topical dermatological medicaments included in this study were antifungals, antipsoriatics, antibiotics, antivirals, corticosteroids, antiacne agents, hair growth stimulants, depigmenting agents, calcineurin inhibitors and metronidazole. Utilisation is measured as total dose of topical medicament in g/ml/1000 population/day.

Miconazole was the most commonly used topical antifungal in the public sector whereas the private sector favoured combination preparations.[4] The usage of combinations was low in the public sector, probably due to the ability to treat based on aetiological diagnosis. There was an overall increase usage of clotrimazole and ketoconazole, with corresponding reduction in miconazole usage from 2006 to 2007. Nystatin, an effective, time-tested and cheap anticandidal preparation was widely used in public sector but not a popular antifungal preparation in the private sector. The low usage of amorolfine lacquer for onychomycosis in both public and private sectors may be due to religious constraints. Only 2 systemic antifungal agents i.e. terbinafine and griseofulvin were surveyed. It would be interesting to know the usage of other triazoles such as fluconazole and itraconazole. Easier dosing and shorter duration of treatment may explain for the two-fold increase in the use of terbinafine in the public sector. Griseofulvin remained the systemic antifungal of choice in both private and public sectors.

The trend in psoriasis management has shifted from photochemotherapy to narrow band UVB, and this may be the reason for low usage of methoxalen.[5] The drop in usage of calcipotriol in the private sector may be due to the preference of using calcipotriol-potent corticosteroid combinations.[6] There was no data available on the usage of first line topical antipsoriatic treatment i.e. tar-based preparations. It would be interesting to know the reasons for the increase in acitretin usage from 2006 to 2007.

The most commonly used topical antibiotics in the public and private sectors were neomycin and gentamicin, respectively.[7] Mupirocin, due to its high cost, was least used. The low usage of topical fusidic acid in public sector was due to its strict use for outpatients only. Benefits of topical acyclovir in herpes genitalis and herpes zoster are limited,[8,9] thus explaining its low usage in public sector. There is a need to disseminate evidence-based indications on its use. Patients' preference for self-administered treatment with topical imiquimod for genital warts[10-12] explained its five-fold increase from 2006 to 2007 in the private sector. Topical metronidazole,[13] for the treatment of rosacea, though not available in the Ministry of Health Drug Formulary, showed an increased usage in the private sector from 2006 to 2007.

The commonest topical corticosteroids prescribed were betamethasone, followed by hydrocortisone and clobetasol. In general, topical corticosteroids usage was higher in the private sector, with the exception of hydrocortisone, a weak topical steroid that was most commonly prescribed in public sector. However, the usage of very potent corticosteroid (clobetasol) has doubled in the public sector. This may be due to the lack of efficacy of the generic lower potency topical corticosteroid and also the higher expectations of both patients and doctors for a faster response. Preference for usage of higher potency corticosteroids with antibiotics was also observed in the private sector, probably due to pressure to clear patients' condition fast in private sector.

Despite being a common topical treatment for acne,[14-17] there was no data available for benzoyl peroxide usage. The commonest topical antiacne agents used in public and private sectors were tretinoin and clindamycin, respectively. Adapalene,[14-17] being a less irritating, but more expensive preparation, was utilised more by the private sector. In Australia, topical adapalene was the most commonly prescribed antiacne preparation, followed by erythromycin and tretinoin. In the absence of data on benzoyl peroxide use, it will be misleading to comment on the most commonly used antiacne treatment in Malaysia. Increased usage of oral isotretinoin reflected a change in the prescribing practice, with early commencement of treatment to reduce scarring.

In government healthcare facilities, procurement of dermatological medicaments for acute cutaneous infections and chronic skin diseases (eczema and psoriasis) took preference over hair growth stimulants (minoxidil and finasteride) and depigmenting agents (hydroquinone), which are perceived as more for cosmetic benefits.

The increasing trend in the usage of higher potency topical corticosteroid preparations is of concern,[18-20] necessitating a Malaysian guideline on the rational use of topical corticosteroids.[18-20] Future monitoring of its implementation and compliance to this guideline will result in better patient care.

Table 11.1 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D01A A	**Antibiotics**				
D01A A01	Nystatin	g/ml/cc	Public	0.1064	0.1019
			Private	0.0089	0.0117
			Total	0.1153	0.1137
D01A A08	Griseofulvin	g/ml/cc	Public	-	-
			Private	-	0.0030
			Total	-	0.0030
D01A A20	Combinations	g/ml/cc	Public	-	-
			Private	-	0.0005
			Total	-	0.0005
D01A C	**Imidazol and triazole derivatives**				
D01A C01	Clotrimazole	g/ml/cc	Public	0.1469	0.1834
			Private	0.3403	0.6932
			Total	0.4872	0.8765
D01A C02	Miconazole	g/ml/cc	Public	0.6857	0.8189
			Private	0.6054	0.4261
			Total	1.2910	1.2450
D01A C03	Econazole	g/ml/cc	Public	-	-
			Private	0.0434	0.0284
			Total	0.0434	0.0284
D01A C05	Isoconazole	g/ml/cc	Public	-	0.0001
			Private	0.0003	0.0097
			Total	0.0003	0.0098
D01A C07	Tioconazole	g/ml/cc	Public	0.0007	0.0005
			Private	0.0059	0.0088
			Total	0.0066	0.0093
D01A C08	Ketoconazole	g/ml/cc	Public	0.0608	0.0760
			Private	0.3199	0.5330
			Total	0.3808	0.6090
D01A C14	Sertaconazole	g/ml/cc	Public	-	-
			Private	-	0.0046
			Total	-	0.0046
D01A C15	Fluconazole	g/ml/cc	Public	-	-
			Private	0.0002	0.0010
			Total	0.0002	0.0010
D01A C20	Combinations	g/ml/cc	Public	0.0051	0.0054
			Private	1.3250	1.8710
			Total	1.3302	1.8765
D01A C52	Miconazole, combinations	g/ml/cc	Public	-	-
			Private	0.0229	0.0045
			Total	0.0229	0.0045

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D01A E	**Other antifungals for topical use**				
D01A E13	Selenium sulfide	g/ml/cc	Public	0.0320	0.0363
			Private	0.0388	0.0850
			Total	0.0707	0.1214
D01A E15	Terbinafine	g/ml/cc	Public	-	-
			Private	0.0277	0.0295
			Total	0.0277	0.0295
D01A E16	Amorolfine	g/ml/cc	Public	0.0001	0.0003
			Private	<0.0001	<0.0001
			Total	0.0002	0.0003
D01A E22	Naftifine	g/ml/cc	Public	-	-
			Private	-	0.0001
			Total	-	0.0001

Table 11.2 : Use of Dermatologicals by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
D01B A	**Antifungals for systemic use**			
D01B A01	Griseofulvin	Public	0.1525	0.1336
		Private	0.2310	0.3107
		Total	0.3835	0.4443
D01B A02	Terbinafine	Public	0.0048	0.0083
		Private	0.0081	0.0091
		Total	0.0128	0.0174

Table 11.3 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D05A C	**Antracen derivatives**				
D05A C01	Dithranol	g/ml/cc	Public	-	0.0003
			Private	-	-
			Total	-	0.0003
D05A D	**Psoralens for topical use**				
D05A D02	Methoxsalen	g/ml/cc	Public	0.0003	0.0003
			Private	0.0001	0.0001
			Total	0.0004	0.0004
D05A X	**Other antipsoriatics for topical use**				
D05A X02	Calcipotriol	g/ml/cc	Public	0.0465	0.0431
			Private	0.0124	0.0066
			Total	0.0589	0.0498
D05A X03	Calcitriol	g/ml/cc	Public	-	0.0002
			Private	-	-
			Total	-	0.0002
D05A X52	Calcipotriol, combinations	g/ml/cc	Public	-	0.0003
			Private	0.0064	0.0092
			Total	0.0064	0.0095

Table 11.4 : Use of Dermatologicals by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
D05B A	**Psoralens for systemic use**			
D05B A01	Trioxysalen	Public	-	-
		Private	-	-
		Total	-	-
D05B A02	Methoxsalen	Public	0.0012	0.0008
		Private	0.0007	0.0004
		Total	0.0020	0.0011
D05B B	**Retinoids for treatment of psoriasis**			
D05B B01	Etretinate	Public	-	-
		Private	-	-
		Total	-	-
D05B B02	Acitretin	Public	0.0060	0.0139
		Private	0.0004	0.0004
		Total	0.0064	0.0143

Table 11.5 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D06A A	**Tetracycline and derivatives**				
D06A A02	Chlortetracycline	g/ml/cc	Public	-	-
			Private	-	0.0003
			Total	-	0.0003
D06A A04	Tetracycline	g/ml/cc	Public	-	-
			Private	0.0041	0.0052
			Total	0.0041	0.0052
D06A X	**Other antibiotics for topical use**				
D06A X01	Fusidic acid	g/ml/cc	Public	0.0303	0.0464
			Private	0.2682	0.2690
			Total	0.2985	0.3154
D06A X04	Neomycin	g/ml/cc	Public	0.8132	0.7759
			Private	0.2511	0.3096
			Total	1.0644	1.0855
D06A X07	Gentamicin	g/ml/cc	Public	0.0116	0.0168
			Private	0.2203	0.3128
			Total	0.2319	0.3297
D06A X09	Mupirocin	g/ml/cc	Public	0.0255	0.0165
			Private	0.0896	0.1013
			Total	0.1151	0.1178

Table 11.6 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D06B A	**Sulfonamides**				
D06B A01	Silver sulfadiazine	g/ml/cc	Public	0.1782	0.1691
			Private	0.0919	0.0789
			Total	0.2701	0.2481
D06B B	**Antivirals**				
D06B B02	Tromantadine	g/ml/cc	Public	-	-
			Private	0.0054	0.0053
			Total	0.0054	0.0053
D06B B03	Aciclovir	g/ml/cc	Public	0.0020	0.0020
			Private	0.0588	0.0515
			Total	0.0608	0.0534
D06B B04	Podophyllotoxin	g/ml/cc	Public	-	0.0001
			Private	-	<0.0001
			Total	-	0.0001
D06B B10	Imiquimod	g/ml/cc	Public	-	-
			Private	0.0003	0.0015
			Total	0.0003	0.0015
D06B X	**Other chemotherapeutics**				
D06B X01	Metronidazole	g/ml/cc	Public	-	<0.0001
			Private	0.0113	0.0161
			Total	0.0113	0.0161

Table 11.7 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D07A A	**Corticosteroids, weak (group I)**				
D07A A02	Hydrocortisone	g/ml/cc	Public	1.0887	0.9927
			Private	0.6583	0.6761
			Total	1.7470	1.6688
D07A A03	Prednisolone	g/ml/cc	Public	-	-
			Private	-	0.0004
			Total	-	0.0004
D07A B	**Corticosteroids, moderately potent (group II)**				
D07A B01	Clobetasone	g/ml/cc	Public	0.0491	0.0843
			Private	0.0622	0.0786
			Total	0.1113	0.1629
D07A B03	Flumetasone	g/ml/cc	Public	0.0002	-
			Private	-	-
			Total	0.0002	-
D07A B09	Triamcinolone	g/ml/cc	Public	0.0013	-
			Private	0.0850	0.0169
			Total	0.0863	0.0169
D07A B10	Alclometasone	g/ml/cc	Public	-	-
			Private	0.0001	-
			Total	0.0001	-
D07A B19	Dexamethasone	g/ml/cc	Public	-	-
			Private	0.0005	0.0007
			Total	0.0005	0.0007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D07A C	**Corticosteroids, potent (group III)**				
D07A C01	Betamethasone	g/ml/cc	Public	0.8813	0.7833
			Private	1.3885	1.6195
			Total	2.2698	2.4028
D07A C04	Fluocinolone acetonide	g/ml/cc	Public	-	-
			Private	0.0276	0.0154
			Total	0.0276	0.0154
D07A C13	Mometasone	g/ml/cc	Public	0.0168	0.0349
			Private	0.0951	0.1455
			Total	0.1119	0.1804
D07A C16	Hydrocortisone aceponate	g/ml/cc	Public	0.0005	0.0002
			Private	0.0083	0.0176
			Total	0.0088	0.0177
D07A C17	Fluticasone	g/ml/cc	Public	-	-
			Private	0.0182	0.0059
			Total	0.0182	0.0059
D07A D	**Corticosteroids, very potent (group IV)**				
D07A D01	Clobetasol	g/ml/cc	Public	0.0583	0.1091
			Private	0.5533	0.6052
			Total	0.6116	0.7143

Table 11.8 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D07C A	**Corticosteroids, weak, combinations with antibiotics**				
D07C A01	Hydrocortisone and antibiotics	g/ml/cc	Public	0.0573	0.0407
			Private	0.0407	0.0535
			Total	0.0981	0.0942
D07C A03	Prednisolone and antibiotics	g/ml/cc	Public	-	-
			Private	0.0006	-
			Total	0.0006	-
D07C B	**Corticosteroids, moderately potent, combinations with antibiotics**				
D07C B01	Triamcinolone and antibiotics	g/ml/cc	Public	-	0.0007
			Private	0.0490	0.0031
			Total	0.0490	0.0038
D07C B04	Dexamethasone and antibiotics	g/ml/cc	Public	-	<0.0001
			Private	0.0015	-
			Total	0.0015	<0.0001
D07C C	**Corticosteroids, potent, combinations with antibiotics**				
D07C C01	Betamethasone and antibiotics	g/ml/cc	Public	0.0198	0.0351
			Private	0.6049	0.7405
			Total	0.6247	0.7756
D07C C02	Fluocinolone acetonide and antibiotics	g/ml/cc	Public	-	-
			Private	0.0016	0.0146
			Total	0.0016	0.0146
D07C D01	Clobetasol and antibiotics	g/ml/cc	Public	-	-
			Private	0.0013	0.0040
			Total	0.0013	0.0040

Table 11.9 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D07X A	**Corticosteroids, weak, other combinations**				
D07X A01	Hydrocortisone	g/ml/cc	Public	-	-
			Private	0.0313	0.0470
			Total	0.0313	0.0470
D07X C	**Corticosteroids, potent, other combinations**				
D07X C01	Betamethasone	g/ml/cc	Public	0.0040	0.0119
			Private	0.1847	0.2250
			Total	0.1887	0.2369

Table 11.10 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D09A A	**Medicated dressings with anti-infectives**				
D09A A02	Fusidic acid	g/ml/cc	Public	0.0002	0.0011
			Private	0.0272	0.0381
			Total	0.0274	0.0392
D09A A13	Iodoform	g/ml/cc	Public	-	0.0007
			Private	-	0.0002
			Total	-	0.0009

Table 11.11 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D10A A	**Corticosteroids, combinations for treatment of acne**				
D10A A02	Methylprednisolone	g/ml/cc	Public	-	-
			Private	-	0.0046
			Total	-	0.0046
D10A D	**Retinoids for topical use in acne**				
D10A D01	Tretinoin	g/ml/cc	Public	0.0358	0.0224
			Private	0.0350	0.0473
			Total	0.0708	0.0697
D10A D03	Adapalene	g/ml/cc	Public	0.0002	0.0010
			Private	0.0357	0.0352
			Total	0.0359	0.0361
D10A D04	Isotretinoin	g/ml/cc	Public	-	-
			Private	0.0031	0.0015
			Total	0.0031	0.0015
D10A E	**Peroxides**				
D10A E01	Benzoyl peroxide	g/ml/cc	Public	-	-
			Private	0.0002	-
			Total	0.0002	-

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D10A F	**Anti-infectives for treatment of acne**				
D10A F01	Clindamycin	g/ml/cc	Public	0.0002	0.0005
			Private	0.0894	0.1892
			Total	0.0896	0.1896
D10A F02	Erythromycin	g/ml/cc	Public	-	-
			Private	0.0384	0.0324
			Total	0.0384	0.0324
D10A F52	Erythromycin, combinations	g/ml/cc	Public	-	-
			Private	0.0029	-
			Total	0.0029	-
D10A X	**Other antiacne preparations for topical use**				
D10A X03	Azelaic acid	g/ml/cc	Public	0.0007	0.0006
			Private	0.0120	0.0037
			Total	0.0128	0.0043

Table 11.12 : Use of Dermatologicals by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
D10B A	**Retinoids for treatment of acne**			
D10B A01	Isotretinoin	Public	0.0100	0.0156
		Private	0.0073	0.0065
		Total	0.0173	0.0220

Table 11.13 : Use of Dermatologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
D11A C	**Medicated shampoos**				
D11A C03	Selenium compounds	g/ml/cc	Public	0.0604	0.0765
			Private	0.1091	0.1440
			Total	0.1695	0.2206
D11A F	**Wart and anticorn preparations**				
D11A F00	Wart and anticorn preparations	g/ml/cc	Public	-	<0.0001
			Private	-	0.0047
			Total	-	0.0047
D11A X	**Other dermatologicals**				
D11A X01	Minoxidil	g/ml/cc	Public	-	<0.0001
			Private	0.0231	0.0326
			Total	0.0231	0.0326
D11A X10	Finasteride	mg	Public	0.0012	-
			Private	0.0993	0.0655
			Total	0.1005	0.0655
D11A X11	Hydroquinone	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0119	0.0102
			Total	0.0120	0.0102
D11A X14	Tacrolimus	g/ml/cc	Public	0.0005	0.0001
			Private	0.0098	0.0085
			Total	0.0103	0.0086
D11A X15	Pimecrolimus	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0019	0.0005
			Total	0.0020	0.0006

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CHAPTER 12 USE OF GYNAECOLOGICALS, SEX HORMONES AND HORMONAL CONTRACEPTIVES

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There has been lack of a comprehensive review on the use of gynaecological, sex hormone and hormonal contraceptive drugs in the Malaysian literature.[1]

The use of gynaecological anti-infectives and antiseptics was 0.1976 DDD/1000 population/ day in 2007; other gynaecologicals was 0.0946 DDD/1000 population/day whereas sex hormones and modulators of the genital system showed a marked increase to 8.1348 DDD/1000 population/day.

Overall usage of anti-infectives and antiseptics showed a slight decrease from the previous year. This may be due to the common antibiotics used in gynaecological practice being captured in other codes of the ATC Classification system. An example would be the total lack of data in the public hospital system and the insignificant use of metronidazole (G01A F01), which is a widely used antibiotic for anaerobic infections in gynaecological practice.

The use of nystatin showed a marked reduction in both the public and private sector. On the other hand, the use of clotrimazole doubled due to its ease of use. There has been a significant reduction in the utilisation of methylergometrine and ergometrine, which are drugs used in the third stage of labour and in the management of post-partum haemorrhage.[2,3]

Misoprostol is a drug that is licensed for peptic ulcer disease but it has been used "off-label" in Obstetrics and Gynaecology (O&G) practice for cervical priming, termination of pregnancy, induction of labour and postpartum haemorrhage.[4] There has been very little use of this drug in the public sector as it has not been included in the Ministry of Health Drug Formulary. However, its use in the private sector has increased from 0.0016 to 0.0027 DDD/1000 population/day. The data is not sufficient to clarify for which indication it has been used in the private sector. There is a role for considering its use in the medical management of miscarriage as evidenced by current O&G guidelines.

Preterm labour complicates up to 15% of pregnancies.[5] The majority of drugs used in labour suppression are used "off-label". As such the burden of this complication and the drugs used in its management are not captured comprehensively in the NMUS; examples would be nifedipine, salbutamol and terbutaline. The use of the only registered drug for labour suppression, atosiban,[5] was negligible.

Bromocriptine was still the most prevalent prolactin inhibitor used. The use of cabergoline showed a decline in 2007 in both the public and private sectors. However, a reversal in this trend is to be expected in future due to worries of cardiovascular complications and the risk of concurrent use of antihypertensives with bromocriptine.[6]

Hormonal contraceptives for systemic use showed a marked increase in utilisation from 4.4113 to 5.8766 DDD/1000 population/day. This rise was contributed significantly by an increase in the usage of fixed combination progestogens and oestrogens, particularly levonorgestrel and oestrogen as well as drospirenone and oestrogen.

In general, the use of progestogens decreased slightly from 0.8777 to 0.8691 DDD/1000 population/day. However, the usage of etonogestrel declined significantly from 0.4533 to 0.0651 DDD/1000 population/day. This decline was reflected in both public and private sector usage. This may have significant implications in the provision of effective contraception with regards to reduction of maternal mortality in high risk mothers.

The usage of oestrogens more than doubled from 0.2309 to 0.5289 DDD/1000 population/day. This rise was due to an increase in both estradiol as well as conjugated oestrogen. Concerns about the implication of hormone replacement therapy and breast malignancy, may have led to the increased utilisation of tibolone seen in 2007. [7]

The usage of gonadotropins and other ovulation stimulants showed a decline from 0.3619 to 0.3187 DDD/1000 population/day. This reduction is in contrast to the increasing number of centres providing Assisted Reproductive Technology. The majority of such centres are in the private sector and the response rate to the NMUS may have contributed to this apparent decline.

There has been a near doubling in the usage of cyproterone and oestrogens. This may be due to the increased burden of polycystic ovarian syndrome (PCOS).[8]

Certain significant changes in prescribing patterns have been noticed in NMUS 2007 as compared to 2006. The reasons for these are not entirely clear. They may be due to an increasing disease burden, cost of drugs, availability of drugs in public sector prescribing systems, and the development of Clinical Practice Guidelines. Better quality data from the private prescribers is essential for meaningful analysis and trending for future reports.

Table 12.1 : Use of Gynaecologicals, Sex Hormones and Hormonal Contraceptives, in DDD/1000 opulation/day 2006-2007

ATC	Drug Class	2006	2007
G01	Gynaecological anti-infectives and antiseptics	0.2124	0.1976
G02	Other gynecologicals	0.0731	0.0946
G03	Sex hormones and modulators of the genital system	6.3615	8.1348

Table 12.2.1 : Use of Gynaecologicals, Sex Hormones and Hormonal Contraceptives by Drug Class,in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
G01A	Anti-infectives and antiseptics, excl. combinations with corticosteroids	0.2124	0.1976
G01A A	Antibiotics	0.0648	0.0089
G01A C	Quinoline derivatives	-	-
G01A D	Organic acids	-	-
G01A F	Imidazole derivatives	0.1476	0.1885
G01A G	Triazole derivatives	-	-
G01A X	Other anti-infectives and antiseptics	-	0.0001
G02A	Oxytocics	0.0515	0.0408
G02A B	Ergot alkaloids	0.0059	0.0022
G02A D	Prostaglandins	0.0457	0.0386
G02C	Other gynaecologicals	0.0215	0.0538
G02C A	Sympathomimetics, labour repressants	-	<0.0001
G02C B	Prolactine inhibitors	0.0215	0.0537
G02C X	Other gynaecologicals	<0.0001	<0.0001
G03A	Hormonal contraceptives for systemic use	4.4113	5.8766
G03A A	Progestogens and oestrogens, fixed combinations	2.6072	4.4199
G03A B	Progestogens and oestrogens, sequential preparations	0.0388	0.0611
G03A C	Progestogens	1.7654	1.3956
G03B	Androgens	0.0267	0.0266
G03B A	3-oxoandrosten (4) derivatives	0.0245	0.0262
G03B B	5-androstanon (3) derivatives	0.0022	0.0005
G03C	Oestrogens	0.2309	0.5289
G03C A	Natural and semisynthetic oestrogens, plain	0.1336	0.4245
G03C B	Synthetic oestrogens, plain	-	-
G03C X	Other oestrogens	0.0973	0.1045
G03D	Progestogens	0.8777	0.8691
G03D A	Pregnen (4) derivatives	0.3673	0.3689
G03D B	Pregnadien derivatives	0.1996	0.1913
G03D C	Estren derivatives	0.3108	0.3089
G03F	Progestogens and oestrogens in combination	0.2108	0.2268
G03F A	Progestogens and oestrogens, fixed combinations	0.0754	0.0544
G03F B	Progestogens and oestrogens, sequential preparations	0.1354	0.1725
G03G	Gonadotropins and other ovulation stimulants	0.3619	0.3187
G03G A	Gonadotropins	0.0342	0.0211
G03G B	Ovulation stimulants, synthetic	0.3277	0.2976
G03H	Antiandrogens	0.0878	0.1421
G03H A	Antiandrogens, plain	0.0130	0.0081
G03H B	Antiandrogens and oestrogens	0.0748	0.1339
G03X	Other sex hormones and modulators of the genital system	0.1544	0.1460
G03X A	Antigonadotropins and similar agents	0.0251	0.0183
G03X C	Selective oestrogen receptor modulators	0.1293	0.1277

Table 12.2.2 : Use of Gynaecologicals, Sex Hormones & Hormonal Contraceptives by Drug Class & Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
G01A A	**Antibiotics**			
G01A A01	Nystatin	Public	0.0596	0.0051
		Private	0.0040	0.0038
		Total	0.0636	0.0089
G01A A03	Amphotericin B	Public	-	-
		Private	0.0012	<0.0001
		Total	0.0012	<0.0001
G01A A10	Clindamycin	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
G01A C	**Quinoline derivatives**			
G01A C03	Chlorquinaldol	Public	-	-
		Private	-	-
		Total	-	-
G01A D	**Organic acids**			
G01A D03	Ascorbic acid	Public	-	-
		Private	-	-
		Total	-	-
G01A F	**Imidazole derivatives**			
G01A F01	Metronidazole	Public	0.0539	-
		Private	0.0003	<0.0001
		Total	0.0543	<0.0001
G01A F02	Clotrimazole	Public	0.0216	0.0716
		Private	0.0585	0.1031
		Total	0.0801	0.1747
G01A F04	Miconazole	Public	-	-
		Private	0.0035	0.0059
		Total	0.0035	0.0059
G01A F05	Econazole	Public	-	-
		Private	0.0069	0.0064
		Total	0.0069	0.0064
G01A F07	Isoconazole	Public	-	-
		Private	-	-
		Total	-	-
G01A F08	Tioconazole	Public	-	<0.0001
		Private	0.0024	0.0014
		Total	0.0024	0.0015
G01A F11	Ketoconazole	Public	-	-
		Private	0.0004	-
		Total	0.0004	-
G01A F15	Butoconazole	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
G01A G	**Triazole derivatives**			
G01A G02	Terconazole	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
G01A X	**Other antiinfectives and antiseptics**			
G01A X03	Policresulen	Public	-	<0.0001
		Private	-	<0.0001
		Total	-	0.0001
G01A X05	Nifuratel	Public	-	-
		Private	-	-
		Total	-	-
G01A X11	Povidone-iodine	Public	-	-
		Private	-	-
		Total	-	-
G02A B	**Ergot alkaloids**			
G02A B01	Methylergometrine	Public	-	-
		Private	0.0025	0.0015
		Total	0.0025	0.0015
G02A B03	Ergometrine	Public	0.0030	0.0007
		Private	0.0004	<0.0001
		Total	0.0034	0.0008
G02A D	**Prostaglandins**			
G02A D02	Dinoprostone	Public	0.0391	0.0337
		Private	0.0050	0.0035
		Total	0.0441	0.0372
G02A D03	Gemeprost	Public	0.0014	0.0012
		Private	0.0001	<0.0001
		Total	0.0015	0.0013
G02A D04	Carboprost	Public	<0.0001	<0.0001
		Private	-	<0.0001
		Total	<0.0001	<0.0001
G02A D05	Sulprostone	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
G02A D06	Misoprostol	Public	<0.0001	<0.0001
		Private	0.0016	0.0027
		Total	0.0016	0.0028
G02C A	**Sympathomimetics, labour repressants**			
G02C A01	Ritodrine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
G02C B	**Prolactine inhibitors**			
G02C B01	Bromocriptine	Public	0.0019	0.0444
		Private	0.0155	0.0058
		Total	0.0173	0.0502
G02C B02	Lisuride	Public	-	-
		Private	-	-
		Total	-	-
G02C B03	Cabergoline	Public	0.0024	0.0020
		Private	0.0018	0.0014
		Total	0.0042	0.0035

ATC	Drug Class and Agents	Sector	2006	2007
G02C X	**Other gynaecologicals**			
G02C X01	Atosiban	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G03A A	**Progestogens and oestrogens, fixed combinations**			
G03A A07	Levonorgestrel and oestrogen	Public	0.8155	1.3678
		Private	0.6838	1.2585
		Total	1.4993	2.6263
G03A A09	Desogestrel and oestrogen	Public	0.3506	0.4085
		Private	0.5492	0.7718
		Total	0.8998	1.1802
G03A A10	Gestodene and oestrogen	Public	0.0002	0.0002
		Private	0.1087	0.3519
		Total	0.1088	0.3522
G03A A12	Drospirenone and oestrogen	Public	0.0043	0.0035
		Private	0.0949	0.2577
		Total	0.0992	0.2612
G03A B	**Progestogens and oestrogens, sequential preparations**			
G03A B03	Levonorgestrel and oestrogen	Public	-	-
		Private	0.0388	0.0611
		Total	0.0388	0.0611
G03A C	**Progestogens**			
G03A C01	Norethisterone	Public	0.1393	0.1271
		Private	0.2283	0.3753
		Total	0.3676	0.5025
G03A C06	Medroxyprogesterone	Public	0.1516	0.1240
		Private	0.7930	0.7041
		Total	0.9445	0.8281
G03A C08	Etonogestrel	Public	0.0785	0.0126
		Private	0.3748	0.0525
		Total	0.4533	0.0651
G03B A	**3-oxoandrosten (4) derivatives**			
G03B A03	Testosterone	Public	0.0112	0.0112
		Private	0.0133	0.0150
		Total	0.0245	0.0262
G03B B	**5-androstanon (3) derivatives**			
G03B B01	Mesterolone	Public	-	-
		Private	0.0022	0.0005
		Total	0.0022	0.0005
G03C A	**Natural and semisynthetic oestrogens, plain**			
G03C A01	Ethinyloestradiol	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
G03C A03	Oestradiol	Public	0.0323	0.0453
		Private	0.0406	0.0701
		Total	0.0729	0.1154
G03C A04	Oestriol	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
G03C A	**Natural and semisynthetic oestrogens, plain**			
G03C A06	Chlorotrianisene	Public	-	-
		Private	-	-
		Total	-	-
G03C A07	Oestrone	Public	-	-
		Private	-	-
		Total	-	-
G03C A57	Conjugated oestrogens	Public	0.0466	0.1844
		Private	0.0141	0.1247
		Total	0.0607	0.3090
G03C B	**Synthetic oestrogens, plain**			
G03C B01	Dienestrol	Public	-	-
		Private	-	-
		Total	-	-
G03C B02	Diethylstilbestrol	Public	-	-
		Private	-	-
		Total	-	-
G03C X	**Other oestrogens**			
G03C X01	Tibolone	Public	0.0470	0.0482
		Private	0.0503	0.0563
		Total	0.0973	0.1045
G03D A	**Pregnen (4) derivatives**			
G03D A01	Gestonorone	Public	-	-
		Private	-	-
		Total	-	-
G03D A02	Medroxyprogesterone	Public	0.3014	0.3087
		Private	0.0400	0.0228
		Total	0.3414	0.3314
G03D A03	Hydroxyprogesterone	Public	0.0005	0.0004
		Private	0.0153	0.0335
		Total	0.0159	0.0339
G03D A04	Progesterone	Public	0.0002	0.0001
		Private	0.0099	0.0035
		Total	0.0101	0.0036
G03D B	**Pregnadien derivatives**			
G03D B01	Dydrogesterone	Public	0.1031	0.1076
		Private	0.0965	0.0689
		Total	0.1996	0.1765
G03D B02	Megestrol	Public	-	-
		Private	-	0.0148
		Total	-	0.0148
G03D C	**Estren derivatives**			
G03D C01	Allylestrenol	Public	-	-
		Private	0.0070	0.0116
		Total	0.0070	0.0116
G03D C02	Norethisterone	Public	0.0223	0.0151
		Private	0.2815	0.2823
		Total	0.3038	0.2974
G03D C03	Lynestrenol	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
G03F A	**Progestogens and oestrogens, fixed combinations**			
G03F A01	Norethisterone and oestrogen	Public	0.0135	0.0066
		Private	0.0203	0.0078
		Total	0.0339	0.0144
G03F A12	Medroxyprogesterone and oestrogen	Public	0.0279	0.0348
		Private	0.0023	0.0007
		Total	0.0302	0.0355
G03F A14	Dydrogesterone and oestrogen	Public	0.0032	0.0025
		Private	0.0082	0.0018
		Total	0.0113	0.0044
G03F B	**Progestogens and oestrogens, sequential preparations**			
G03F B01	Norgestrel and oestrogen	Public	0.0709	0.0798
		Private	0.0155	0.0394
		Total	0.0864	0.1192
G03F B05	Norethisterone and oestrogen	Public	<0.0001	-
		Private	0.0014	0.0069
		Total	0.0014	0.0069
G03F B06	Medroxyprogesterone and oestrogen	Public	0.0240	0.0016
		Private	0.0007	0.0037
		Total	0.0247	0.0053
G03F B07	Medrogestone and oestrogen	Public	0.0006	-
		Private	-	-
		Total	0.0006	-
G03F B08	Dydrogesterone and oestrogen	Public	0.0081	0.0202
		Private	0.0142	0.0209
		Total	0.0223	0.0410
G03G A	**Gonadotropins**			
G03G A01	Chorionic gonadotrophin	Public	0.0122	0.0131
		Private	0.0183	0.0048
		Total	0.0305	0.0179
G03G A02	Human menopausal gonadotrophin	Public	-	-
		Private	0.0003	0.0001
		Total	0.0003	0.0001
G03G A04	Urofollitropin	Public	-	-
		Private	-	0.0001
		Total	-	0.0001
G03G A05	Follitropin alfa	Public	0.0009	0.0010
		Private	0.0008	0.0004
		Total	0.0018	0.0014
G03G A06	Follitropin beta	Public	0.0007	0.0011
		Private	0.0009	0.0004
		Total	0.0016	0.0015
G03G A07	Lutropin alfa	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G03G A08	Choriogonadotropin alfa	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

ATC	Drug Class and Agents	Sector	2006	2007
G03G B	**Ovulation stimulants, synthetic**			
G03G B02	Clomifene	Public	0.1178	0.1141
		Private	0.2098	0.1836
		Total	0.3277	0.2976
G03H A	**Antiandrogens, plain**			
G03H A01	Cyproterone	Public	0.0111	0.0061
		Private	0.0019	0.0020
		Total	0.0130	0.0081
G03H B	**Antiandrogens and oestrogens**			
G03H B01	Cyproterone and oestrogen	Public	0.0110	0.0268
		Private	0.0638	0.1072
		Total	0.0748	0.1339
G03X A	**Antigonadotropins and similar agents**			
G03X A01	Danazol	Public	0.0156	0.0112
		Private	0.0080	0.0046
		Total	0.0237	0.0158
G03X A02	Gestrinone	Public	0.0012	0.0005
		Private	0.0003	0.0020
		Total	0.0014	0.0025
G03X C	**Selective oestrogen receptor modulators**			
G03X C01	Raloxifene	Public	0.0646	0.0638
		Private	0.0647	0.0639
		Total	0.1293	0.1277

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CHAPTER 13 | USE OF UROLOGICALS

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Drugs used in urology can be divided into the following categories:

Drugs used in overactive bladder

Tolterodine, oxybutinin, propiverine, solifenacin and trospium are recommended for use in overactive bladder.[1-3] The usage of oxybutinin has decreased in both public and private sector due to increasing use of tolterodine as it is better tolerated by patients. Our use of tolterodine is comparable to Australia (0.0615 vs 0.062 DDD/1000 population/day). Propiverine is being used in private only. However its usage can be expected to rise in the public sector once it becomes available.

Flavoxate, the oldest drug in the group is prescribed with increasing trend especially in the private sector (especially by non-specialists). However, this is not recommended in the European Urology Guidelines due to its questionable efficacy and has only level 2 evidence for its use.

Drugs used in erectile dysfunction

Sildenafil, tadalafil and vardenafil are the three selective phosphodiesterase type-5 (PDE5) inhibitors used in the treatment of erectile dysfunction. As sildenafil had been launched since 1998, its usage prevails over tadalafil and vardenafil, which were both launched in 2003.[1]

PDE5 inhibitors are more commonly prescribed in the private sector. This is probably because the drugs are not available in public pharmacies. Among the three, sildenafil is still the most popular in both private and public sectors; this is probably because it was the first PDE5 inhibitor available in Malaysia. Tadalafil is second probably because it is longer acting (duration 36 hrs) compared to vardenafil (duration 5 hours).

There has been a decrease in usage of all three drugs in both private and public sectors and this could be due to its high cost. Sildenafil usage is much lower compared to Australia (0.0525 vs 0.458 DDD/1000 population/day). Patients may be turning to cheaper alternatives such as traditional treatment or counterfeit drugs.

Alprostadil is the first and only drug approved for intracavernosal injection for erectile dysfunction treatment.[4,5] It is the second-line treatment.[1] This treatment is not popular with Malaysians as it is invasive, requiring patient to do own self injection and this explains its low usage in both private and public sectors.

Alpha-adrenoceptor antagonists

The first-line treatment for lower urinary tract symptoms (LUTS) is the α1-blockers.[1] All alpha 1 blockers have similar efficacy[6] and only vary in their side effect profile. The most frequent side effects of α-blockers are asthenia, dizziness and (orthostatic) hypotension.

There is an increase usage of all alpha blockers probably because of increase in number of patients. Alfuzosin XL and doxazosin XL are becoming more popular since dose titration is not required. However, our usage of terazosin is still high and is much higher than in Australia.

5-alpha reductase inhibitors

The two 5-alpha reductase inhibitors used are finasteride (5α-reductase type 2 inhibitor) and dutasteride (5α-reductase types 1 and 2 inhibitor). Both drugs show similar potency. However, dutasteride has a longer elimination half-life (3-5 weeks).[1] As finasteride has been longer in the market, its usage is higher than dutasteride, which was only recently launched into the market. The usage of finasteride in Malaysia is higher compared to Australia (0.2682 vs 0.218 DDD/ 1000 population/day).

Gonadotropin releasing hormone analogues

Long-acting Luteinizing Hormone-Releasing Hormone (LHRH) agonists (buserelin, goserelin, leuprorelin and triptorelin) are used in the treatment of advanced prostate cancer and are currently the main forms of androgen deprivation treatment (ADT).[7, 8]

Leuprorelin and goserelin are the most popular. Its usage has increased due to increasing number of advanced prostate cancer patients. Usage is also more in public sector as this is expensive treatment and more cancer patients are seen in the public sector. Our usage is much lower than that in Australia due to the higher incidence of prostate cancer there.

Antiandrogens

The antiandrogens are indicated for advanced prostate cancer. Cyproterone (steroidal) is the oldest drug;[1] its usage has decreased since the introduction of non-steroidal antiandrogens especially bicalutamide.

Testosterone

Testosterone replacement therapy is a well-tolerated and established treatment for hypogonadism.[1] Route is via short and long acting injections, patch, gel and implants. Men's health is now increasingly being emphasised. There has been a rise in Men's Health Clinics and partial androgen deficiency is now more commonly diagnosed as part of the metabolic syndrome and is also seen in the ageing male. Our overall usage of testosterone is much lower than that in Australia.

BCG Vaccine

BCG vaccine is administered intravesically for high risk urothelial bladder cancer. Its usage has decreased more in private compared to fairly stable usage in public.

Table 13.1 : Use of Urologicals, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
G04	Urologicals	0.7256	1.0800

Table 13.2.1 : Use of Urologicals by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
G04B	Other urologicals, incl. antispasmodics	0.2019	0.1427
G04C	Drugs used in benign prostatic hypertrophy	0.5238	0.9373

Table 13.2.2: Use of by Urologicals Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
G04B A	**Acidifiers**			
G04B A01	Ammonium chloride	Public	-	-
		Private	-	-
		Total	-	-
G04B D	**Urinary antispasmodics**			
G04B D02	Flavoxate	Public	0.0002	0.0006
		Private	0.0150	0.0151
		Total	0.0151	0.0157
G04B D04	Oxybutynin	Public	0.0029	0.0007
		Private	0.0003	0.0001
		Total	0.0032	0.0008
G04B D05	Terodiline	Public	-	-
		Private	-	-
		Total	-	-
G04B D06	Propiverine	Public	-	-
		Private	-	0.0008
		Total	-	0.0008
G04B D07	Tolterodine	Public	0.0159	0.0362
		Private	0.0060	0.0253
		Total	0.0219	0.0615
G04B D09	Trospium	Public	-	-
		Private	-	-
		Total	-	-
G04B D11	Fesoterodine	Public	-	-
		Private	-	-
		Total	-	-
G04B E	**Drugs used in erectile dysfunction**			
G04B E01	Alprostadil	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G04B E03	Sildenafil	Public	0.0010	0.0007
		Private	0.1174	0.0518
		Total	0.1184	0.0525
G04B E04	Yohimbin	Public	-	-
		Private	-	-
		Total	-	-
G04B E05	Phentolamine	Public	-	-
		Private	-	-
		Total	-	-
G04B E08	Tadalafil	Public	0.0023	0.0003
		Private	0.0364	0.0068
		Total	0.0387	0.0070
G04B E09	Vardenafil	Public	0.0001	0.0001
		Private	0.0044	0.0043
		Total	0.0045	0.0044
G04B X	**Other urologicals**			
G04B X03	Acetohydroxamic acid	Public	-	-
		Private	-	-
		Total	-	-
G04C A	**Alpha-adrenoreceptor antagonists**			
G04C A01	Alfuzosin	Public	0.0486	0.1535
		Private	0.0512	0.0851
		Total	0.0998	0.2386
G04C A03	Terazosin	Public	0.2901	0.3098
		Private	0.0700	0.0607
		Total	0.3602	0.3705
C02C A04	Doxazosin	Public	0.1764	0.3525
		Private	0.0628	0.0585
		Total	0.2393	0.4110

ATC	Drug Class and Agents	Sector	2006	2007
G04C B	**Testosterone-5-alpha reductase inhibitors**			
G04C B01	Finasteride	Public	0.0300	0.2464
		Private	0.0039	0.0218
		Total	0.0339	0.2682
G04C B02	Dutasteride	Public	0.0151	0.0344
		Private	0.0148	0.0255
		Total	0.0299	0.0600
G03B A	**3-oxoandrosten (4) derivatives**			
G03B A03	Testosterone	Public	0.0112	0.0112
		Private	0.0133	0.0150
		Total	0.0245	0.0262
L02A E	**Gonadotropin releasing hormone analogues**			
L02A E01	Buserelin	Public	<0.0001	-
		Private	<0.0001	0.0002
		Total	<0.0001	0.0002
L02A E02	Leuprorelin	Public	0.0019	0.0114
		Private	0.0069	0.0076
		Total	0.0088	0.0191
L02A E03	Goserelin	Public	0.0038	0.0173
		Private	0.0021	0.0131
		Total	0.0059	0.0304
L02A E04	Triptorelin	Public	0.0011	0.0010
		Private	0.0003	0.0003
		Total	0.0015	0.0014
L02B B	**Anti-androgens**			
L02B B01	Flutamide	Public	0.0018	0.0023
		Private	0.0007	0.0008
		Total	0.0025	0.003
L02B B03	Bicalutamide	Public	0.0053	0.0094
		Private	0.0010	0.0037
		Total	0.0063	0.0131
G03H A	**Antiandrogens, plain**			
G03H A01	Cyproterone	Public	0.0111	0.0061
		Private	0.0019	0.0020
		Total	0.0130	0.0081
L03A X	**Other immunostimulants**			
L03A X03	BCG vaccine	Public	0.0009	0.0007
		Private	0.0016	0.0008
		Total	0.0025	0.0015

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CHAPTER 14 | USE OF DRUGS FOR ENDOCRINE DISORDERS

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In Malaysia, the total consumption for endocrine-related drugs for 2007 increased only by 0.8% when compared to 2006 (2.113 to 2.130 DDD/1000 populations/day).[1] The most utilised endocrine drugs were thyroid-related drugs (94.4%), followed by pituitary-hypothalamic hormones and analogues (4.9%), and drugs for calcium homeostasis (0.6%). In comparison, there was much higher utilisation of endocrine-related drugs in Australia for 2007 at a level of 18.9 DDD/1000 population/day, with thyroid-related drugs (94.2%) being most commonly used, followed by pituitary-hypothalamic hormones and analogues (5.8%) and drugs for calcium homeostasis (0.001%).[2]

Thyroid therapy consisted of drugs utilised for hypothyroidism and hyperthyroidism. Treatment of hypothyroidism was almost entirely with levothyroxine (T4) sodium (99.99%) at 0.97 DDD/1000 population/day. This was markedly lower compared to Australia (16.94 DDD/1000 population/day).[2] Liothyronine (T3) sodium was hardly used in Malaysia. Similarly, its use in Australia was minimal (0.05 DDD/1000 population/day). Thyroid hormone consumption with levothyroxine sodium was more than 10-fold higher in Australia compared to Malaysia, suggesting a higher prevalence of hypothyroidism, possibly related to better screening, diagnosis and treatment among the elderly population, as well as higher utilisation of radioactive iodine treatment.[2]

In 2007, the consumption of antithyroid preparations for hyperthyroidism was higher in Malaysia (1.05 DDD/1000 population/day) as compared to Australia (0.83 DDD/1000 population/day).[2] The most utilised antithyroid preparation in Malaysia was carbimazole (82.8%), followed by propylthiouracil (17.2%), which may reflect the preference for the more convenient once-daily dosing of carbimazole. The higher antithyroid drug utilisation in Malaysia is probably related to a preference for drugs as the first-line therapy in hyperthyroidism, often continued over the long-term as radioactive iodine facilities for treatment of hyperthyroidism are currently still limited and usually placed as second-line therapy.

Drug utilisation of pituitary-hypothalamic hormones and analogues were generally low in Malaysia at 0.11 DDD/1000 population/day and similarly in Australia at 0.32 DDD/1000 population/day.[2] This may be due to the low prevalence or low detection rate of neuro-endocrine disorders. This may also reflect under-reporting of drug utilisation of pituitary-hypothalamic hormones and analogues in view of increasing number of patients over the years.

Consumption of drugs for calcium homeostasis was low in Malaysia at 0.014 DDD/1000 population/day, compared to Australia at 0.001 DDD/1000 population/day.[2] The Malaysian 2007 figure, however, was more than double of that in 2006 (0.006 DDD/1000 population/day).[1] This is mainly due to an almost 5-fold increase in the use of teriparatide (0.0028 versus 0.0006 DDD/1000 population/day)[1] by the private sectors since the launching of the drug in Malaysia in 2006. There was no data on teriparatide use in Australia.

There was a 40% increase in the use of calcitonin preparations (0.0081 DDD/1000 population/day) in 2007 versus 0.0058 DDD/1000 population/day in 2006.[1] This increase occurred predominantly in the public hospitals in Malaysia. The use of calcitonin in Australia was much lower (0.001 DDD/1000 population/day).[2]

In conclusion, although the overall consumption of endocrine related drugs has increased, these figures may still not accurately reflect the actual usage of drugs as these data rely heavily on public and private sectors purchasing reports. Furthermore, the common practice of purchasing medicines at the end of the year may affect the statistics of drug utilisation in the following year.

Table 14.1 : Use of Drug for Endocrine Disorders, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
H01	Pituitary and hypothalamic hormones and analogues	0.1131	0.1051
H03	Thyroid therapy	1.9934	2.0112
H04	Pancreatic hormones	<0.0001	0.0001
H05	Calcium homeostasis	0.0064	0.0136

Table 14.2 : Use of Pituitary and Hypothalamic Hormones and Analogues by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
H01A	Anterior pituitary lobe hormones and analogues	0.0090	0.0018
H01A A	Adrenocorticotropic hormone (ACTH)	0.0045	0.0001
H01A B	Thyrotropin	<0.0001	-
H01A C	Somatropin and somatropin agonists	0.0045	0.0017
H01B	Posterior pituitary lobe hormones	0.1028	0.1022
H01B A	Vasopressin and analogues	0.0191	0.0234
H01B B	Oxytocin and analogues	0.0837	0.0788
H01C	Hypothalamic hormones	0.0012	0.0011
H01C A	Gonadotropin-releasing hormones	-	-
H01C B	Antigrowth hormone	0.0012	0.0010
H01C C	Antigonadotropin-releasing hormones	<0.0001	<0.0001

Table 14.3.1 : Use of Thyroid Therapy by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
H03A	Thyroid preparations	0.9338	0.9656
H03A A	Thyroid hormones	0.9338	0.9656
H03B	Antithyroid preparations	1.0596	1.0454
H03B A	Thiouracils	0.1661	0.1798
H03B B	Sulfur-containing imidazole derivatives	0.8935	0.8656
H03C	Iodine therapy	-	0.0002
H03C A	Iodine therapy	-	0.0002

Table 14.3.2 : Use of Thyroid Therapy by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
H03A A	**Thyroid hormones**			
H03A A01	Levothyroxine sodium	Public	0.7504	0.7675
		Private	0.1834	0.1981
		Total	0.9338	0.9656
H03A A02	Liothyronine sodium	Public	<0.0001	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
H03B A	**Thiouracils**			
H03B A01	Methylthiouracil	Public	-	-
		Private	-	-
		Total	-	-
H03B A02	Propylthiouracil	Public	0.0877	0.1145
		Private	0.0784	0.0653
		Total	0.1661	0.1798

ATC	Drug Class and Agents	Sector	2006	2007
H03B B	**Sulfur-containing imidazole derivatives**			
H03B B01	Carbimazole	Public	0.6110	0.6010
		Private	0.2825	0.2645
		Total	0.8935	0.8655
H03B B02	Thiamazole	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
H03C A	**Iodine therapy**			
H03C AXX	Iodine therapy	Public	-	-
		Private	-	0.0002
		Total	-	0.0002

Table 14.4.1 : Use of Pancreatic Hormones by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
H05A	Parathyroid hormones and analogues	0.0006	0.0028
H05A A	Parathyroid hormones and analogues	0.0006	0.0028
H05B	Antiparathyroid agents	0.0058	0.0108
H05B A	Calcitonin preparations	0.0058	0.0081
H05B X	Other antiparathyroid agents	-	0.0027

Table 14.4.2 : Use of Pancreatic Hormones by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
H05A A	**Parathyroid hormones and analogues**			
H05A A02	Teriparatide	Public	<0.0001	-
		Private	0.0005	0.0028
		Total	0.0006	0.0028
H05A A03	Parathyroid hormone	Public	-	-
		Private	-	-
		Total	-	-
H05B A	**Calcitonin preparations**			
H05B A01	Calcitonin (salmon synthetic)	Public	0.0044	0.0056
		Private	0.0013	0.0025
		Total	0.0058	0.0081
H05B X	**Other antiparathyroid agents**			
H05B X01	Cinacalcet	Public	-	-
		Private	-	-
		Total	-	-
H05B X02	Paricalcitol	Public	-	0.0012
		Private	-	0.0015
		Total	-	0.0027

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CHAPTER 15 | USE OF ANTI-INFECTIVES

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Anti-infectives consumption in Malaysia has shown an increase of 7% from 2006 to 2007. Of these, antibacterials for systemic use contributed the largest increase, accounting for 89% of total increment. This is not surprising as antibacterials (124 drugs) formed the largest group of anti-infectives, followed by the antivirals (29 drugs), antimycobacterials (15 drugs), antimalarials (13 drugs) and lastly, the antimycotics (9 drugs). There are currently few projects carried out in other countries that report national use of anti-infectives. Of notable interest is the European Surveillance of Antimicrobial Consumption (ESAC),[1] which has 31 participating countries, with consumption data ranging from year 2001 till to date. When compared with ESAC, our national usage of anti-infectives would be at the lower end of the spectrum similar to a country like Austria. The largest class of antibacterials used in 2007 was penicillins, followed by macrolides, tetracyclines and other beta lactam antibacterials, respectively. This was also reflected in the pattern of consumption in other European countries. Prominent increment year on year was mainly with penicillins (+0.71 DDD/population/day) followed by quinolones (+0.14) and other beta lactams (+0.10). The most widely used single antimicrobial was amoxycillin.

Among the penicillins, ampicillin, amoxicillin and bacampicillin were the most widely used drugs in both public and private sectors; likely as empirical therapy for upper respiratory tract infection (upper RTI), urinary tract infection (UTI) and mild community acquired pneumonia. However, our National Antimicrobial Resistance Surveillance data in 2007 showed high resistance of gram-negative bacteria such as *Klebsiella* spp. (99%), *Enterobacter* spp. (93%), *Escherichia coli* (69%), *Proteus* spp. (48%) and *Haemophilus influenzae* (20%)[2] to ampicillin. Thus the use of these antibiotics as empirical therapy in the primary healthcare setting may need to be reviewed. Further clinical and laboratory based surveillance data for community acquired pneumonia and UTI would prove informative. Ampicillin/sulbactam and amoxicillin/clavulanate were the most commonly used penicillin with beta-lactamase inhibitor in both public and private sectors. Usage of amoxycillin/clavulanate in the private sector was 5 times higher compared to the public sector. Restricted policy on prescribing these drugs in MOH hospitals could have resulted in this pattern. Conversely, ampicillin/sulbactam was used 4 times more in the public sector. Its predominant usage is in surgical prophylaxis, treatment of diabetic foot ulcers and the increased prevalence of multiresistant *Acinetobacter baumannii* isolates in MOH hospitals.

Cephalosporins constituted 10.8% of total antibacterial use. In 2007, increase usage of cefuroxime, ceftriaxone and cefepime was seen in the public sector as compared to 2006 data. Ceftriaxone was the most widely prescribed third-generation cephalosporins (3rd GCS) in 2007. The marked increase (44%) in the use of ceftriaxone will raise concern as Extended Spectrum Beta-Lactamase (ESBL) rates and carbapenem resistance in *Acinetobacter* [3] have been linked with the usage of 3rd GCS.[4,5]

Carbapenems constituted 0.22% of total antibacterial used in 2007. 70% increase was noted in the use of meropenem in 2007 as compared to 2006. The use of meropenem was 1.6 times higher compared to imipenem. The primary use of carbapenems for empirical therapy of nosocomial infections especially in critically ill patients is supported by various opinion leaders mainly due to the good clinical efficacy and favourable safety profiles.[3] However, to maintain efficacy of this antibiotic, it should be used judiciously. By implementing a stewardship programme, empirical usage of broad spectrum can be de-escalated when susceptibility results are available in order to prevent the emergence of resistance.[6]

The second largest class of antibacterials was the macrolides, lincosamides and streptogramins class. This ranking mirrors that of most European countries. The greatest consumption was for erythromycin. Clarithromycin and azithromycin usage in the private sector dwarfed that of the public sector by 4-8 times and is thought to be used mainly for RTIs and Sexually Transmitted Diseases (STD).

Compared to 2006, fluoroquinoles as a group had the second highest increase in the antibiotic class after penicillins, both in the private as well as public spheres. The highest contributor was ciprofloxacin. Usage across the board for all fluoroquinolones was many times higher in private sector.

This is likely to be because fluoroquinolones are available in oral formulation, are easily tolerable, have minimal side effects and have good efficacy across a wide spectrum of infections like RTIs, gastrointestinal infections, STDs and UTIs which would account for the bulk of community acquired infections that would present to the private sector. It is important to note however that usage of fluoroquinolones has been shown in numerous clinical papers to be associated with an increase in resistance among bacteria, not only to fluoroquinolones but also other resistance mechanisms that include methicillin-resistant *Staphylococcus aureus* (MRSA) and ESBL.[7,8] Increase in fluoroquinolone resistance is especially marked among gram negative infections.[9] Certain hospitals and even countries abroad have now introduced formulary restrictions for access to fluoroquinolones.

Antibacterials for multiresistant organisms like those in the glycopeptide (vancomycin, teicoplanin) and polymyxins (colistin, polymyxin B) group did not show any change in the trends from 2006 to 2007. Aminoglycoside usage has also remained fairly static over the 2 years. Usage of these drugs has been predominantly in the public hospital. Fusidic acid usage has increased in both public and private sectors, causing an increase of 61% in 2007 when compared to 2006. According to more recent antimicrobial resistance data for 2008[2] there is now a marked increase in resistance of MRSA to fusidic acid. This antibiotic should be used with care and always in combination with other antistaphylococcal antibiotics. Usage of topical agents against methicillin-sensitive *Staphylococcus aureus* (MSSA) skin infections ought to be discouraged.

As a drug class, there was no significant change in the prescriptions of antimycobacterials. A marked increase in the prescriptions of antimalarials was fuelled by increase in usage of hydroxychloroquine. This drug is now hardly used as an anti-infective agent and has found its main use as a disease modifying agent in rheumatology and dermatology, which we suspect explains the recent increase in consumption.

Antimycotics for systemic use had an increase by 30%, mainly due to ketoconazole and fluconazole. This was especially marked in the private sector where usage had increased by almost 50%. It would be useful to have data on the indications for which these agents were used in view of recent increases in rates of fluconazole resistant candida reported worldwide.[10]

Antiviral agents as a whole have increased over the 2 years. This increase is largely contributed by Anti-Human Immunodeficiency Virus (anti-HIV) medications for which the combined usage of zidovudine and stavudine (which represent the backbone of first line HAART regimes) has doubled from 2006 to 2007. There was also a notable swing in the non-nucleoside reverse transcriptase inhibitor class where efavirenz prescriptions had increased 4 fold and nevirapine had dropped marginally when 2007 data was compared to 2006. In view that both drugs are equally efficacious, it would be worthwhile re-looking into prescription patterns of Human Immunodeficiency Virus (HIV) physicians in the country.[11]

In conclusion, a concerted effort is required to merge resistance data with the antibiotic consumption, to enable a more meaningful approach in promoting judicious use of antimicrobials. Available data on antimicrobial resistance is already at hand in the public sector,[12] with ongoing awareness of antimicrobial stewardship programmes being implemented in a number of public hospitals. These programmes and resistance data are, however, lacking in the private sectors, which in our opinion should be dealt with in a prompt manner to curb problems with rising antimicrobial resistance. Further data on the prevalence of specific infections (e.g. community-acquired pneumonia, urinary tract infections etc.) would allow for further plans in evaluating the appropriateness of anti-infective usage.

Table 15.1 : Use of Anti-infectives, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class	DDD/ 1000 population/day		DDD/population/year	
		2006	2007	2006	2007
J01	Antibacterials for systemic use	8.9383	9.6494	3.2625	3.5220
J02	Antimycotics for systemic use	0.3253	0.4246	0.1187	0.1550
J04	Antimycobacterials	1.1015	0.9590	0.4021	0.3500
J05	Antivirals for systemic use	0.4900	0.6358	0.1789	0.2321
P01B	Antimalarials	0.0794	0.1405	0.0290	0.0513

Table 15.2.1 : Use of Antibacterials by Drug Class, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class	DDD/ 1000 population/day		DDD/population/year	
		2006	2007	2006	2007
J01A	Tetracyclines	1.1033	1.0726	0.4027	0.3915
J01B	Amphe nicols	0.0045	0.0033	0.0017	0.0012
J01C	Beta-lactam antibacterials, penicillins	4.2081	4.9936	1.5359	1.8227
J01D	Other beta-lactam antibacterials	0.9587	1.0601	0.3499	0.3870
J01E	Sulfonamides and trimethoprim	0.7663	0.4978	0.2797	0.1817
J01F	Macrolides, lincosamides and streptogramins	1.3874	1.3638	0.5064	0.4978
J01G	Aminoglycoside antibacterials	0.0460	0.0427	0.0168	0.0156
J01M	Quinolone antibacterials	0.3877	0.5266	0.1415	0.1922
J01X	Other antibacterials	0.0762	0.0888	0.0278	0.0324

Table 15.2.2 : Use of Antibacterials by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01A A	**Tetracyclines**					
J01A A01	Demeclocycline	Public	-	-	-	-
		Private	-	0.0008	-	0.0003
		Total	-	0.0008	-	0.0003
J01A A02	Doxycycline	Public	0.2688	0.2455	0.0981	0.0896
		Private	0.6529	0.6920	0.2383	0.2526
		Total	0.9217	0.9376	0.3364	0.3422
J01A A06	Oxytetracycline	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001
J01A A07	Tetracycline	Public	0.0585	0.0488	0.0214	0.0178
		Private	0.0885	0.0793	0.0323	0.0290
		Total	0.1470	0.1281	0.0537	0.0468
J01A A08	Minocycline	Public	0.0004	0.0014	0.0001	0.0005
		Private	0.0342	0.0046	0.0125	0.0017
		Total	0.0346	0.0060	0.0126	0.0022
J01A A12	Tigecycline	Public	-	<0.0001	-	<0.0001
		Private	-	0.0001	-	<0.0001
		Total	-	0.0001	-	<0.0001

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01B A	**Amphenicols**					
J01B A01	Chloramphenicol	Public	0.0027	0.0013	0.0010	0.0005
		Private	0.0019	0.0020	0.0007	0.0007
		Total	0.0045	0.0033	0.0017	0.0012
J01B A02	Thiamphenicol	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C A	**Penicillins with extended spectrum**					
J01C A01	Ampicillin	Public	0.0692	0.0654	0.0252	0.0239
		Private	0.0565	0.0815	0.0206	0.0297
		Total	0.1257	0.1469	0.0459	0.0536
J01C A03	Carbenicillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C A04	Amoxicillin	Public	0.6980	0.7373	0.2548	0.2691
		Private	1.4019	1.7944	0.5117	0.6549
		Total	2.0999	2.5317	0.7665	0.9241
J01C A06	Bacampicillin	Public	0.2145	0.1991	0.0783	0.0727
		Private	0.0648	0.0863	0.0237	0.0315
		Total	0.2793	0.2854	0.1020	0.1042
J01C A07	Epicillin	Public	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
J01C A11	Mecillinam	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C A12	Piperacillin	Public	0.0002	<0.0001	<0.0001	<0.0001
		Private	-	-	-	-
		Total	0.0002	<0.0001	<0.0001	<0.0001
J01C A13	Ticarcillin	Public	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
J01C A14	Metampicillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C A15	Talampicillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C A17	Temocillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C A18	Hetacillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01C E	**Beta-lactamase sensitive penicillins**					
J01C E01	Benzylpenicillin	Public	0.0182	0.0149	0.0067	0.0054
		Private	0.0013	0.0010	0.0005	0.0004
		Total	0.0195	0.0158	0.0071	0.0058
J01C E02	Phenoxymethylpenicillin	Public	0.1706	0.1561	0.0623	0.0570
		Private	0.0173	0.0193	0.0063	0.0070
		Total	0.1880	0.1754	0.0686	0.0640
J01C E04	Azidocillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C E05	Pheneticillin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C E08	Benzathine benzylpenicillin	Public	0.0018	0.0008	0.0007	0.0003
		Private	0.0004	0.0008	0.0001	0.0003
		Total	0.0022	0.0016	0.0008	0.0006
J01C E09	Procaine benzylpenicillin	Public	0.0077	0.0030	0.0028	0.0011
		Private	0.0002	<0.0001	<0.0001	<0.0001
		Total	0.0079	0.0030	0.0029	0.0011
J01C F	**Beta-lactamase resistant penicillins**					
J01C F02	Cloxacillin	Public	0.6363	0.6475	0.2323	0.2363
		Private	0.1638	0.1986	0.0598	0.0725
		Total	0.8002	0.8460	0.2921	0.3088
J01C F04	Oxacillin	Public	-	-	-	-
		Private	-	0.0010	-	0.0004
		Total	-	0.0010	-	0.0004
J01C F05	Flucloxacillin	Public	0.0014	0.0017	0.0005	0.0006
		Private	0.0112	0.0139	0.0041	0.0051
		Total	0.0126	0.0156	0.0046	0.0057
J01C R	**Combinations of penicillins, incl. beta-lactamase inhibitors**					
J01C R01	Ampicillin and enzyme inhibitor	Public	0.0181	0.0260	0.0066	0.0095
		Private	0.0124	0.0066	0.0045	0.0024
		Total	0.0306	0.0326	0.0112	0.0119
J01C R02	Amoxicillin and enzyme inhibitor	Public	0.1484	0.1548	0.0542	0.0565
		Private	0.4491	0.7086	0.1639	0.2587
		Total	0.5974	0.8634	0.2181	0.3152
J01C R03	Ticarcillin and enzyme inhibitor	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C R04	Sultamicillin	Public	0.0113	0.0352	0.0041	0.0129
		Private	0.0289	0.0337	0.0105	0.0123
		Total	0.0402	0.0689	0.0147	0.0251
J01C R05	Piperacillin and enzyme inhibitor	Public	0.0030	0.0048	0.0011	0.0018
		Private	0.0014	0.0014	0.0005	0.0005
		Total	0.0044	0.0063	0.0016	0.0023

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01D B	**First-generation cephalosporins**					
J01D B01	Cefalexin	Public	0.0607	0.0588	0.0222	0.0215
		Private	0.3060	0.3847	0.1117	0.1404
		Total	0.3667	0.4436	0.1339	0.1619
J01D B04	Cefazolin	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0031	0.0026	0.0011	0.0009
		Total	0.0031	0.0026	0.0011	0.0010
J01D B05	Cefadroxil	Public	-	-	-	-
		Private	0.0488	0.0781	0.0178	0.0285
		Total	0.0488	0.0781	0.0178	0.0285
J01D B08	Cefapirin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01D B09	Cefradine	Public	-	-	-	-
		Private	0.0008	0.0010	0.0003	0.0004
		Total	0.0008	0.0010	0.0003	0.0004
J01D C	**Second-generation cephalosporins**					
J01D C02	Cefuroxime	Public	0.1619	0.2025	0.0591	0.0739
		Private	0.2012	0.1638	0.0734	0.0598
		Total	0.3631	0.3663	0.1325	0.1337
J01D C04	Cefaclor	Public	0.0019	0.0013	0.0007	0.0005
		Private	0.0462	0.0392	0.0169	0.0143
		Total	0.0481	0.0405	0.0176	0.0148
J01D C05	Cefotetan	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01D C06	Cefonicide	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01D C07	Cefotiam	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01D C08	Loracarbef	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01D C10	Cefprozil	Public	0.0004	0.0003	0.0001	<0.0001
		Private	0.0135	0.0085	0.0049	0.0031
		Total	0.0140	0.0088	0.0051	0.0032
J01D D	**Third-generation cephalosporins**					
J01D D01	Cefotaxime	Public	0.0040	0.0038	0.0015	0.0014
		Private	0.0005	0.0006	0.0002	0.0002
		Total	0.0046	0.0043	0.0017	0.0016
J01D D02	Ceftazidime	Public	0.0078	0.0078	0.0028	0.0028
		Private	0.0027	0.0020	0.0010	0.0007
		Total	0.0104	0.0098	0.0038	0.0036

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01D D	**Third-generation cephalosporins**					
J01D D04	Ceftriaxone	Public	0.0163	0.0234	0.0059	0.0085
		Private	0.0221	0.0182	0.0081	0.0066
		Total	0.0384	0.0416	0.0140	0.0152
J01D D08	Cefixime	Public	-	-	-	-
		Private	-	0.0026	-	0.0010
		Total	-	0.0026	-	0.0010
J01D D12	Cefoperazone	Public	0.0091	0.0085	0.0033	0.0031
		Private	0.0006	0.0003	0.0002	0.0001
		Total	0.0098	0.0088	0.0036	0.0032
J01D D14	Ceftibuten	Public	-	-	-	-
		Private	0.0134	0.0124	0.0049	0.0045
		Total	0.0134	0.0124	0.0049	0.0045
J01D D62	Cefoperazone, combinations	Public	-	0.0023	-	0.0008
		Private	-	0.0030	-	0.0011
		Total	-	0.0052	-	0.0019
J01D E	**Fourth-generation cephalosporins**					
J01D E01	Cefepime	Public	0.0105	0.0111	0.0038	0.0041
		Private	0.0085	0.0022	0.0031	0.0008
		Total	0.0190	0.0133	0.0069	0.0049
J01D H	**Carbapenems**					
J01D H02	Meropenem	Public	0.0055	0.0094	0.0020	0.0034
		Private	0.0027	0.0027	0.0010	0.0010
		Total	0.0082	0.0121	0.0030	0.0044
J01D H03	Ertapenem	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0021	0.0014	0.0008	0.0005
		Total	0.0022	0.0015	0.0008	0.0006
J01D H51	Imipenem and enzyme inhibitor	Public	0.0058	0.0057	0.0021	0.0021
		Private	0.0023	0.0018	0.0008	0.0007
		Total	0.0081	0.0075	0.0029	0.0027
J01D H55	Panipenem and betamipron	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E A	**Trimethoprim and derivatives**					
J01E A01	Trimethoprim	Public	0.0178	0.0036	0.0065	0.0013
		Private	0.0051	0.0082	0.0018	0.0030
		Total	0.0229	0.0118	0.0083	0.0043
J01E A02	Brodimoprim	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E B	**Short-acting sulfonamides**					
J01E B02	Sulfamethizole	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E B03	Sulfadimidine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E B04	Sulfapyridine	Public	0.2112	-	0.0771	-
		Private	-	-	-	-
		Total	0.2112	-	0.0771	-

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01E B	**Short-acting sulfonamides**					
J01E B05	Sulfafurazole	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E C	**Intermediate-acting sulfonamides**					
J01E C02	Sulfadiazine	Public	-	0.0044	-	0.0016
		Private	-	-	-	-
		Total	-	0.0044	-	0.0016
J01E C03	Sulfamoxole	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E D	**Long-acting sulfonamides**					
J01E D01	Sulfadimethoxine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E D02	Sulfalene	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E D04	Sulfametoxydiazine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E D07	Sulfamerazine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01E E	**Combinations of sulfonamides and trimethoprim, incl. derivatives**					
J01E E01	Sulfamethoxazole and trimethoprim	Public	0.2491	0.2060	0.0909	0.0752
		Private	0.2587	0.2588	0.0944	0.0945
		Total	0.5078	0.4648	0.1853	0.1696
J01E E02	Sulfadiazine and trimethoprim	Public	-	-	-	-
		Private	0.0245	0.0168	0.0089	0.0061
		Total	0.0245	0.0168	0.0089	0.0061
J01F A	**Macrolides**					
J01F A01	Erythromycin	Public	0.5574	0.5358	0.2035	0.1956
		Private	0.3840	0.3034	0.1401	0.1107
		Total	0.9414	0.8391	0.3436	0.3063
J01F A02	Spiramycin	Public	<0.0001	-	<0.0001	-
		Private	0.0015	0.0008	0.0005	0.0003
		Total	0.0015	0.0008	0.0006	0.0003
J01F A05	Oleandomycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01F A	**Macrolides**					
J01F A06	Roxithromycin	Public	-	-	-	-
		Private	0.1190	0.1208	0.0434	0.0441
		Total	0.1190	0.1208	0.0434	0.0441
J01F A08	Troleandomycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01F A09	Clarithromycin	Public	0.0191	0.0334	0.0070	0.0122
		Private	0.1744	0.2344	0.0637	0.0856
		Total	0.1935	0.2678	0.0706	0.0978
J01F A10	Azithromycin	Public	0.0119	0.0194	0.0044	0.0071
		Private	0.0998	0.0889	0.0364	0.0324
		Total	0.1117	0.1083	0.0408	0.0395
J01F A11	Miocamycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01F A14	Flurithromycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01F F	**Lincosamides**					
J01F F01	Clindamycin	Public	0.0057	0.0066	0.0021	0.0024
		Private	0.0083	0.0165	0.0030	0.0060
		Total	0.0140	0.0231	0.0051	0.0084
J01F F02	Lincomycin	Public	-	-	-	-
		Private	0.0064	0.0038	0.0023	0.0014
		Total	0.0064	0.0038	0.0023	0.0014
J01F G	**Streptogramins**					
J01F G01	Pristinamycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01G A	**Streptomycins**					
J01G A01	Streptomycin	Public	0.0243	0.0217	0.0089	0.0079
		Private	0.0007	0.0002	0.0003	<0.0001
		Total	0.0250	0.0219	0.0091	0.0080
J01G B	**Other aminoglycosides**					
J01G B01	Tobramycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01G B03	Gentamicin	Public	0.0060	0.0099	0.0022	0.0036
		Private	0.0077	0.0041	0.0028	0.0015
		Total	0.0136	0.0140	0.0050	0.0051
J01G B04	Kanamycin	Public	0.0002	0.0008	<0.0001	0.0003
		Private	0.0004	0.0009	0.0002	0.0003
		Total	0.0007	0.0016	0.0002	0.0006

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01G B	**Other aminoglycosides**					
J01G B05	Neomycin	Public	-	-	-	-
		Private	-	0.0003	-	<0.0001
		Total	-	0.0003	-	<0.0001
J01G B06	Amikacin	Public	0.0032	0.0024	0.0012	0.0009
		Private	0.0014	0.0009	0.0005	0.0003
		Total	0.0046	0.0032	0.0017	0.0012
J01G B07	Netilmicin	Public	0.0009	0.0008	0.0003	0.0003
		Private	0.0012	0.0010	0.0005	0.0004
		Total	0.0021	0.0017	0.0008	0.0006
J01G B08	Sisomicin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M A	**Fluoroquinolones**					
J01M A01	Ofloxacin	Public	0.0130	0.0132	0.0047	0.0048
		Private	0.0935	0.0912	0.0341	0.0333
		Total	0.1066	0.1044	0.0389	0.0381
J01M A02	Ciprofloxacin	Public	0.0226	0.0392	0.0082	0.0143
		Private	0.1179	0.1508	0.0430	0.0551
		Total	0.1405	0.1900	0.0513	0.0694
J01M A03	Pefloxacin	Public	0.0022	0.0016	0.0008	0.0006
		Private	0.0065	0.0032	0.0024	0.0012
		Total	0.0087	0.0048	0.0032	0.0017
J01M A04	Enoxacin	Public	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
J01M A05	Temafloxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M A06	Norfloxacin	Public	<0.0001	0.0003	<0.0001	<0.0001
		Private	0.0818	0.1105	0.0299	0.0403
		Total	0.0818	0.1107	0.0299	0.0404
J01M A08	Fleroxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M A09	Sparfloxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M A10	Rufloxacin	Public	-	-	-	-
		Private	-	0.0035	-	0.0013
		Total	-	0.0035	-	0.0013
J01M A11	Grepafloxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01M A	**Fluoroquinolones**					
J01M A12	Levofloxacin	Public	0.0010	0.0017	0.0004	0.0006
		Private	0.0195	0.0469	0.0071	0.0171
		Total	0.0205	0.0486	0.0075	0.0177
J01M A14	Moxifloxacin	Public	0.0002	0.0003	<0.0001	0.0001
		Private	0.0163	0.0284	0.0059	0.0103
		Total	0.0165	0.0287	0.0060	0.0105
J01M A16	Gatifloxacin	Public	0.0003	-	0.0001	-
		Private	0.0043	-	0.0016	-
		Total	0.0046	-	0.0017	-
J01M A17	Prulifloxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M B	**Other quinolones**					
J01M B01	Rosoxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M B03	Piromidic acid	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M B04	Pipemidic acid	Public	-	-	-	-
		Private	0.0085	0.0078	0.0031	0.0028
		Total	0.0085	0.0078	0.0031	0.0028
J01M B05	Oxolinic acid	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M B06	Cinoxacin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M B07	Flumequine	Public	-	-	-	-
		Private	<0.0001	0.0280	<0.0001	0.0102
		Total	<0.0001	0.0280	<0.0001	0.0102
J01X A	**Glycopeptide antibacterials**					
J01X A01	Vancomycin	Public	0.0035	0.0039	0.0013	0.0014
		Private	0.0013	0.0011	0.0005	0.0004
		Total	0.0048	0.0050	0.0018	0.0018
J01X A02	Teicoplanin	Public	0.0002	0.0002	<0.0001	<0.0001
		Private	0.0004	0.0001	0.0001	<0.0001
		Total	0.0005	0.0003	0.0002	0.0001
J01X B	**Polymyxins**					
J01X B01	Colistin	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	-	-	-	-
		Total	<0.0001	<0.0001	<0.0001	<0.0001
J01X B02	Polymyxin B	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	0.0001	<0.0001	<0.0001

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	ss2007	2006	2007
J01X C	**Steroid antibacterials**					
J01X C01	Fusidic acid	Public	0.0089	0.0136	0.0032	0.0050
		Private	0.0016	0.0031	0.0006	0.0011
		Total	0.0105	0.0167	0.0038	0.0061
J01X D	**Imidazole derivatives**					
J01X D01	Metronidazole	Public	0.0358	0.0421	0.0131	0.0153
		Private	0.0128	0.0082	0.0047	0.0030
		Total	0.0486	0.0503	0.0177	0.0184
J01X D03	Ornidazole	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01X E	**Nitrofuran derivatives**					
J01X E01	Nitrofurantoin	Public	0.0064	0.0085	0.0023	0.0031
		Private	0.0022	0.0052	0.0008	0.0019
		Total	0.0086	0.0137	0.0031	0.0050
J01X X	**Other antibacterials**					
J01X X01	Fosfomycin	Public	-	<0.0001	-	<0.0001
		Private	0.0016	0.0016	0.0006	0.0006
		Total	0.0016	0.0016	0.0006	0.0006
J01X X04	Spectinomycin	Public	<0.0001	-	<0.0001	-
		Private	-	-	-	-
		Total	<0.0001	-	<0.0001	-
J01X X05	Methenamine	Public	-	-	-	-
		Private	-	0.0005	-	0.0002
		Total	-	0.0005	-	0.0002
J01X X07	Nitroxoline	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01X X08	Linezolid	Public	0.0010	0.0003	0.0004	0.0001
		Private	0.0004	0.0004	0.0001	0.0001
		Total	0.0014	0.0007	0.0005	0.0002

Table 15.3.1: Use of Antimycotics by Drug Class, in DDD/1000 population/day and DDD/population/year

ATC	Drug Class	DDD/ 1000 population/day		DDD/population/year	
		2006	2007	2006	2007
J02A A	Antibiotics	0.0028	0.0027	0.0010	0.0010
J02A B	Imidazole derivatives	0.2352	0.3196	0.0859	0.1166
J02A C	Triazole derivatives	0.0872	0.1021	0.0318	0.0373
J02A X	Other antimycotics for systemic use	0.0001	0.0002	<0.0001	<0.0001

Table 15.3.2 : Use of Antimycotics by Drug Class and Agents, in DDD/1000 population/day and DDD/ population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDD/ 1000 population/day		DDD/population/year	
			2006	2007	2006	2007
J02A A	**Antibiotics**					
J02A A01	Amphotericin B	Public	0.0026	0.0023	0.0010	0.0008
		Private	0.0002	0.0004	<0.0001	0.0002
		Total	0.0028	0.0027	0.0010	0.0010
J02A B	**Imidazole derivatives**					
J02A B01	Miconazole	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J02A B02	Ketoconazole	Public	0.0117	0.014	0.0043	0.0051
		Private	0.2235	0.3056	0.0816	0.1115
		Total	0.2352	0.3196	0.0859	0.1166
J02A C	**Triazole derivatives**					
J02A C01	Fluconazole	Public	0.0146	0.0177	0.0053	0.0064
		Private	0.0203	0.0300	0.0074	0.0110
		Total	0.0350	0.0477	0.0128	0.0174
J02A C02	Itraconazole	Public	0.0227	0.0191	0.0083	0.0070
		Private	0.0294	0.0348	0.0107	0.0127
		Total	0.0521	0.0539	0.0190	0.0197
J02A C03	Voriconazole	Public	0.0002	0.0003	<0.0001	0.0001
		Private	-	0.0002	-	<0.0001
		Total	0.0002	0.0005	<0.0001	0.0002
J02A C04	Posaconazole	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J02A X	**Other antimycotics for systemic use**					
J02A X01	Flucytosine	Public	<0.0001	-	<0.0001	-
		Private	-	-	-	-
		Total	<0.0001	-	<0.0001	-
J02A X04	Caspofungin	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	0.0002	<0.0001	<0.0001

Table 15.4.1: Use of Antimycobacterials by Drug Class and Agents, in DDD/1000 population/day and DDD/ population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDD/1000 population/day		DDD/population/year	
			2006	2007	2006	2007
J04A A	**Aminosalicylic acid and derivatives**					
J04A A02	Sodium aminosalicylate	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J04A B	**Antibiotics**					
J04A B01	Cycloserine	Public	0.0016	0.0004	0.0006	0.0001
		Private	-	-	-	-
		Total	0.0016	0.0004	0.0006	0.0001
J04A B02	Rifampicin	Public	0.2560	0.2063	0.0934	0.0753
		Private	0.0228	0.0179	0.0083	0.0065
		Total	0.2788	0.2243	0.1018	0.0819
J04A B03	Rifamycin	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

ATC	Drug Class and Agents	Sector	DDD/1000 population/day		DDD/population/year	
			2006	2007	2006	2007
J04A C	**Hydrazides**					
J04A C01	Isoniazid	Public	0.4356	0.3490	0.1590	0.1274
		Private	0.0268	0.0621	0.0098	0.0227
		Total	0.4624	0.4111	0.1688	0.1500
J04A D	**Thiocarbamide derivatives**					
J04A D01	Protionamide	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J04A D02	Tiocarlide	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J04A D03	Ethionamide	Public	<0.0001	0.0005	<0.0001	0.0002
		Private	-	-	-	-
		Total	<0.0001	0.0005	<0.0001	0.0002
J04A K	**Other drugs for treatment of tuberculosis**					
J04A K01	Pyrazinamide	Public	0.1084	0.1271	0.0395	0.0464
		Private	0.0143	0.0097	0.0052	0.0035
		Total	0.1226	0.1367	0.0448	0.0499
J04A K02	Ethambutol	Public	0.0891	0.0722	0.0325	0.0263
		Private	0.0174	0.0116	0.0064	0.0042
		Total	0.1065	0.0837	0.0389	0.0306
J04A M	**Combinations of drugs for treatment of tuberculosis**					
J04A M02	Rifampicin and isoniazid	Public	-	<0.0001	-	<0.0001
		Private	0.0143	0.0131	0.0052	0.0048
		Total	0.0143	0.0131	0.0052	0.0048
J04A M05	Rifampicin, pyrazinamide and isoniazid	Public	-	<0.0001	-	<0.0001
		Private	0.0065	0.0043	0.0024	0.0016
		Total	0.0065	0.0043	0.0024	0.0016
J04A M06	Rifampicin, pyrazinamide, ethambutol and isoniazid	Public	-	-	-	-
		Private	0.0001	0.0007	<0.0001	0.0002
		Total	0.0001	0.0007	<0.0001	0.0002
J04B A	**Drugs for treatment of lepra**					
J04B A01	Clofazimine	Public	0.0040	0.0035	0.0015	0.0013
		Private	-	-	-	-
		Total	0.0040	0.0035	0.0015	0.0013
J04B A02	Dapsone	Public	0.1047	0.0708	0.0382	0.0259
		Private	<0.0001	0.0097	<0.0001	0.0036
		Total	0.1047	0.0806	0.0382	0.0294

Table 15.5.1 : Use of Antimalarials by Drug Class, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class	DDD/ 1000 population/day		DDD/population/year	
		2006	2007	2006	2007
P01A	Agents against amoebiasis & other protozoal diseases	0.1993	0.2054	0.0727	0.0750
P01B A	Aminoquinolines	0.0635	0.1237	0.0232	0.0451
P01B B	Biguanides	<0.0001	0.0002	<0.0001	<0.0001
P01B C	Methanolquinolines	0.0049	0.0045	0.0018	0.0017
P01B D	Diaminopyrimidines	0.0110	0.0122	0.0040	0.0044

Table 15.5.2: Use of Antimalarials by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDD/1000 population/day		DDD/population/year	
			2006	2007	2006	2007
P01A	**Agents against amoebiasis and other protozoal diseases**					
P01A B01	Metronidazole	Public	0.1108	0.1123	0.0404	0.0410
		Private	0.0839	0.0864	0.0306	0.0316
		Total	0.1947	0.1987	0.0711	0.0725
P01A B02	Tinidazole	Public	-	<0.0001	-	<0.0001
		Private	0.0046	0.0067	0.0017	0.0024
		Total	0.0046	0.0067	0.0017	0.0025
P01A X02	Emetine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
P01A X06	Atovaquone	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
P01A X11	Nitazoxanide	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
P01B A	**Aminoquinolines**					
P01B A01	Chloroquine	Public	0.0082	0.0130	0.0030	0.0048
		Private	0.0048	0.0054	0.0018	0.0020
		Total	0.0130	0.0185	0.0048	0.0067
P01B A02	Hydroxychloroquine	Public	0.0147	0.0597	0.0054	0.0218
		Private	0.0023	0.0105	0.0008	0.0038
		Total	0.0170	0.0702	0.0062	0.0256
P01B A03	Primaquine	Public	0.0310	0.0325	0.0113	0.0119
		Private	0.0024	0.0024	0.0009	0.0009
		Total	0.0334	0.0350	0.0122	0.0128
P01B B	**Biguanides**					
P01B B01	Proguanil	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
P01B B51	Proguanil, combinations	Public	-	-	-	-
		Private	<0.0001	0.0002	<0.0001	<0.0001
		Total	<0.0001	0.0002	<0.0001	<0.0001
P01B C	**Methanolquinolines**					
P01B C01	Quinine	Public	0.0035	0.0043	0.0013	0.0016
		Private	0.0013	0.0002	0.0005	<0.0001
		Total	0.0048	0.0044	0.0018	0.0016
P01B C02	Mefloquine	Public	-	<0.0001	-	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001
P01B D	**Diaminopyrimidines**					
P01B D01	Pyrimethamine	Public	0.0002	0.0009	<0.0001	0.0003
		Private	<0.0001	-	<0.0001	-
		Total	0.0003	0.0009	0.0001	0.0003
P01B D51	Pyrimethamine, combinations	Public	0.0091	0.0099	0.0033	0.0036
		Private	0.0017	0.0014	0.0006	0.0005
		Total	0.0108	0.0112	0.0039	0.0041

Table 15.6.1 : Use of Antivirals by Drug Class, in DDD/1000 population/day and DDD/population/ year 2006-2007

ATC	Drug Class	DDD/1000 population/day		DDD/population/year	
		2006	2007	2006	2007
J05A B	Nucleosides and nucleotides excl. reverse transcriptase inhibitors	0.0519	0.0494	0.0189	0.0180
J05A D	Phosphonic acid derivatives	<0.0001	<0.0001	<0.0001	<0.0001
J05A E	Protease inhibitors	0.0109	0.0127	0.0040	0.0046
J05A F	Nucleoside and nucleotide reverse transcriptase inhibitors	0.1034	0.1813	0.0378	0.0662
J05A G	Non-nucleoside reverse transcriptase inhibitors	0.0918	0.1770	0.0335	0.0646
J05A H	Neuraminidase inhibitors	0.1543	0.0893	0.0563	0.0326
J05A R	Antivirals for treatment of HIV infections, combinations	0.0776	0.1261	0.0283	0.0461

Table 15.6.2 : Use of Antivirals by Drug Class and Agents, in DDD/1000 population/day and DDD/ population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDD/1000 population/day		DDD/population/year	
			2006	2007	2006	2007
J05A B	**Nucleosides and nucleotides excl. reverse transcriptase inhibitors**					
J05A B01	Aciclovir	Public	0.0063	0.0055	0.0023	0.0020
		Private	0.0406	0.0409	0.0148	0.0149
		Total	0.0470	0.0464	0.0171	0.0169
J05A B04	Ribavirin	Public	0.0026	0.0008	0.0009	0.0003
		Private	0.0005	0.0004	0.0002	0.0001
		Total	0.0031	0.0011	0.0011	0.0004
J05A B06	Ganciclovir	Public	0.0004	0.0002	0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0004	0.0003	0.0001	<0.0001
J05A B11	Valaciclovir	Public	<0.0001	0.0001	<0.0001	<0.0001
		Private	0.0012	0.0013	0.0004	0.0005
		Total	0.0013	0.0014	0.0005	0.0005
J05A B14	Valganciclovir	Public	<0.0001	0.0001	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	0.0002	<0.0001	<0.0001
J05A D	**Phosphonic acid derivatives**					
J05A D01	Foscarnet	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	-	-	-	-
		Total	<0.0001	<0.0001	<0.0001	<0.0001
J05A E	**Protease inhibitors**					
J05A E01	Saquinavir	Public	-	-	-	-
		Private	<0.0001	-	<0.0001	-
		Total	<0.0001	-	<0.0001	-
J05A E02	Indinavir	Public	0.0063	0.0062	0.0023	0.0022
		Private	0.0003	0.0002	0.0001	<0.0001
		Total	0.0066	0.0063	0.0024	0.0023

ATC	Drug Class and Agents	Sector	DDD/1000 population/day		DDD/population/year	
			2006	2007	2006	2007
J05A E	**Protease inhibitors**					
J05A E03	Ritonavir	Public	0.0021	0.0031	0.0008	0.0011
		Private	-	<0.0001	-	<0.0001
		Total	0.0021	0.0031	0.0008	0.0011
J05A E04	Nelfinavir	Public	<0.0001	-	<0.0001	-
		Private	-	-	-	-
		Total	<0.0001	-	<0.0001	-
J05A E06	Lopinavir	Public	0.0022	0.0033	0.0008	0.0012
		Private	-	-	-	-
		Total	0.0022	0.0033	0.0008	0.0012
J05A E08	Atazanavir	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J05A E09	Tipranavir	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J05A E10	Darunavir	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J05A F	**Nucleoside and nucleotide reverse transcriptase inhibitors**					
J05A F01	Zidovudine	Public	0.0016	0.0126	0.0006	0.0046
		Private	-	<0.0001	-	<0.0001
		Total	0.0016	0.0127	0.0006	0.0046
J05A F02	Didanosine	Public	0.0089	0.0145	0.0032	0.0053
		Private	0.0011	0.0005	0.0004	0.0002
		Total	0.0100	0.0150	0.0036	0.0055
J05A F04	Stavudine	Public	0.0337	0.0571	0.0123	0.0209
		Private	0.0012	0.0005	0.0004	0.0002
		Total	0.0349	0.0577	0.0128	0.0210
J05A F05	Lamivudine	Public	0.0378	0.0670	0.0138	0.0245
		Private	0.0064	0.0033	0.0023	0.0012
		Total	0.0441	0.0703	0.0161	0.0257
J05A F07	Tenofovir disoproxil	Public	-	0.0008	-	0.0003
		Private	-	-	-	-
		Total	-	0.0008	-	0.0003
J05A F08	Adefovir dipivoxil	Public	0.0038	0.0075	0.0014	0.0027
		Private	0.0061	0.0077	0.0022	0.0028
		Total	0.0099	0.0152	0.0036	0.0055
J05A F10	Entecavir	Public	-	0.0005	-	0.0002
		Private	0.0028	0.0073	0.0010	0.0027
		Total	0.0028	0.0078	0.0010	0.0029
J05A F11	Telbivudine	Public	-	-	-	-
		Private	-	0.0019	-	0.0007
		Total	-	0.0019	-	0.0007
J05A F12	Clevudine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

ATC	Drug Class and Agents	Sector	DDD/1000 population/day		DDD/population/year	
			2006	2007	2006	2007
J05A G	**Non-nucleoside reverse transcriptase inhibitors**					
J05A G01	Nevirapine	Public	0.0616	0.0292	0.0225	0.0107
		Private	0.0001	0.0002	<0.0001	<0.0001
		Total	0.0618	0.0294	0.0225	0.0107
J05A G03	Efavirenz	Public	0.0283	0.1454	0.0103	0.0531
		Private	0.0017	0.0021	0.0006	0.0008
		Total	0.0300	0.1475	0.0110	0.0538
J05A H	**Neuraminidase inhibitors**					
J05A H01	Zanamivir	Public	0.0299	-	0.0109	-
		Private	-	-	-	-
		Total	0.0299	-	0.0109	-
J05A H02	Oseltamivir	Public	0.1204	0.0893	0.0440	0.0326
		Private	0.0040	<0.0001	0.0015	<0.0001
		Total	0.1245	0.0893	0.0454	0.0326
J05A R	**Antivirals for treatment of HIV infections, combinations**					
J05A R01	Zidovudine and lamivudine	Public	0.0751	0.0967	0.0274	0.0353
		Private	0.0025	0.0034	0.0009	0.0012
		Total	0.0776	0.1000	0.0283	0.0365
J05A R03	Tenofovir disoproxil and emtricitabine	Public	-	<0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	<0.0001	-	<0.0001
J05A R07	Stavudine, lamivudine and nevirapine	Public	-	0.0260	-	0.0095
		Private	-	-	-	-
		Total	-	0.0260	-	0.0095

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CHAPTER 16 | USE OF ANTINEOPLASTIC AGENTS, INCLUDING ENDOCRINE THERAPY AND IMMUNOSTIMULANTS

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Malignant neoplasm was the second principle cause of death in the Ministry of Health (MOH) Hospitals in 2008.[1] According to the National Cancer Registry 2006, it was estimated that 21,773 new cancer cases were diagnosed in Peninsular Malaysia. The estimated Age-Standardised Incidence Rate (ASR) was 131.3 per 100,000 and the five most common cancers were breast, colorectal, lung, cervix and nasopharynx.[2]

The Defined Daily Dose (DDD) is the measurement unit adopted primarily in other chapters in this Malaysian Statistics on Medicines report to reflect the average maintenance dose per day for a drug used in its main indication in adults.[3] However, there is no assigned DDD for antineoplastics because of its highly individualised use and wide dosage ranges. Antineoplastics are also usually given as combination therapy for specific number of cycles per patient and not continuously.

In this chapter, the total utilisation of antineoplastics was initially expressed in milligrams/1000 population. However, this unit of measurement does not reflect the actual usage of the antineoplastics as each agent has different potency and different standard prescribed dose per cycle. Therefore, for the purpose of comparing usage between the agents, an estimation of the number of cycles used were done using the standard dose for the main indication in adults,[4,5] standardised Body Surface Area (BSA) of 1.72m^2 and standardised weight of 60 kg.[6] Agents that are prescribed daily were calculated as a monthly cycle comprising of 28 days.

Total Number Of Treatment Cycles = T / Proposed DDD

where $T = (D_{/1000pop} * P * 365)/1000$

T = an estimate of the total quantity of the drug utilised in the year (mg/mcg/iu)

$D_{/1000pop}$ = Dosage per 1000 population (mg/mcg/iu)

P = mid-year population of Malaysia

The 10 antineoplastic agents with the highest overall usage were Fluorouracil amounting to 29,056 cycles, Cyclophosphamide (21,889 cycles), Doxorubicin (11,759 cycles), Mercaptopurine (11,575 cycles), Cisplatin (11,025 cycles), Hydroxycarbamide (8,591 cycles), Epirubicin (7,828 cycles), Carboplatin (7,270 cycles), Capecitabine (6,417 cycles) and Vincristine (5,703 cycles).

Comparing the public and private, the top 10 antineoplastics used in the public sector were Fluorouracil, Cyclophosphamide, Mercaptopurine, Doxorubicin, Cisplatin, Hydroxycarbamide, Epirubicin, Vincristine, Carboplatin and Paclitaxel. In the private sector, Fluorouracil, Cyclophosphamide, Cisplatin, Capecitabine, Doxorubicin, Oxaliplatin, Carboplatin, Hydroxycarbamide, Paclitaxel and Docetaxel were the 10 most used agents.

According to the different drug classes, the most used alkylating agent was Cyclophosphamide. This was followed by Ifosfamide and Dacarbazine. Thiotepa was noted to be used in 2007 compared to none in 2006. For antimetabolites, Fluorouracil was the most used agent followed by Mercaptopurine and Capecitabine. There was a striking increase in the use of Thioguanine from 141 cycles in 2006 to 1003 cycles in 2007. It was noted that the usage of Fluorouracil had decreased by 5% while Capecitabine which is an oral pro-drug of Fluorouracil had increased by 40%.

For vinca alkaloids, Vincristine was most frequently used. Etoposide was the most common agent in the podophyllotoxin class. Paclitaxel was the most common agent in the Taxane group. In the anthracycline group, Doxorubicin is the most used followed by Epirubicin and Dactinomycin. Cisplatin was the commonest prescribed platinum group.

For targeted therapy overall usage, Rituximab was the most commonly prescribed monoclonal antibody followed by Bevacizumab and Trastuzumab. In terms of small molecules, Erlotinib use was initiated in 2007 and it ranked as the highest in usage in that year. This was followed by Gefitinib and Imatinib. However there was a difference in prescribing between the public and private sector. In the public sector, Rituximab ranked first while in the private sector, Bevacizumab was the highest. For small molecules, Imatinib was the most used in the public sector compared to Erlotinib in the private sector.

Novel cancer therapy especially targeted therapy is expensive. The cost of subsidising cancer therapy by the MOH is becoming exorbitant. There is also a possibility of patient migration from the private to the public sector once it is made available. This may be the explanation in the use of Imatinib which had doubled in the public sector in 2007 with a 30% reduction in the private sector.

The doses and schedule of each agent were based on assumption on the most common usage and indications by the authors, as listed in the table below. Caution is advised on quoting or use of this data. We await a standardised model to be established for meaningful interpretation and comparison of antineoplastic usage.

Table 16.1 : Use of Antineoplastic Agents by Drug Class and Agents, in total dosage/1000 population and total number of treatment cycle/1000 population 2006-2007

ATC	Drug Class & Agents	Dose & Duration	Average dose per treatment cycle (Proposed DDD)	Unit	Sector	Total dosage / 1000 population (2006)	Total no. of treatment cycle [2006]	Total dosage / 1000 population (2007)	Total no. of treatment cycle [2007]
L01A A	**Nitrogen mustard analogues**								
L01A A01	Cyclophosphamide	750mg/m2	1,300	mg	Public	2.2612	16,913	2.1704	16,559
					Private	0.6601	4,937	0.6986	5,330
					Total	2.9212	21,850	2.8690	21,889
L01A A02	Chlorambucil	10mg d1-14	140	mg	Public	0.0062	431	0.0040	283
					Private	0.0009	63	0.0009	64
					Total	0.0071	493	0.0048	340
L01A A03	Melphalan	30mg/m2	50	mg	Public	0.0036	700	0.0012	238
					Private	0.0001	19	0.0010	198
					Total	0.0036	700	0.0021	417
L01A A06	Ifosfamide	1500mg/ m2 x 5/7	12,900	mg	Public	0.9000	678	1.6000	1,230
					Private	0.1000	75	0.3000	231
					Total	1.1000	829	1.9000	1,461
L01A B	**Alkyl sulfonates**								
L01A B01	Busulfan	0.8mg/kg QID x 4/7	800	mg	Public	0.0093	113	0.0051	63
					Private	0.0001	1	0.0020	25
					Total	0.0095	115	0.0071	88
L01A C	**Ethylene imines**								
L01A C01	Thiotepa	45mg/m2 weekly	80	mg	Public	-	-	<0.0001	12
					Private	-	-	-	-
					Total	-	-	<0.0001	12
L01A D	**Nitrosoureas**								
L01A D01	Carmustine	300mg/m2 x 1/7	500	mg	Public	0.0030	58	0.0006	12
					Private	0.0001	2	0.0013	26
					Total	0.0030	58	0.0018	36
L01A D02	Lomustine	110mg/m2 d1	190	mg	Public	0.0008	41	0.0006	31
					Private	0.0003	15	0.0002	10
					Total	0.0010	51	0.0008	42
L01A X	**Other alkylating agents**								
L01A X03	Temozolomide	75mg/m2 d1-5 x 6 weeks	3,900	mg	Public	0.0047	12	0.0046	12
					Private	0.0233	58	0.0096	24
					Total	0.0280	70	0.0142	36
L01A X04	Dacarbazine	375mg/m2 D1+15	1,300	mg	Public	0.0631	472	0.1002	764
					Private	0.0198	148	0.0446	340
					Total	0.0829	620	0.1448	1,105

ATC	Drug Class & Agents	Dose & Duration	Average dose per treatment cycle (Proposed DDD)	Unit	Sector	Total dosage / 1000 population (2006)	Total no. of treatment cycle [2006]	Total dosage / 1000 population (2007)	Total no. of treatment cycle [2007]
L01B A	**Folic acid analogues**								
L01B A01	Methotrexate	2000mg/m2	3,500	mg	Public	0.6852	1,904	0.7348	2,082
					Private	0.1102	306	0.1919	544
					Total	0.7954	2,210	0.9266	2,626
L01B A04	Pemetrexed	500mg/m2	860	mg	Public	-	-	-	-
					Private	0.0055	62	0.0116	134
					Total	0.0055	62	0.0116	134
L01B B	**Purine analogues**								
L01B B02	Mercaptopurine	100mg/m2 d1-5	860	mg	Public	0.6879	7,778	0.8572	9,886
					Private	0.0103	116	0.1464	1,688
					Total	0.6982	7,894	1.0036	11,575
L01B B03	Tioguanine	100mg/m2 d1-5	860	mg	Public	0.0123	139	0.0822	948
					Private	0.0002	2	0.0048	55
					Total	0.0125	141	0.0870	1,003
L01B B04	Cladribine	0.2mg/kg d1-5	60	mg	Public	<0.0001	16	<0.0001	17
					Private	-	-	0.0001	17
					Total	<0.0001	16	<0.0001	17
L01B B05	Fludarabine	25mg/m2 d1-5	215	mg	Public	0.0010	45	0.0073	337
					Private	0.0018	81	0.0013	60
					Total	0.0028	127	0.0086	397
L01B C	**Pyrimidine analogues**								
L01B C01	Cytarabine	1500mg/m2 b BD x 4/7	20,640	mg	Public	0.7999	377	1.4036	674
					Private	0.0436	21	0.2533	122
					Total	0.8435	397	1.6569	796
L01B C02	Fluorouracil	1000mg/m2	2,000	mg	Public	4.8107	23,389	4.1406	20,534
					Private	1.4858	7,224	1.7185	8,522
					Total	6.2965	30,612	5.8591	29,056
L01B C05	Gemcitabine	1000mg/m2 d1+8	3,440	mg	Public	0.2908	822	0.9037	2,606
					Private	0.1210	342	0.5102	1,471
					Total	0.4118	1,164	1.4138	4,076
L01B C06	Capecitabine	2500mg/ d d1-14	35,000	mg	Public	7.5826	2,107	11.2026	3,175
					Private	8.9727	2,493	11.4404	3,242
					Total	16.5553	4,599	22.6429	6,417
L01B C53	Tegafur, combinations	100mg tds x 28 days	8,400	mg	Public	0.0272	31	0.0121	14
					Private	0.3260	377	0.1773	209
					Total	0.3533	409	0.1894	224
L01C A	**Vinca alkaloids and analogues**								
L01C A01	Vinblastine	10mg d1+15	20	mg	Public	0.0011	535	0.0014	694
					Private	0.0003	146	0.0018	893
					Total	0.0014	681	0.0032	1,587
L01C A02	Vincristine	2mg d1+8	4	mg	Public	0.0018	4,376	0.0019	4,711
					Private	0.0002	486	0.0004	992
					Total	0.0020	4,862	0.0023	5,703
L01C A04	Vinorelbine	30mg/m2 d1+8	100	mg	Public	0.0062	603	0.0027	268
					Private	0.0051	496	0.0061	605
					Total	0.0113	1,099	0.0087	863

ATC	Drug Class & Agents	Dose & Duration	Average dose per treatment cycle (Proposed DDD)	Unit	Sector	Total dosage / 1000 population (2006)	Total no. of treatment cycle [2006]	Total dosage / 1000 population (2007)	Total no. of treatment cycle [2007]
L01C B	**Podophyllotoxin derivatives**								
L01C B01	Etoposide	100mg/m2 d1-5	860	mg	Public	0.1511	1,708	0.1796	2,071
					Private	0.0293	331	0.0483	557
					Total	0.1804	2,040	0.2279	2,628
L01C B02	Teniposide	100mg/m2 d1-5	860	mg	Public	0.0015	17	0.0006	7
					Private	0.0000	0.0000	0.0014	16
					Total	0.0015	17	0.0020	23
L01C D	**Taxanes**								
L01C D01	Paclitaxel	175mg/m2	300	mg	Public	0.0687	2,227	0.1014	3,352
					Private	0.0464	1,504	0.0575	1,901
					Total	0.1151	3,731	0.1588	5,250
L01C D02	Docetaxel	75mg/m2	130	mg	Public	0.0152	1,137	0.0279	2,129
					Private	0.0158	1,182	0.0223	1,701
					Total	0.0310	2,319	0.0501	3,822
L01D A	**Actinomycines**								
L01D A01	Dactinomycin	15mcg/kg	1	mcg	Public	<0.0001	1,080	0.0003	3,306
					Private	<0.0001	1,080	<0.0001	1,102
					Total	<0.0001	1,080	0.0003	3,306
L01D B	**Anthracyclines and related substances**								
L01D B01	Doxorubicin	50mg/m2	90	mg	Public	0.0426	4,603	0.0774	8,530
					Private	0.0274	2,960	0.0292	3,218
					Total	0.0701	7,574	0.1067	11,759
L01D B02	Daunorubicin	45mg/m2 d1-3	230	mg	Public	0.0085	359	0.0134	578
					Private	0.0008	34	0.0016	69
					Total	0.0093	393	0.0150	647
L01D B03	Epirubicin	75mg/m2	130	mg	Public	0.0771	5,767	0.0857	6,538
					Private	0.0123	920	0.0169	1,289
					Total	0.0893	6,679	0.1026	7,828
L01D B06	Idarubicin	12mg/m2 d1-3	105	mg	Public	0.0008	74	0.0009	85
					Private	<0.0001	9	0.0003	28
					Total	0.0009	83	0.0011	104
L01D B07	Mitoxantrone	12mg/m2 d1-3	60	mg	Public	0.0003	49	0.0009	149
					Private	0.0001	16	0.0004	66
					Total	0.0004	65	0.0013	215
L01D C	**Other cytotoxic antibiotics**								
L01D C01	Bleomycin	30mg/m2 d1,8,15	90	mg	Public	0.0074	799	0.0062	683
					Private	0.0031	335	0.0021	231
					Total	0.0105	1,134	0.0083	915
L01D C03	Mitomycin		12	mg	Public	0.0020	1,621	0.0021	1,736
					Private	0.0010	810	0.0011	909
					Total	0.0030	2,431	0.0032	2,645
L01X A	**Platinum compounds**								
L01X A01	Cisplatin	75mg/m2	130	mg	Public	0.0817	6,111	0.0969	7,393
					Private	0.0462	3,456	0.0476	3,632
					Total	0.1278	9,559	0.1445	11,025
L01X A02	Carboplatin		500	mg	Public	0.3832	7,452	0.2276	4,515
					Private	0.1088	2,116	0.1389	2,755
					Total	0.4919	9,566	0.3665	7,270
L01X A03	Oxaliplatin	85mg/m2	150	mg	Public	0.0123	797	0.0370	2,447
					Private	0.0281	1,822	0.0460	3,042
					Total	0.0404	2,619	0.0830	5,488

ATC	Drug Class & Agents	Dose & Duration	Average dose per treatment cycle (Proposed DDD)	Unit	Sector	Total dosage / 1000 population (2006)	Total no. of treatment cycle [2006]	Total dosage / 1000 population (2007)	Total no. of treatment cycle [2007]
L01X B	**Methylhydrazines**								
L01X B01	Procarbazine	100mg/m2 d1-14 [max 150mg]	2,100	mg	Public	0.0269	125	0.0070	33
					Private	-	-	0.0185	87
					Total	0.0269	125	0.0255	120
L01X C	**Monoclonal antibodies**								
L01X C02	Rituximab	375mg/m2	500	mg	Public	0.0377	733	0.0697	1,383
					Private	0.0242	471	0.0512	1,016
					Total	0.0619	1,204	0.1209	2,398
L01X C03	Trastuzumab	6mg/kg	400	mg	Public	0.0008	19	0.0004	10
					Private	0.0058	141	0.0150	372
					Total	0.0065	158	0.0154	382
L01X C04	Alemtuzumab	30mg [3x/week]	90	mg	Public	0.0005	54	-	-
					Private	-	-	0.0004	44
					Total	0.0005	54	0.0004	44
L01X C05	Gemtuzumab	-	5	mg	Public	-	-	<0.0001	198
					Private	-	-	-	198
					Total	-	-	<0.0001	198
L01X C06	Cetuximab	250mg/m2 d1 +15	800	mg	Public	0.0017	21	-	-
					Private	0.0335	407	0.0235	291
					Total	0.0352	428	0.0235	291
L01X C07	Bevacizumab	5mg/kg	300	mg	Public	-	-	-	-
					Private	0.0128	415	0.0335	1,108
					Total	0.0128	415	0.0335	1,108
L01X E	**Protein kinase inhibitors**								
L01X E01	Imatinib	400mg od x 28 days	11,200	mg	Public	0.0942	82	0.1757	156
					Private	0.2025	176	0.1389	123
					Total	0.2966	258	0.3145	279
L01X E02	Gefitinib	250mg od x 28 days	7,000	mg	Public	0.0086	12	-	-
					Private	0.1336	186	0.2020	286
					Total	0.1422	198	0.2020	286
L01X E03	Erlotinib	100mg od x 28 days	2,800	mg	Public	-	-	0.0046	16
					Private	-	-	0.0942	334
					Total	-	-	0.0988	350
L01X E04	Sunitinib	37.5mg x 4/52 rest 2/52	1,050	mg	Public	-	-	0.0003	3
					Private	0.0009	8	0.0048	45
					Total	0.0009	8	0.0051	48
L01X E05	Sorafenib	400mg bd x 28 days	22,400	mg	Public	-	-	0.0054	2
					Private	-	-	0.0859	38
					Total	-	-	0.0913	40
L01X E06	Dasatinib	70mg bd x 28 days	3,920	mg	Public	-	-	-	-
					Private	-	-	0.0007	2
					Total	-	-	0.0007	2
L01X E07	Lapatinib	1250mg od x 28 days	35,000	mg	Public	-	-	-	-
					Private	-	-	0.0418	12
					Total	-	-	0.0418	12

ATC	Drug Class & Agents	Dose & Duration	Average dose per treatment cycle (Proposed DDD)	Unit	Sector	Total dosage / 1000 population (2006)	Total no. of treatment cycle [2006]	Total dosage / 1000 population (2007)	Total no. of treatment cycle [2007]
L01X X	**Other antineoplastic agents**								
L01X X02	Asparaginase	10000iu/m2	20,000	iu	Public	5.2422	2,549	4.7908	2,376
					Private	0.2473	120	0.8304	412
					Total	5.4895	2,669	5.6212	2,788
L01X X05	Hydroxycarbamide	500mg tds x 28 days	42,000	mg	Public	23.5787	5,459	28.1318	6,643
					Private	5.4791	1,268	8.2493	1,948
					Total	29.0578	6,727	36.3811	8,591
L01X X11	Estramustine	280mg tds d1-5	4,200	mg	Public	-	-	-	-
					Private	-	-	0.1792	423
					Total	-	-	0.1792	423
L01X X14	Tretinoin	45mg/m2 d1-15 q12 weeks	1,160	mg	Public	0.0301	252	0.0181	155
					Private	0.0046	39	0.0122	104
					Total	0.0347	291	0.0303	259
L01X X17	Topotecan	1.25mg/m2 d2-6	10	mg	Public	-	-	0.0000	0
					Private	-	-	<0.0001	99
					Total	-	-	0.0001	99
L01X X19	Irinotecan	180mg/m2	310	mg	Public	0.0202	634	0.0354	1,133
					Private	0.0097	304	0.0123	394
					Total	0.0300	941	0.0477	1,526
L01X X27	Arsenic trioxide	10mg od x 42days	420	mg	Public	0.0007	16	0.0003	7
					Private	-	-	-	-
					Total	0.0007	16	0.0003	7
L01X X32	Bortezomib	1.3mg/m2 d1,4,8,11 q21 days	9	mg	Public	<0.0001	108	<0.0001	110
					Private	<0.0001	108	<0.0001	110
					Total	<0.0001	108	<0.0001	110
L01X X35	Anagrelide	0.5mg bd x 28 days	28	mg	Public	0.0037	1,285	0.0042	1,488
					Private	0.0005	174	0.0026	921
					Total	0.0042	1,459	0.0068	2,409

ENDOCRINE THERAPY

Hormonal therapy was commonly used for breast and prostate cancer. The use in prostate cancer is discussed in the urology section (Chapter 13). The DDDs are based on the treatment of cancer breast, endometrium and prostate.

In terms of the different antiendocrine agents, antioestrogens with total DDD of 0.2077 is the most used hormonal treatment in 2007. This was followed by gonadotropin releasing hormone analogues, with DDD of 0.0511 and enzyme inhibitors (Aromatase inhibitors) DDD of 0.0318. Tamoxifen was the most used antioestrogen while goserelin was most used among gonadotropin releasing hormone analogues. Letrozole is the most used aromatase inhibitor for year 2007. The total usage of tamoxifen had reduced in 2007 compared to 2006. In contrast, there was an increase in the use of anatrozole and letrozole in 2007.The use of both goserelin and leuprorelin had also increased.

The four top most hormonal agents was the same for the public and the private sector ie tamoxifen, goserelin, leuprorelin and letrozole. The use of tamoxifen had reduced both in the private and in the public sector. Letrozole usage in both the private and the public sector had increased remarkably. Anastrozole had shown an increase in use in the public but not in the private sector. Exemestane use had decreased for the public but remained the same in the private sector. The use of goserelin has increased tremendously in both the public and the private sector. Leuprorelin usage in the public had increased by six fold in 2007. Megestrol had been used only in the private sector.

Table 16.2 : Use of Antiendocrine Therapeutics by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
L02A A	**Oestrogens**			
L02A A01	Diethylstilbestrol	Public	-	-
		Private	-	-
		Total	-	-
L02A A02	Polyoestradiol phosphate	Public	-	-
		Private	-	-
		Total	-	-
L02A A04	Fosfestrol	Public	-	-
		Private	-	-
		Total	-	-
L02A B	**Progestogens**			
L02A B01	Megestrol	Public	-	-
		Private	0.0067	0.0062
		Total	0.0067	0.0062
L02A B02	Medroxyprogesterone	Public	0.0006	0.0001
		Private	0.0001	0.0001
		Total	0.0006	0.0002
L02A E	**Gonadotropin releasing hormone analogues**			
L02A E01	Buserelin	Public	<0.0001	-
		Private	<0.0001	0.0002
		Total	<0.0001	0.0002
L02A E02	Leuprorelin	Public	0.0019	0.0114
		Private	0.0069	0.0076
		Total	0.0088	0.0191
L02A E03	Goserelin	Public	0.0038	0.0173
		Private	0.0021	0.0131
		Total	0.0059	0.0304
L02A E04	Triptorelin	Public	0.0011	0.0010
		Private	0.0003	0.0003
		Total	0.0015	0.0014
L02B A	**Antioestrogens**			
L02B A01	Tamoxifen	Public	0.1664	0.1482
		Private	0.0622	0.0594
		Total	0.2287	0.2076
L02B A02	Toremifene	Public	-	-
		Private	-	-
		Total	-	-
L02B A03	Fulvestrant	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
L02B B	**Antiandrogen**			
L02B B01	Flutamide	Public	0.0018	0.0023
		Private	0.0007	0.0008
		Total	0.0025	0.0030
L02B B03	Bicalutamide	Public	0.0053	0.0094
		Private	0.0010	0.0037
		Total	0.0063	0.0131

ATC	Drug Class and Agents	Sector	2006	2007
L02B G	**Enzyme inhibitors**			
L02B G02	Formestane	Public	-	-
		Private	-	-
		Total	-	-
L02B G03	Anastrozole	Public	0.0067	0.0092
		Private	0.0043	0.0044
		Total	0.0110	0.0136
L02B G04	Letrozole	Public	0.0054	0.0112
		Private	0.0050	0.0063
		Total	0.0104	0.0176
L02B G06	Exemestane	Public	0.0006	<0.0001
		Private	0.0005	0.0005
		Total	0.0011	0.0006

IMMUNOSTIMULANTS

Colony stimulating factors are used as prophylaxis or treatment of neutropenia. Filgrastim with DDD of 0.004 was the most used colony stimulating factor and usage had almost doubled in 2007. The private sector started using Pegfilgrastim in 2007.

Interferons may be used in the treatment of renal cancer, Kaposi's sarcoma, haematological malignancies and non-malignant conditions. The use of Interferon was dominantly in the public sector. Interferon alfa-2b was more extensively used compared to interferon alfa-2a. However, its use had reduced by half in 2007. This may be due to availability of other new drugs for the above indications.

Table 16.3 : Use of Immunostimulants by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
L03A A	**Colony stimulating factor**			
L03A A02	Filgrastim	Public	0.0018	0.0028
		Private	0.0006	0.0012
		Total	0.0024	0.0040
L03A A03	Molgramostim	Public	-	-
		Private	-	-
		Total	-	-
L03A A10	Lenograstim	Public	0.0001	0.0001
		Private	<0.0001	0.0001
		Total	0.0002	0.0002
L03A A13	Pegfilgrastim	Public	-	-
		Private	-	0.0001
		Total	-	0.0001
L03A B	**Interferon**			
L03A B04	Interferon alfa-2a	Public	0.0005	0.0004
		Private	<0.0001	0.0002
		Total	0.0005	0.0006
L03A B05	Interferon alfa-2b	Public	0.0043	0.0018
		Private	<0.0001	0.0002
		Total	0.0044	0.0020

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CHAPTER 17 | USE OF SYSTEMIC CORTICOSTEROIDS AND IMMUNOSUPPRESSIVE AGENTS

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The list of drugs in this chapter includes mineralocorticoids, glucocorticoids and immunosuppressants such as calcineurin inhibitors, antimetabolites and biological agents.

The main corticosteroid used in 2007 was glucocorticoids where it was used in 0.47% of the general population. This was an increase of 6% compared to 2006 (Table 17.1). This amounted to 127,000 people on glucocorticoids daily, assuming the population of Malaysia was 27.1 million in 2007. This usage was lower in comparison to Australia where 1.37% of populations in 2007 were on systemic glucocorticoids. Prednisolone was the most commonly used glucocorticoids accounting for 71.2% of all glucocorticoids used. There was a 33.3% rise in the overall usage of prednisolone and this was due to the increased usage in the private sector (65.5%). An overall corresponding 39.8% reduction in the usage of hydrocortisone was reported and this was primarily due to the reduction in the usage in the private sector. This was probably due to the changing pattern in the prescription of systemic glucocorticoids in the private sector, with prednisolone gradually replacing hydrocortisone.

Based on the National Medicine Use Survey (NMUS) and assuming the population of Malaysia was 27.1 million in 2007, there should be about 1,135 people on cyclosporine A, 309 on tacrolimus and 813 on mycophenolic acid. However, data from the 16th Malaysian Dialysis and Transplant Registry, in December 2007, there were 1,732 patients with functioning kidney transplants with 1,198 people on cyclosporine A, 352 on tacrolimus and 907 on mycophenolic acid.[1] Even without taking into account other solid organ and bone marrow recipients, the actual numbers of renal transplant recipients on various immunosuppressants were bigger than those calculated based on NMUS.[2] This was probably due to a lower dose of immunosuppressants used in Malaysian population compared to the WHO proposed Defined Daily Dose (DDD) of these immunosuppressants used in this survey.

Despite minimal increase in the number of functioning renal transplants and other solid organ recipients from 2006 to 2007, there was 47% increase in the usage of mycophenolic acid. This was probably due to the increase in usage of mycophenolic acid in autoimmune diseases especially lupus nephritis.

Despite an increase in the number of transplant recipients, there was a decrease in the usage of cyclosporine (23.7%) and tacrolimus (20.8%) in 2007. This was likely due to the increased awareness of calcineurin inhibitor (CNI) nephrotoxicity that has led to the usage of CNI minimisation regime in Malaysian transplant recipients. Sirolimus usage in this country only began in 2007. The use of azathioprine has reduced by 17.7% as it has gradually been replaced by mycophenolic acid in both transplant and autoimmune diseases.

Etanercept began to be used in 2006 for rheumatoid arthritis and in 2007 there was a 50% increase in its usage, predominantly in the public sector. The number of people on infliximab remained the same over the 2-year period while the usage of efalizumab and adalimumab remained negligible. Methotrexate was used in 3,807 people in 2007.

Thalidomide is increasingly being used for multiple myeloma since 2006 and this was reflected by nearly 4 folds increase in its usage in 2007.

Table 17.1 : Use of Systemic Corticosteroids by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
H02A A	Mineralocorticoids	0.0034	0.0279
H02A B	Glucocorticoids	4.4427	4.7172

Table 17.2 : Use of Systemic Corticosteroids by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
H02A A	**Mineralocorticoids**			
H02A A02	Fludrocortisone	Public	0.0023	0.0218
		Private	0.0011	0.0062
		Total	0.0034	0.0279
H02A B	**Glucocorticoids**			
H02A B01	Betamethasone	Public	-	0.0002
		Private	0.4290	0.0671
		Total	0.4290	0.0673
H02A B02	Dexamethasone	Public	0.3200	0.3852
		Private	0.2740	0.2872
		Total	0.5940	0.6724
H02A B04	Methylprednisolone	Public	0.0866	0.0573
		Private	0.0561	0.0580
		Total	0.1427	0.1153
H02A B05	Paramethasone	Public	-	-
		Private	-	-
		Total	-	-
H02A B06	Prednisolone	Public	1.1766	1.1353
		Private	1.3429	2.2221
		Total	2.5194	3.3575
H02A B07	Prednisone	Public	-	-
		Private	-	-
		Total	-	-
H02A B08	Triamcinolone	Public	0.0133	0.0093
		Private	0.1078	0.1121
		Total	0.1211	0.1215
H02A B09	Hydrocortisone	Public	0.3073	0.3225
		Private	0.3291	0.0608
		Total	0.6364	0.3832
H02A B10	Cortisone	Public	-	-
		Private	-	-
		Total	-	-

Table 17.3 : Use of Immunosuppressive Agents by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
L04	Immunosuppressants	0.2093	0.3394

Table 17.4 : Use of Immunosuppressive Agents by Drug Class and Agents, in DDD/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
L04A A	**Selective immunosuppressants**			
L04A A06	Mycophenolic acid	Public	0.0157	0.0227
		Private	0.0046	0.0073
		Total	0.0203	0.0300
L04A A10	Sirolimus	Public	<0.0001	0.0003
		Private	-	-
		Total	<0.0001	0.0003
L04A A13	Leflunomide	Public	0.0077	0.0133
		Private	0.0069	0.0054
		Total	0.0146	0.0187
L04A A18	Everolimus	Public	-	-
		Private	-	-
		Total	-	-
L04A A21	Efalizumab	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
L04A B	**Tumour necrosis factor alfa (TNF-α) inhibitors**			
L04A B01	Etanercept	Public	0.0001	0.0006
		Private	0.0009	0.0009
		Total	0.0010	0.0015
L04A B02	Infliximab	Public	0.0001	0.0002
		Private	0.0036	0.0035
		Total	0.0037	0.0037
L04A B04	Adalimumab	Public	-	-
		Private	-	0.0002
		Total	-	0.0002
L04A C	**Interleukin Inhibitors**			
L04A C01	Daclizumab	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
L04A C02	Basiliximab	Public	<0.0001	<0.0001
		Private	-	<0.0001
		Total	<0.0001	<0.0001
L04A D	**Calcineurin inhibitors**			
L04A D01	Ciclosporin	Public	0.0519	0.0389
		Private	0.0030	0.0030
		Total	0.0549	0.0419
L04A D02	Tacrolimus	Public	0.0139	0.0088
		Private	0.0005	0.0026
		Total	0.0144	0.0114

ATC	Drug Class and Agents	Sector	2006	2007
L04A X	**Other immunosuppressants**			
L04A X01	Azathioprine	Public	0.0856	0.0686
		Private	0.0084	0.0087
		Total	0.0939	0.0773
L04A X02	Thalidomide	Public	0.0015	0.0092
		Private	0.0012	0.0047
		Total	0.0028	0.0138
L04A X03	Methotrexate	Public	-	0.0818
		Private	0.0036	0.0587
		Total	0.0036	0.1405

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CHAPTER 18 | USE OF DRUGS FOR RHEUMATOLOGICAL AND BONE DISORDERS

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Anti-inflammatory and antirheumatic products ranked 8th as the most used drugs by therapeutic group in Malaysia in 2007 (12.311DDD/1000 population/day) with estimated 1.23% population utilising them. The acetic acid derivatives and related substances were the most used Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) by drug class (4.48DDD/1000 population/day) followed by the fenamates (3.48), coxibs (1.83) and oxicams (1.28). Diclofenac acid was the most consumed NSAID (1.11 and 2.92DDD/1000 population/day, public and private sectors respectively). The second commonest NSAID used was mefenamic acid (total DDD 3.48).

The newer group of NSAIDs which are more cyclooxygenase-2 (COX-2) selective called coxibs (DDD 1.83) saw an increase in usage from the previous year. This is due to the reduced gastrointestinal side effects of the coxibs. Etoricoxib (DDD 0.91) was mainly used by private hospitals (78%) while celecoxib was mainly prescribed in the public hospitals (63.7%). The usage of celecoxib has doubled in public hospitals in 2007 (DDD 0.58) compared to 2006 (DDD 0.27). However, Malaysians consumed less anti-inflammatory and antirheumatic products (DDD 12.311) compared to Nordic countries (DDD 53.14) in 2007.[1] In Australia, coxibs (DDD 10.27) were the highest prescribed, followed closely by Oxicams (DDD 8.28) and acetic acid derivatives (DDD 5.56).[2]

Among all the drugs for rheumatological and bone disorders, anti-inflammatory and antirheumatic products ranked the highest (DDD 12.311), followed by antigout preparations (DDD 1.77), then drugs for treatment of bone diseases (DDD 0.6338). This can be explained by the increasing burden of musculoskeletal diseases in this country.[3]

For the usage of antirheumatic drugs, statistics showed that the usage is in increasing trend for all drug classes except penicillamine and similar agents. The emergence of newer disease-modifying antirheumatic drugs (DMARD) has resulted in the usage of penicillamine to remain in status quo. There is no usage of butylpyrazolidines in both private and public practices due to the availability of newer and better options of treatment.

As for antigout preparations, all drugs are in increasing trend. This is probably due to lifestyle changes in our population.[4]

The three commonest muscle relaxants prescribed were orphenadrine, baclofen and eperisone. Generally, all are in increasing trend except the use of eperisone in total.[5] The public hospitals used baclofen more to treat non-inflammatory muscle spasm e.g., in cerebral palsy. Dantrolene, another muscle relaxant, is rarely used in Malaysia because it is reserved for malignant hyperthermia.

Increased demand in usage of antiosteoporosis drugs is expected with increasing lifespan and awareness in health professionals as well as patients. The three commonest drugs used in 2007 were the biphosphonates, followed by selective oestrogen receptor modulators (SORMs) and calcitonin groups. The usage of combination of alendronic acid with cholecalciferol showed remarkable increment compared to alendronic acid alone. This is not unexpected as this is more economical. The weekly or monthly dosing of bisphosphonates resulting in better compliance made their usage popular. Strontium emerged as a new drug for osteoporosis. However, it was only available in private institutions in 2007.

Table 18.1 : Use of Drugs for Rheumatological and Bone Disorders, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007	Trend (%)
G03X C	Selective oestrogen receptor modulators	0.1293	0.1277	-1.25
H05B A	Calcitonin preparations	0.0058	0.0081	39.66
M01	Anti-inflammatory and antirheumatic products	9.9729	12.311	23.44
M03	Muscle relaxants	0.5549	0.3302	-40.49
M04	Antigout preparations	1.5347	1.7736	15.57
M05	Drugs for treatment of bone diseases	0.4360	0.6142	40.87

Table 18.2.1 : Use of Non-Steroidal Anti-Inflammatory Drugs by Drug Class, in DDD/1000 population/ day 2006-2007

ATC	Drug Class	2006	2007	Trend (%)
M01A A	Butylpyrazolidines	-	-	-
M01A B	Acetic acid derivatives and related substances	4.0494	4.4801	10.64
M01A C	Oxicams	1.0311	1.2836	24.49
M01A E	Propionic acid derivatives	0.8315	1.088	30.85
M01A G	Fenamates	2.6833	3.4759	29.54
M01A H	Coxibs	1.2649	1.8349	45.06
M01A X	Other anti-inflammatory and antirheumatic agents, non-steroids	0.1078	0.1432	19.89
M01C C	Penicillamine and similar agents	0.0050	0.0053	6.00

Table 18.2.2 : Use of Non-Steroidal Anti-Inflammatory Drugs by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M01A A	**Butylpyrazolidines**				
M01A A01	Phenylbutazone	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A A02	Mofebutazone	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A A03	Oxyphenbutazone	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A A05	Clofezone	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A B	**Acetic acid derivatives and related substances**				
M01A B01	Indometacin	Public	0.3642	0.3474	-4.61
		Private	0.0897	0.1010	12.60
		Total	0.4539	0.4484	-1.21
M01A B02	Sulindac	Public	-	-	-
		Private	<0.0001	-	-
		Total	<0.0001	-	-
M01A B05	Diclofenac	Public	1.4652	1.1058	-24.53
		Private	2.1251	2.9248	37.63
		Total	3.5902	4.0306	12.27

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M01A B	**Acetic acid derivatives and related substances**				
M01A B06	Alclofenac	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A B11	Acemetacin	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A B15	Ketorolac	Public	0.0007	0.0007	0.00
		Private	0.0045	0.0003	-93.33
		Total	0.0052	0.0010	-80.77
M01A B16	Aceclofenac	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A B55	Diclofenac, combinations	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A C	**Oxicams**				
M01A C01	Piroxicam	Public	0.0538	0.0380	-29.37
		Private	0.3958	0.5405	36.56
		Total	0.4496	0.5785	28.67
M01A C02	Tenoxicam	Public	0.0001	-	-
		Private	0.0372	0.0535	43.82
		Total	0.0373	0.0535	43.43
M01A C06	Meloxicam	Public	0.1999	0.2418	20.96
		Private	0.3443	0.4098	19.02
		Total	0.5443	0.6517	19.73
M01A E	**Propionic acid derivatives**				
M01A E01	Ibuprofen	Public	0.1584	0.1111	-29.86
		Private	0.2328	0.3513	50.90
		Total	0.3912	0.4624	18.20
M01A E02	Naproxen	Public	0.0981	0.0935	-4.69
		Private	0.3248	0.5133	58.04
		Total	0.4229	0.6068	43.49
M01A E03	Ketoprofen	Public	0.0106	0.0047	-53.49
		Private	0.0068	0.0141	107.33
		Total	0.0174	0.0188	8.05
M01A E09	Flurbiprofen	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A E11	Tiaprofenic acid	Public	-	-	-
		Private	-	-	-
		Total	-	-	-

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M01A G	**Fenamates**				
M01A G01	Mefenamic acid	Public	1.2609	1.4147	12.20
		Private	1.4223	2.0612	44.92
		Total	2.6833	3.4759	29.54
M01A G02	Tolfenamic acid	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A G03	Flufenamic acid	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A H	**Coxibs**				
M01A H01	Celecoxib	Public	0.2733	0.5791	111.89
		Private	0.3151	0.3324	5.49
		Total	0.5884	0.9114	54.89
M01A H02	Rofecoxib	Public	-	-	-
		Private	-	<0.0001	-
		Total	-	<0.0001	-
M01A H03	Valdecoxib	Public	-	-	-
		Private	0.0014	0.0007	-50.00
		Total	0.0014	0.0007	-50.00
M01A H04	Parecoxib	Public	0.0008	0.0014	75.00
		Private	0.0038	0.0047	23.68
		Total	0.0046	0.0062	34.78
M01A H05	Etoricoxib	Public	0.0604	0.2038	237.42
		Private	0.6101	0.7126	16.80
		Total	0.6705	0.9165	36.69
M01A X	**Other anti-inflammatory and antirheumatic agents, non-steroids**				
M01A X02	Niflumic acid	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A X05	Glucosamine	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A X07	Benzydamine	Public	-	0.0001	
		Private	-	-	-
		Total	-	0.0001	
M01A X13	Proquazone	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01A X17	Nimesulide	Public	-	-	-
		Private	0.1078	0.1431	32.75
		Total	0.1078	0.1431	32.75

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M01C B	**Gold preparations**				
M01C B04	Aurothioglucose	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M01C C	**Penicillamine and similar agents**				
M01C C01	Penicillamine	Public	0.0048	0.0051	26.52
		Private	0.0002	0.0002	0.00
		Total	0.0050	0.0053	6.00

Table 18.3.1 : Use of Muscle Relaxants by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M03B	**Muscle relaxants, centrally acting agents**				
M03B A01	Phenprobamate	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M03B B03	Chlorzoxazone	Public	-	-	-
		Private	-	0.0035	
		Total	-	0.0035	
M03B B52	Chlormezanone, combinations excl. psycholeptics	Public	-	-	-
		Private	0.2807	0.0357	-87.28
		Total	0.2807	0.0357	-87.28
M03B B53	Chlorzoxazone, combinations excl. psycholeptics	Public	-	-	-
		Private	0.0266	0.0240	-9.77
		Total	0.0266	0.0240	-9.77
M03B C01	Orphenadrine (citrate)	Public	0.0153	0.0071	-33.59
		Private	0.0848	0.1280	50.94
		Total	0.1001	0.1350	34.87
M03B X01	Baclofen	Public	0.0504	0.0572	13.49
		Private	0.0044	0.0060	36.36
		Total	0.0548	0.0632	15.33
M03B X09	Eperisone	Public	0.0236	0.0332	40.68
		Private	0.0690	0.0357	-48.26
		Total	0.0927	0.0689	-25.67
M03B X30	Fenyramidol	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M03C	**Muscle relaxants, directly acting agents**				
M03C A01	Dantrolene	Public	-	<0.0001	
		Private	-	<0.0001	
		Total	-	<0.0001	

Table 18.4.1 : Use of Antigout Preparations by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M04A	**Antigout preparations**				
M04A A01	Allopurinol	Public	0.9627	1.0825	12.44
		Private	0.3601	0.4317	19.88
		Total	1.3227	1.5142	14.48
M04A B01	Probenecid	Public	0.0004	0.0023	475.00
		Private	0.0031	0.0032	3.23
		Total	0.0036	0.0055	52.78
M04A C01	Colchicine	Public	0.0664	0.0616	-7.23
		Private	0.1421	0.1923	35.33
		Total	0.2084	0.2538	21.79

Table 18.5.1 : Use of Bone Diseases Therapy by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
M05	**Drugs for treatment of bone diseases**				
M05B A01	Etidronic acid	Public	-	-	-
		Private	0.0005	0.0011	120.00
		Total	0.0005	0.0011	120.00
M05B A02	Clodronic acid	Public	0.0018	0.0015	-16.67
		Private	0.0020	0.0025	25.00
		Total	0.0038	0.0040	5.26
M05B A03	Pamidronic acid	Public	0.0003	0.0004	33.33
		Private	<0.0001	<0.0001	0.00
		Total	0.0004	0.0004	0.00
M05B A04	Alendronic acid	Public	0.2570	0.2858	11.21
		Private	0.1148	0.0632	-44.96
		Total	0.3718	0.3490	-6.13
M05B A06	Ibandronic acid	Public	-	-	-
		Private	<0.0001	-	-
		Total	<0.0001	-	-
M05B A07	Risedronic acid	Public	0.0036	0.0034	-5.56
		Private	0.0212	0.0305	43.67
		Total	0.0248	0.0339	36.69
M05B A08	Zolendronic acid	Public	<0.0001	<0.0001	-
		Private	<0.0001	0.0002	-
		Total	0.0002	0.0003	50.00
M05B B01	Etidronic acid and calcium, sequential	Public	-	-	-
		Private	-	-	-
		Total	-	-	-
M05B B03	Alendronic acid and cholecalciferol	Public	0.0004	0.0979	Significantly increased
		Private	0.0341	0.1053	208.80
		Total	0.0345	0.2032	488.99
M05B X03	Strontium ranelate	Public	-	-	-
		Private	-	0.0222	-
		Total	-	0.0222	-

Table 18.6.1 : Use of Selective Oestrogen Receptor Modulators by Drug Class and Agents, in DDD/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
G03	**Sex hormones and modulators of the genital system**				
G03X C01	Raloxifene	Public	0.0646	0.0638	-1.24
		Private	0.0647	0.0639	-1.24
		Total	0.1293	0.1277	-1.24

Table 18.7.1 : Use Calcitonin preparations of by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007	Trend (%)
H05	**Calcium homeostasis**				
H05B A01	Calcitonin (salmon synthetic)	Public	0.0044	0.0056	27.27
		Private	0.0013	0.0025	92.31
		Total	0.0058	0.0081	39.66

References:

1. Nordic Medico Statistical Committee. Medicines Consumption in the Nordic Countries 2004-2008. Copenhagen 2009
2. Australian Government Department of Health and Ageing. Australian Statistics on Medicines. 2007 13th Edition. Commonwealth of Australia 2009
3. Institute for Health Management. Malaysian Burden of Disease and Injury Study. Ministry of Health 2004
4. National Clinical Practice Guidelines Management of Gout. Ministry of Health Malaysia 2008
5. Pharmaceutical Services Division & Clinical Research Centre. Malaysian Statistics on Medicines 2006. Ministry of Health Malaysia 2009

CHAPTER 19 | USE OF OPIOID ANALGESICS

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Drugs used for pain control belong to the following subgroups of the ATC classification: anti-inflammatory products, opioids, analgesics and antipyretics. This chapter covers only opioid analgesics.

The total opioid consumption in Malaysia in 2007 was 0.4184 DDD/1000 population/day with decreasing trend compared to 2006 (0.556 DDD/1000 population/day). This figure is very much lower than the opioid consumption in Australia (8.216 DDD/1000 population/day),[1] and that in the Nordic countries, which ranged from 6.0 DDD/1000 population/day in Greenland to 20.2 DDD/1000 population/day in Sweden.[2]

Weak opioids were more commonly used than strong opioids. The combined use of all the weak opioids (dihydrocodeine, tramadol and tramadol combinations) was 0.3247 DDD/1000 population/day, which is much more than that of all the strong opioids (morphine, oxycodone, pethidine and fentanyl) which totalled 0.0915. This pattern is different from Australia[1] and the Nordic countries[2], where the total consumption of strong opioids is higher than that of weak opioids.

The most commonly used strong opioid was morphine, which had much higher use than fentanyl, pethidine and oxycodone - the total use of morphine alone was more than that of the other 3 strong opioids together. Of the weak opioids, tramadol was the most commonly used (0.2544 DDD/1000 population/day), and this has increased from 2006 (0.1971 DDD/100 population/day). The use of dihydrocodeine and tramadol combinations remained about the same from 2006 to 2007, but was only about 10-15% of that of tramadol. One possible reason that tramadol is the most commonly used opioid in Malaysia may be that tramadol and its combinations are not controlled under the Dangerous Drugs Act (DDA) which makes it more accessible.

Table 19.1 : Use of Analgesics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N02A	Opioids	0.5763	0.4184

Table 19.1.2 : Use of Analgesics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N02A A	Natural opium alkaloids	0.2838	0.0778
N02A B	Phenylpiperidine derivatives	0.0451	0.0410
N02A D	Benzomorphan derivatives	<0.0001	<0.0001
N02A F	Morphinan derivatives	0.0019	0.0016
N02A X	Other opioids	0.2454	0.2973

Table 19.2 : Use of Opioid Analgesics by Drug Class, Agents and Administration Route, in DDD/ 1000population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006					2007				
			AdmR Code O	AdmR Code P	AdmR Code TD	AdmR Code SL	Total	AdmR Code O	AdmR Code P	AdmR Code TD	AdmR Code SL	Total
N02A A	**Natural opium alkaloids**											
N02A A01	Morphine	Public	0.0211	0.0248	-	-	0.0459	0.0203	0.0205	-	-	0.0409
		Private	0.0026	0.0062	-	-	0.0088	0.0020	0.0045	-	-	0.0065
		Total	0.0237	0.0310	-	-	0.0547	0.0223	0.0251	-	-	0.0474
N02A A05	Oxycodone	Public	0.0004	-	-	-	0.0004	0.0018	-	-	-	0.0018
		Private	0.0004	-	-	-	0.0004	0.0012	-	-	-	0.0012
		Total	0.0008	-	-	-	0.0008	0.0030	-	-	-	0.0030
N02A A08	Dihydrocodeine	Public	0.0161	-	-	-	0.0161	0.0153	-	-	-	0.0153
		Private	0.0189	-	-	-	0.0189	0.0121	-	-	-	0.0121
		Total	0.0350	-	-	-	0.0350	0.0274	-	-	-	0.0274
N02A A59	Codeine, combinations excl. psycholeptics	Public	-	-	-	-	-	-	-	-	-	-
		Private	0.1934	-	-	-	0.1934	-	-	-	-	-
		Total	0.1934	-	-	-	0.1934	-	-	-	-	-

ATC	Drug Class and Agents	Sector	2006					2007				
			AdmR Code O	AdmR Code P	AdmR Code TD	AdmR Code SL	Total	AdmR Code O	AdmR Code P	AdmR Code TD	AdmR Code SL	Total
N02A B	**Phenylpiperidine derivatives**											
N02A B02	Pethidine	Public	-	0.0085	-	-	0.0085	-	0.0074	-	-	0.0074
		Private	-	0.0088	-	-	0.0088	-	0.0051	-	-	0.0051
		Total	-	0.0173	-	-	0.0173	-	0.0125	-	-	0.0125
N02A B03	Fentanyl	Public	-	-	0.0226	-	0.0226	-	-	0.0200	-	0.0200
		Private	-	-	0.0052	-	0.0052	-	-	0.0086	-	0.0086
		Total	-	-	0.0278	-	0.0278	-	-	0.0286	-	0.0286
N02A D	**Benzomorphan derivatives**											
N02A D01	Pentazocine	Public	-	-	-	-	-	-	-	-	-	-
		Private	-	<0.0001	-	-	<0.0001	-	<0.0001	-	-	<0.0001
		Total	-	<0.0001	-	-	<0.0001	-	<0.0001	-	-	<0.0001
N02A E	**Oripavine derivatives**											
N02A E01	Buprenorphine	Public	-	-	-	-	-	-	-	-	-	-
		Private	-	-	-	-	-	-	-	-	0.0007	0.0007
		Total	-	-	-	-	-	-	-	-	0.0007	0.0007
N02A F	**Morphinan derivatives**											
N02A F01	Butorphanol	Public	-	-	-	-	-	-	-	-	-	-
		Private	-	-	-	-	-	-	-	-	-	-
		Total	-	-	-	-	-	-	-	-	-	-
N02A F02	Nalbuphine	Public	-	0.0013	-	-	0.0013	-	0.0012	-	-	0.0012
		Private	-	0.0006	-	-	0.0006	-	0.0003	-	-	0.0003
		Total	-	0.0019	-	-	0.0019	-	0.0016	-	-	0.0016
N02A X	**Other opioids**											
N02A X02	Tramadol	Public	0.1460	0.0084	-	-	0.1544	0.2084	0.0121	-	-	0.2205
		Private	0.0397	0.0030	-	-	0.0427	0.0316	0.0022	-	-	0.0338
		Total	0.1857	0.0114	-	-	0.1971	0.2401	0.0143	-	-	0.2544
N02A X52	Tramadol, combinations	Public	0.0003	-	-	-	0.0003	0.0014	-	-	-	0.0014
		Private	0.0481	-	-	-	0.0481	0.0416	-	-	-	0.0416
		Total	0.0483	-	-	-	0.0483	0.0429	-	-	-	0.0429

References:

1. Australian Government Department of Health and Ageing. Australian Statistics on Medicines. 2007 13th Edition. Commonwealth of Australia 2009

2. Nordic Medico Statistical Committee. Medicines Consumption in the Nordic Countries 1999-2003. Copenhagen 2004

CHAPTER 20 | USE OF DRUGS FOR NEUROLOGICAL DISORDERS

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In 2007, there were four major categories of neurological drugs being analysed. These include the antiepileptics (AEDs), drugs for Parkinson's Disease (PD), antimigraine preparations and Central Nervous System (CNS) drugs for other nervous system disorders. The later drugs were grouped together as '*other nervous system drugs'.*

AEDs were the largest group of neurological drugs dispensed nationwide with the total utilisation of 1.64 DDD/1000 population/day. This translates to a rough estimation of about 0.16% of our population being diagnosed with epilepsy. However, it should be noted that some of these AEDs were also indicated for other conditions such as neuropathic pain and bipolar mood disorders.

Among the older AEDs group, the most commonly prescribed drug remains unchanged, the drug being phenytoin (0.4754DDD/1000 population/day). This was followed by sodium valproate (0.4357DDD/1000 population/day) and carbamazepine (0.3383DDD/1000 population/day). However, there was a two-fold increase in the utilisation of sodium valproate in the private sector. This significant increase could be due to the drug having relatively lesser adverse drug reactions compared to the other older AEDs as well as the broad spectrum characteristic of sodium valproate. There was, however, a slight decrease in phenytoin usage in both the government and private sector and this may be in concordance with the Malaysian Epilepsy Guidelines whereby phenytoin is recommended as the second line choice for generalised seizure.[1] Nevertheless, it still remains as the treatment of choice for status epilepticus after the benzodiazepines.[1]

Use of phenobarbitone (0.1018DDD/1000 population/day), clonazepam (0.0528DDD/1000 population/day), and primidone (0.0038DDD/1000 population/day) was limited and this was most likely related to their sedative side effects, particularly with clonazepam. Benzodiazepines, however, have a particularly prominent role in myoclonus and movement disorders.[1]

Among the newer AEDs, gabapentin (0.0833DDD/1000 population/day), levetiracetam (0.073DDD/1000 population/day) and lamotrigine (0.0557DDD/1000 population/day), were more commonly used compared to topiramate (0.0183DDD/1000 population/day), vigabatrin (0.0002DDD/1000 population/day) and pregabalin (0.0002DDD/1000 population/day). In our clinical practice, gabapentin and pregabalin were widely used for the treatment of neuropathic pain rather than epilepsy.[1] However, there was an exponential surge in the usage of the newer AEDs, especially with levetiracetam (0.0089 to 0.049DDD/1000 population/day) in the private sector. In the public sector, a similar trend was also noted but to a lesser extent. This increase can be explained by the fact that the newer AEDs have better safety profiles and better clinical efficacy.[1] However, the overall usage for the newer AEDs was still low when compared to the older AEDs as their use was limited by their higher cost.

The prescribing trend of AEDs in Australia was similar whereby there was a higher usage of the older AEDs like sodium valproate (3.711DDD/1000 population/day)[2], carbamazepine (1.851DDD/1000population/day)[2] and phenytoin (1.581DDD/1000 population/day).[2] In descending order of frequency, the most commonly used newer AEDs were lamotrigine (0.991DDD/1000 population/day)[2] followed by gabapentin (0.471DDD/1000 population/day)[2], levetiracetam (0.471DDD/1000 population/day)[2], topiramate (0.291DDD/1000 population/day)[2], pregabalin (0.221DDD/1000 population/day)[2], oxcarbazepine (0.061DDD/1000 population/day)[2] and vigabatrin (0.0481DDD/1000 population/day) [2].

The five main classes of drugs available for PD are the levodopa (+ peripheral dopamine decarboxylase inhibitors), dopamine agonists, anticholinergics, amantadine and the enzyme inhibitors.[3] Trihexyphenidyl (Artane) was the most commonly prescribed drug (0.5417 DDD/1000 population/day). It is used mainly for tremor in PD[3] but it is also widely used for the prevention and treatment of psycholeptic-induced extrapyramidal syndrome (EPS).

Table 20.1 : Use of Drugs for Neurological Disorders, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N02C	Antimigraine preparations	0.1065	0.0768
N03	Antiepileptics	1.5024	1.6368
N04	Antiparkinson drugs	0.8803	0.8094
N06D	Antidementia drugs	0.0236	0.0655
N07	Other nervous system drugs	1.0408	1.1162

Table 20.2 : Use of Antiepileptics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N03A	Antiepileptics	1.5024	1.6368
N03A A	Barbiturates and derivatives	0.1231	0.1057
N03A B	Hydantoin derivatives	0.5077	0.4754
N03A C	Oxazolidine derivatives	-	-
N03A D	Succinimide derivatives	-	<0.0001
N03A E	Benzodiazepine derivatives	0.0483	0.0528
N03A F	Carboxamide derivatives	0.3172	0.3392
N03A G	Fatty acid derivatives	0.4019	0.4358
N03A X	Other antiepileptics	0.1042	0.2278

Table 20.3 : Use of Antiepileptics by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N03A A	**Barbiturates and derivatives**			
N03A A02	Phenobarbital	Public	0.1062	0.0809
		Private	0.0153	0.0209
		Total	0.1215	0.1018
N03A A03	Primidone	Public	0.0013	0.0010
		Private	0.0002	0.0029
		Total	0.0015	0.0038
N03A B	**Hydantoin derivatives**			
N03A B02	Phenytoin	Public	0.4641	0.4317
		Private	0.0436	0.0437
		Total	0.5077	0.4754
N03A B05	Fosphenytoin	Public	-	-
		Private	-	-
		Total	-	-
N03A C	**Oxazolidine derivatives**			
N03A C02	Trimethadione	Public	-	-
		Private	-	-
		Total	-	-
N03A D	**Succinimide derivatives**			
N03A D01	Ethosuximide	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
N03A D03	Mesuximide	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N03A E	**Benzodiazepine derivatives**			
N03A E01	Clonazepam	Public	0.0399	0.0428
		Private	0.0085	0.0100
		Total	0.0483	0.0528
N03A F	**Carboxamide derivatives**			
N03A F01	Carbamazepine	Public	0.2905	0.3134
		Private	0.0236	0.0249
		Total	0.3142	0.3383
N03A F02	Oxcarbazepine	Public	0.0002	0.0001
		Private	0.0027	0.0008
		Total	0.0030	0.0009
N03A G	**Fatty acid derivatives**			
N03A G01	Valproic acid	Public	0.3673	0.3709
		Private	0.0342	0.0647
		Total	0.4015	0.4357
N03A G04	Vigabatrin	Public	0.0001	<0.0001
		Private	0.0003	0.0001
		Total	0.0004	0.0002
N03A X	**Other antiepileptics**			
N03A X09	Lamotrigine	Public	0.0380	0.0525
		Private	0.0033	0.0031
		Total	0.0412	0.0557
N03A X11	Topiramate	Public	0.0056	0.0127
		Private	0.0003	0.0057
		Total	0.0059	0.0183
N03A X12	Gabapentin	Public	0.0221	0.0476
		Private	0.0159	0.0357
		Total	0.0380	0.0833
N03A X14	Levetiracetam	Public	0.0101	0.0213
		Private	0.0089	0.0490
		Total	0.0191	0.0703
N03A X15	Zonisamide	Public	-	-
		Private	-	-
		Total	-	-
N03A X16	Pregabalin	Public	-	<0.0001
		Private	-	0.0002
		Total	-	0.0002

Levodopa is the gold standard for PD[3] with a usage of 0.1747DDD/1000 population/day. Entacapone, a catechol-o-methytransferase (COMT) inhibitor, which must be consumed together with levodopa,[3] had 0.0117DDD/1000 population/day. Stalevo, a 3-in-1 preparation consisting of levodopa, carbidopa and entacapone showed very little usage at 0.0046DDD/1000 population/day.

Among the dopamine agonists (DAs), the commonly used drugs in descending order of frequency were: piribedil (0.0123DDD/1000 population/day), ropinirole (0.0067DDD/1000 population/day), pramipexole (0.0013DDD/1000 population/day) and bromocriptine (0.0005DDD/1000 population/day). Amantadine (0.0075DDD/1000 population/day), a tricyclic amine, is used primarily for the treatment of levodopa-induced dyskinesias.[3] It is also has a role in the initial treatment of PD. Selegiline (0.0468DDD/1000 population/day), a monoamine oxidase B inhibitor, is being used in early stages of PD as a neuroprotective agent.[3]

The prescribing practice in Australia differed slightly from the Malaysian practice with the levodopa group (1.401DDD/1000 population/day) having the highest usage as compared to the anticholinergics.[2] Among the anticholinergics, benzatropine[2] (0.481DDD/1000 population/day) which is not widely available in the local public hospitals was more commonly prescribed compared to Artane (0.1351DDD/1000 population/day). The DAs as well as amantadine showed the lowest level of usage with bromocriptine (0.011DDD/1000 population/day)[2], ropinirole (0.0061DDD/1000 population/day)[2], and amantadine (0.1021DDD/1000 population/day). The usage of entacapone (0.091DDD/1000 population/day) and stalevo (0.071DDD/1000 population/day)[2] were much higher compared to selegiline (0.091DDD/1000 population/day).[2]

Table 20.4 : Use of Antiparkinsons by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N04A	Anticholinergic agents	0.6121	0.5431
N04A A	Tertiary amines	0.6094	0.5423
N04A B	Ethers chemically close to antihistamines	0.0004	-
N04A C	Ethers of tropine or tropine derivatives	0.0023	0.0008
N04B	Dopaminergic agents	0.2682	0.2663
N04B A	Dopa and dopa derivatives	0.1739	0.1793
N04B B	Adamantane derivatives	0.0066	0.0075
N04B C	Dopamine agonists	0.0155	0.0209
N04B D	Monoamine oxidase B inhibitors	0.0604	0.0468
N04B X	Other dopaminergic agents	0.0118	0.0117

Table 20.5 : Use of Antiparkinsons by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N04A A	**Tertiary amines**			
N04A A01	Trihexyphenidyl	Public	0.5887	0.5049
		Private	0.0204	0.0368
		Total	0.6091	0.5417
N04A A02	Biperiden	Public	-	-
		Private	-	-
		Total	-	-
N04A A04	Procyclidine	Public	0.0003	0.0007
		Private	<0.0001	<0.0001
		Total	0.0003	0.0007
N04A B	**Ethers chemically close to antihistamines**			
N04A B02	Orphenadrine (chloride)	Public	-	-
		Private	0.0004	-
		Total	0.0004	-

ATC	Drug Class and Agents	Sector	2006	2007
N04A C	**Ethers of tropine or tropine derivatives**			
N04A C01	Benzatropine	Public	0.0020	0.0008
		Private	0.0003	-
		Total	0.0023	0.0008
N04B A	**Dopa and dopa derivatives**			
N04B A02	Levodopa and decarboxylase inhibitor	Public	0.1549	0.1573
		Private	0.0173	0.0174
		Total	0.1722	0.1747
N04B A03	Levodopa, decarboxylase inhibitor and COMT inhibitor	Public	0.0008	0.0034
		Private	0.0009	0.0013
		Total	0.0017	0.0046
N04B B	**Adamantane derivatives**			
N04B B01	Amantadine	Public	0.0029	0.0042
		Private	0.0036	0.0033
		Total	0.0066	0.0075
N04B C	**Dopamine agonists**			
N04B C01	Bromocriptine	Public	0.0061	0.0005
		Private	0.0002	<0.0001
		Total	0.0063	0.0005
N04B C04	Ropinirole	Public	0.0006	0.0053
		Private	0.0006	0.0013
		Total	0.0012	0.0067
N04B C05	Pramipexole	Public	-	0.0002
		Private	0.0003	0.0012
		Total	0.0003	0.0013
N04B C06	Cabergoline	Public	-	-
		Private	-	-
		Total	-	-
N04B C07	Apomorphine	Public	-	-
		Private	-	-
		Total	-	-
N04B C08	Piribedil	Public	0.0068	0.0107
		Private	0.0009	0.0016
		Total	0.0077	0.0123
N04B D	**Monoamine oxidase B inhibitors**			
N04B D01	Selegiline	Public	0.0540	0.0417
		Private	0.0065	0.0051
		Total	0.0604	0.0468
N04B X	**Other dopaminergic agents**			
N04B X02	Entacapone	Public	0.0109	0.0109
		Private	0.0009	0.0008
		Total	0.0118	0.0117

The total utilisation of antimigraine preparations in Malaysia was 0.0768DDD/1000 population/day. The most commonly used drug for the acute relief of migrainous attack was ergot in combination with psycholeptic (0.0463DDD/1000 population/day), followed by sumatriptan, a selective serotonin (5HT1) agonist (0.0069DDD /1000population/day) and ergotamine (0.0005DDD /1000 population/day), which is not available in public hospitals due to its low safety profile. As for prophylactic treatment[4] flunarizine, a calcium channel blocker, (0.0690 DDD/1000 population/day) was the drug most commonly prescribed, followed by pizotifen, a serotonin antagonist (0.0231DDD /1000 population/day).[4] The other prophylactic agents used (not surveyed) were beta blockers (e.g. propranolol, atenolol), tricyclic antidepressants (amitriptyline) and AEDs (eg: sodium valproate, topiramate).[4] There was also no survey made on other abortive drugs like paracetamol, COX-2 inhibitors, NSAIDs, opioids or corticosteroids. In Australia, sumatriptan (0.26 DDD/1000 population/day)[3] had the highest usage for acute migrainous attacks, followed by the newer triptans, eg: zolmitriptans (0.09 DDD/1000 population/day)[3] and naratriptan (0.06 DDD/1000 population/day)[3] and the ergot alkaloid methysergide (0.03 DDD/1000 population/day)[3]. Methysergide is no longer listed as antimigranous drug locally.[3]

Table 20.6 : Use of Antimigraine Preparations by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N02C	Antimigraine preparations	0.1065	0.0768
N02C A	Ergot alkaloids	0.0705	0.0468
N02C B	Corticosteroid derivatives	-	-
N02C C	Selective serotonin (5HT1) agonists	0.0087	0.0069
N02C X	Other antimigraine preparations	0.0273	0.0231

Table 20.7 : Use of Antimigraine Preparations by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N02C A	**Ergot alkaloids**			
N02C A01	Dihydroergotamine	Public	-	-
		Private	-	-
		Total	-	-
N02C A02	Ergotamine	Public	-	-
		Private	0.0001	0.0005
		Total	0.0001	0.0005
N02C A72	Ergotamine, combinations with psycholeptics	Public	0.0003	0.0014
		Private	0.0701	0.0449
		Total	0.0704	0.0463
N02C B	**Corticosteroid derivatives**			
N02C B01	Flumedroxone	Public	-	-
		Private	-	-
		Total	-	-
N02C C	**Selective serotonin (5HT1) agonists**			
N02C C01	Sumatriptan	Public	0.0020	0.0035
		Private	0.0067	0.0033
		Total	0.0087	0.0069
N02C C03	Zolmitriptan	Public	-	-
		Private	-	-
		Total	-	-
N02C C04	Rizatriptan	Public	-	-
		Private	-	-
		Total	-	-
N02C C07	Frovatriptan	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N02C X	**Other antimigraine preparations**			
N02C X01	Pizotifen	Public	0.0183	0.0198
		Private	0.0090	0.0033
		Total	0.0273	0.0231
N02C X02	Clonidine	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001

The other nervous system drugs are categorised as anticholinesterases (neostigmine, pyridostigmine), antivertigo and immunomodulating. Pyridostigmine (0.0748DDD/1000 population/day), for treatment of Myastenia Gravis (MG) was most commonly dispensed followed by neostigmine (0.0287DDD/1000 population/day). Neostigmine, which is available only in the injection formulation, is usually used with caution in the diagnosis of MG and myasthenic crisis. For the antivertigo drugs, cinnarizine was the most preferred drug with 0.3351DDD/1000 population/day followed by betahistine with 0.3857DDD /1000 population/day. The immunomodulating drugs, namely Interferon beta 1-a (Rebif) and beta 1-b (Betaferon) are used in the treatment of Remitting-Relapsing Multiple Sclerosis (RRMS). Their DDD/1000 population/day were 0.004 and <0.0001, respectively. This difference could be due to the late introduction of Betaferon into the Drug Control Authority (DCA). Riluzole, the only drug used for the treatment of amyotrophic lateral sclerosis, is a very costly drug and in 2007, only the private sector has used it with DDD/1000 population/day of 0.0002.

Table 20.8 : Use of Other Nervous System Drugs by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N07A	Parasympathomimetics	0.1268	0.1035
N07A A	Anticholinesterases	0.1268	0.1035
N07C	Antivertigo preparations	0.7411	0.7896
N07C A	Antivertigo preparations	0.7411	0.7896
N07X	Other nervous system drugs	<0.0001	0.0002
N07X X	Other nervous system drugs	<0.0001	0.0002

Table 20.9 : Use of Other Nervous System Drugs by Drug Class and Agents, in DDD/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N07A A	**Anticholinesterases**			
N07A A01	Neostigmine	Public	0.0294	0.0157
		Private	0.0213	0.0130
		Total	0.0507	0.0287
N07A A02	Pyridostigmine	Public	0.0704	0.0702
		Private	0.0056	0.0045
		Total	0.0761	0.0748
N07A A03	Distigmine	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-

ATC	Drug Class and Agents	Sector	2006	2007
N07C A	**Antivertigo preparations**			
N07C A01	Betahistine	Public	0.1262	0.1861
		Private	0.2041	0.1995
		Total	0.3302	0.3857
N07C A02	Cinnarizine	Public	0.1156	0.1127
		Private	0.2004	0.2224
		Total	0.3160	0.3351
N07C A03	Flunarizine	Public	0.0183	0.0177
		Private	0.0766	0.0511
		Total	0.0949	0.0689
N07X X	**Other nervous system drugs**			
N07X X02	Riluzole	Public	-	-
		Private	<0.0001	0.0002
		Total	<0.0001	0.0002
N07X X06	Tetrabenazine	Public	<0.0001	-
		Private	-	-
		Total	<0.0001	-

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3. Malaysian Parkinson's Disease Association (MPDA). Malaysian Consensus on Parkinson's Disease 2006
4. Malaysian Consensus Guidelines on the Management of Headache 2006

CHAPTER 21 | USE OF DRUGS FOR PSYCHIATRIC DISORDERS

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Mental health problems account for a significant and growing proportion of the global burden of disease[1, 2] with huge negative consequences on quality of life, productivity and economic burden.[3] In Malaysia, The National Health and Morbidity Survey 2006 showed that overall psychiatric morbidity prevalence was 11.2%.[4]

Antipsychotics remained as the major bulk of medications used in psychiatry (49.75%). As epidemiological data showed higher prevalence of non-psychotic disorders than psychotic disorders[2], this finding most likely reflected the societal help-seeking behaviours[5] and illness severity rather than the prevalence of the illness itself. Psychiatric illnesses such as mild to moderate depressive and anxiety disorders are also intervened non-pharmacologically.[6]

There was a two-fold increase in the usage of atypical antipsychotics in 2007 (26.1%) as compared to 2006 (13%). Despite the increase, the utilisation of atypical antipsychotics remained relatively low compared to the trend observed globally especially in the developed countries such as in New Zealand (82%)[7] and Australia (77%)[8]. In fact, it was also lower in comparison with earlier data from some Asian countries. Prescription patterns of inpatient schizophrenia in China, Hong Kong, Japan, Korea, Singapore and Taiwan already showed higher utilisation of atypical antipsychotics in 2001 (45.5%) and 2004 (64.7%).[9]

There was a high consumption of antipsychotics in the public sector (89% versus 11%). However it is interesting to note that the use of atypical antipsychotics was strikingly very low in the public sector (21.4%) compared to the private sector (72.8%). Although atypical antipsychotics had been the recommended treatment of choice by evidence-based guidelines worldwide,[10, 11] the large volume of patients being treated in the public sector and related budget constraint may have caused significant challenges for the practitioners to prescribe atypical antipsychotics. Resource insufficiency has been acknowledged as a key barrier in improving mental healthcare services.[12]

Concerning the usage of antidepressants, selective serotonin reuptake inhibitors (SSRIs) were the most prescribed medications and constantly showed increasing utilisation trend from 2006 to 2007 (67.2% to 72.1%) taking over the tricyclic antidepressants. This practice is consistent with the global trend, supported by the growing evidence in the efficacy, tolerability, as well as broader clinical indications of SSRIs.[6] Among the SSRIs, high consumption of Fluvoxamine may be attributed to its accessibility following the downgrading of the prescriber's category which allowed prescription by medical officers since 2004.[13]

Anxiolytics were mostly consumed in private sector (68.1%), with alprazolam being the most prescribed benzodiazepines. These patterns were similarly observed in 2006. The high consumption of anxiolytics in the private sector may be related to the help seeking behaviour during the initial presentation of illness.[5]

Medications for addictive disorders showed remarkable increase of usage in the public sector from 43.7% in 2006 to 76.2% in 2007. Utilisation of methadone was almost doubled following the implementation of the Methadone Replacement Therapy Program since 2005.[14]

Antidementia drug showed significant increase of three-fold from the previous year, most probably attributed to increased awareness and availability of geriatric subspecialty services.

Table 21.1.1 : Use of Antipsychotics by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N05A A	Phenothiazines with aliphatic side-chain	0.4881	0.4253
N05A B	Phenothiazines with piperazine structure	0.8033	0.7292
N05A C	Phenothiazines with piperidine structure	0.0007	0.0006
N05A D	Butyrophenone derivatives	0.6728	0.6774
N05A E	Indole derivatives	0.0013	0.0006
N05A F	Thioxanthene derivatives	0.0693	0.1518
N05A G	Diphenylbutylpiperidine derivatives	-	-
N05A H	Diazepines, oxazepines and thiazepines	0.1337	0.6123
N05A L	Benzamides	0.3112	0.3749
N05A N	Lithium	0.0290	0.0304
N05A X	Other antipsychotics	0.2061	0.2626

Table 21.1.2: Use of Antipsychotics by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N05A A	**Phenothiazines with aliphatic side-chain**			
N05A A01	Chlorpromazine	Public	0.4835	0.4205
		Private	0.0046	0.0048
		Total	0.4881	0.4253
N05A A04	Acepromazine	Public	-	-
		Private	-	-
		Total	-	-
N05A A05	Triflupromazine	Public	-	-
		Private	-	-
		Total	-	-
N05A B	**Phenothiazines with piperazine structure**			
N05A B01	Dixyrazine	Public	-	-
		Private	-	-
		Total	-	-
N05A B02	Fluphenazine	Public	0.5418	0.4527
		Private	0.0115	0.0188
		Total	0.5534	0.4714
N05A B03	Perphenazine	Public	0.0224	0.0555
		Private	0.0026	0.0080
		Total	0.0250	0.0635
N05A B04	Prochlorperazine	Public	0.0818	0.0594
		Private	0.0318	0.0376
		Total	0.1136	0.0970
N05A B06	Trifluoperazine	Public	0.1106	0.0949
		Private	0.0009	0.0023
		Total	0.1115	0.0972
N05A B07	Acetophenazine	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N05A B	**Phenothiazines with piperazine structure**			
N05A B08	Thioproperazine	Public	-	-
		Private	-	-
		Total	-	-
N05A B10	Perazine	Public	-	-
		Private	-	-
		Total	-	-
N05A C	**Phenothiazines with piperidine structure**			
N05A C02	Thioridazine	Public	<0.0001	-
		Private	0.0006	0.0006
		Total	0.0007	0.0006
N05A D	**Butyrophenone derivatives**			
N05A D01	Haloperidol	Public	0.6600	0.6633
		Private	0.0128	0.0141
		Total	0.6728	0.6774
N05A D02	Trifluperidol	Public	-	-
		Private	-	-
		Total	-	-
N05A D06	Bromperidol	Public	-	-
		Private	-	-
		Total	-	-
N05A D07	Benperidol	Public	-	-
		Private	-	-
		Total	-	-
N05A E	**Indole derivatives**			
N05A E04	Ziprasidone	Public	0.0003	<0.0001
		Private	0.0010	0.0006
		Total	0.0013	0.0006
N05A F	**Thioxanthene derivatives**			
N05A F01	Flupentixol	Public	0.0205	0.0828
		Private	0.0015	0.0045
		Total	0.0220	0.0874
N05A F02	Clopenthixol	Public	-	-
		Private	-	-
		Total	-	-
N05A F03	Chlorprothixene	Public	-	-
		Private	-	-
		Total	-	-
N05A F05	Zuclopenthixol	Public	0.0459	0.0636
		Private	0.0014	0.0008
		Total	0.0473	0.0644
N05A G	**Diphenylbutylpiperidine derivatives**			
N05A G01	Fluspirilene	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N05A H	**Diazepines, oxazepines and thiazepines**			
N05A H02	Clozapine	Public	0.0887	0.0878
		Private	0.0003	0.0028
		Total	0.0890	0.0906
N05A H03	Olanzapine	Public	0.0296	0.2252
		Private	0.0011	0.1480
		Total	0.0307	0.3732
N05A H04	Quetiapine	Public	0.0128	0.0841
		Private	0.0012	0.0643
		Total	0.0140	0.1484
N05A L	**Benzamides**			
N05A L01	Sulpiride	Public	0.3082	0.3698
		Private	0.0030	0.0051
		Total	0.3112	0.3749
N05A N	**Lithium**			
N05A N01	Lithium	Public	0.0275	0.0291
		Private	0.0014	0.0013
		Total	0.0290	0.0304
N05A X	**Other antipsychotics**			
N05A X08	Risperidone	Public	0.2009	0.2177
		Private	0.0034	0.0410
		Total	0.2043	0.2587
N05A X12	Aripiprazole	Public	0.0002	0.0014
		Private	0.0017	0.0025
		Total	0.0018	0.0039

Table 21.1.3 : Use of Antipsychotics in DDD/1000 population/day 2006-2007 in Public and Private Sector

Total antipsychotics	2006		2007	
	DDD/1000 population/day	%	DDD/1000 population/day	%
Public	2.6072	97	2.8787	89
Private	0.0793	3	0.3560	11
Total	2.6865	100	3.2347	100

Table 21.1.4 : Use of Atypical Antipsychotics in DDD/1000 population/day 2006-2007 in Public and Private Sector

Total antipsychotics	2006		2007	
	DDD/1000 population/day	%	DDD/1000 population/day	%
Atypical Public/Total Public	0.3325/2.6072	12.75%	0.6162/2.8787	21.4%
Atypical Private/Total Private	0.0087/0.0793	10.8%	0.2592/0.3560	72.8%

Table 21.2.1 : Use of Antidepressants by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N06A A	Non-selective monoamine reuptake inhibitors	0.2723	0.2998
N06A B	Selective serotonin reuptake inhibitors	0.7515	1.1250
N06A F	Monoamine oxidase inhibitors, non-selective	<0.0001	-
N06A G	Monoamine oxidase A inhibitors	0.0180	0.0161
N06A X	Other antidepressants	0.0760	0.1202

Table 21.2.2 : Use of Antidepressants by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N06A A	**Non-selective monoamine reuptake inhibitors**			
N06A A02	Imipramine	Public	0.0290	0.0281
		Private	0.0046	0.0039
		Total	0.0336	0.0320
N06A A04	Clomipramine	Public	0.0175	0.0069
		Private	0.0011	0.0047
		Total	0.0186	0.0116
N06A A05	Opipramol	Public	-	-
		Private	-	-
		Total	-	-
N06A A07	Lofepramine	Public	-	-
		Private	-	-
		Total	-	-
N06A A09	Amitriptyline	Public	0.0906	0.1207
		Private	0.0479	0.0504
		Total	0.1384	0.1711
N06A A10	Nortriptyline	Public	-	-
		Private	<0.0001	0.0007
		Total	<0.0001	0.0007
N06A A12	Doxepin	Public	-	-
		Private	-	-
		Total	-	-
N06A A13	Iprindole	Public	-	-
		Private	-	-
		Total	-	-
N06A A14	Melitracen	Public	-	-
		Private	-	-
		Total	-	-
N06A A16	Dosulepin	Public	0.0626	0.0667
		Private	0.0156	0.0146
		Total	0.0782	0.0813
N06A A17	Amoxapine	Public	-	-
		Private	-	-
		Total	-	-
N06A A18	Dimetacrine	Public	-	-
		Private	-	-
		Total	-	-
N06A A21	Maprotiline	Public	0.0018	0.0016
		Private	0.0016	0.0015
		Total	0.0034	0.0031

ATC	Drug Class and Agents	Sector	2006	2007
N06A B	**Selective serotonin reuptake inhibitors**			
N06A B03	Fluoxetine	Public	0.1119	0.1371
		Private	0.0280	0.0252
		Total	0.1399	0.1623
N06A B04	Citalopram	Public	0.0010	0.0001
		Private	0.0230	0.0076
		Total	0.0240	0.0078
N06A B05	Paroxetine	Public	0.0040	0.0044
		Private	0.0073	0.0149
		Total	0.0112	0.0193
N06A B06	Sertraline	Public	0.2392	0.1810
		Private	0.0526	0.0910
		Total	0.2918	0.2721
N06A B08	Fluvoxamine	Public	0.1859	0.4477
		Private	0.0282	0.0302
		Total	0.2140	0.4779
N06A B10	Escitalopram	Public	0.0425	0.0709
		Private	0.0280	0.1148
		Total	0.0705	0.1857
N06A F	**Monoamine oxidase inhibitors, non-selective**			
N06A F01	Isocarboxazid	Public	-	-
		Private	-	-
		Total	-	-
N06A F04	Tranylcypromine	Public	<0.0001	-
		Private	-	-
		Total	<0.0001	-
N06A G	**Monoamine oxidase A inhibitors**			
N06A G02	Moclobemide	Public	0.0171	0.0158
		Private	0.0009	0.0003
		Total	0.0180	0.0161
N06A X	**Other antidepressants**			
N06A X03	Mianserin	Public	0.0091	0.0038
		Private	0.0006	0.0002
		Total	0.0097	0.0040
N06A X05	Trazodone	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
N06A X06	Nefazodone	Public	-	-
		Private	-	-
		Total	-	-
N06A X07	Minaprine	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N06A X	**Other antidepressants**			
N06A X11	Mirtazapine	Public	0.0171	0.0269
		Private	0.0168	0.0446
		Total	0.0339	0.0716
N06A X12	Bupropion	Public	-	-
		Private	-	0.0013
		Total	-	0.0013
N06A X14	Tianeptine	Public	0.0003	0.0005
		Private	0.0065	0.0023
		Total	0.0068	0.0028
N06A X16	Venlafaxine	Public	0.0191	0.0241
		Private	0.0047	0.0104
		Total	0.0238	0.0344
N06A X18	Reboxetine	Public	-	-
		Private	-	-
		Total	-	-
N06A X21	Duloxetine	Public	0.0002	0.0005
		Private	0.0016	0.0055
		Total	0.0018	0.0061

Table 21.3.1 : Use of Anxiolytics, Hypnotics and Sedatives by Drug Class, in DDD/1000 population/day

ATC	Drug Class	2006	2007
N05B A	Benzodiazepine derivatives	0.7990	1.0022
N05B B	Diphenylmethane derivatives	0.1418	0.1740
N05C C	Aldehydes and derivatives	0.0139	0.0088
N05C D	Benzodiazepine derivatives	0.2149	0.2350
N05C F	Benzodiazepine related drugs	0.1613	0.1939
N05C M	Other hypnotics and sedatives	<0.0001	<0.0001

Table 21.3.2 : Use of Anxiolytics, Hypnotics and Sedatives by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N05B A	**Benzodiazepine derivatives**			
N05B A01	Diazepam	Public	0.0656	0.0914
		Private	0.1565	0.3088
		Total	0.2221	0.4002
N05B A02	Chlordiazepoxide	Public	-	-
		Private	0.0061	0.0093
		Total	0.0061	0.0093
N05B A04	Oxazepam	Public	-	-
		Private	-	-
		Total	-	-
N05B A05	Potassium clorazepate	Public	-	-
		Private	0.0195	0.0227
		Total	0.0195	0.0227

ATC	Drug Class and Agents	Sector	2006	2007
N05B A	**Benzodiazepine derivatives**			
N05B A06	Lorazepam	Public	0.0834	0.0636
		Private	0.0939	0.1211
		Total	0.1773	0.1846
N05B A08	Bromazepam	Public	0.0063	0.0051
		Private	0.0219	0.0143
		Total	0.0281	0.0195
N05B A09	Clobazam	Public	0.0013	0.0009
		Private	0.0128	0.0065
		Total	0.0141	0.0074
N05B A12	Alprazolam	Public	0.0856	0.1340
		Private	0.2461	0.2244
		Total	0.3317	0.3584
N05B A13	Halazepam	Public	-	-
		Private	-	-
		Total	-	-
N05B A15	Camazepam	Public	-	-
		Private	-	-
		Total	-	-
N05B B	**Diphenylmethane derivatives**			
N05B B01	Hydroxyzine	Public	0.0522	0.0440
		Private	0.0896	0.1300
		Total	0.1418	0.1740
N05B C	**Carbamates**			
N05B C01	Meprobamate	Public	-	-
		Private	-	-
		Total	-	-
N05B C03	Emylcamate	Public	-	-
		Private	-	-
		Total	-	-
N05C A	**Barbiturates, plain**			
N05C A01	Pentobarbital	Public	-	-
		Private	-	-
		Total	-	-
N05C A02	Amobarbital	Public	-	-
		Private	-	-
		Total	-	-
N05C A08	Vinylbital	Public	-	-
		Private	-	-
		Total	-	-
N05C A11	Heptabarbital	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N05C C	**Aldehydes and derivatives**			
N05C C01	Chloral hydrate	Public	0.0060	0.0074
		Private	0.0080	0.0010
		Total	0.0139	0.0085
N05C C04	Dichloralphenazone	Public	-	-
		Private	-	-
		Total	-	-
N05C C05	Paraldehyde	Public	<0.0001	0.0002
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0003
N05C D	**Benzodiazepine derivatives**			
N05C D01	Flurazepam	Public	-	-
		Private	0.0004	-
		Total	0.0004	-
N05C D02	Nitrazepam	Public	0.0019	0.0019
		Private	0.0169	0.0112
		Total	0.0189	0.0131
N05C D05	Triazolam	Public	-	-
		Private	0.0192	0.0219
		Total	0.0192	0.0219
N05C D06	Lormetazepam	Public	-	-
		Private	-	-
		Total	-	-
N05C D08	Midazolam	Public	0.0524	0.0980
		Private	0.1241	0.1020
		Total	0.1764	0.2000
N05C D11	Loprazolam	Public	-	-
		Private	-	-
		Total	-	-
N05C E	**Piperidinedione derivatives**			
N05C E01	Glutethimide	Public	-	-
		Private	-	-
		Total	-	-
N05C E03	Pyrithyldione	Public	-	-
		Private	-	-
		Total	-	-
N05C F	**Benzodiazepine related drugs**			
N05C F01	Zopiclone	Public	-	-
		Private	0.0292	0.0651
		Total	0.0292	0.0651
N05C F02	Zolpidem	Public	0.0601	0.0697
		Private	0.0720	0.0591
		Total	0.1321	0.1289
N05C F03	Zaleplon	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
N05C H	**Melatonin receptor agonists**			
N05C H01	Melatonin	Public	0.0005	-
		Private	-	<0.0001
		Total	0.0005	<0.0001
N05C M	**Other hypnotics and sedatives**			
N05C M03	Bromisoval	Public	-	-
		Private	-	-
		Total	-	-
N05C M04	Carbromal	Public	-	-
		Private	-	-
		Total	-	-
N05C M05	Scopolamine	Public	<0.0001	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
N05C M06	Propiomazine	Public	-	-
		Private	-	-
		Total	-	-
N05C M10	Hexapropymate	Public	-	-
		Private	-	-
		Total	-	-
N05C M12	Apronal	Public	-	-
		Private	-	-
		Total	-	-
N05C M13	Valnoctamide	Public	-	-
		Private	-	-
		Total	-	-

Table 21.4.1 : Use of Drugs in Addictive Disorders by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N07B	Drugs used in addictive disorders	0.1728	0.2229
N07B A	Drugs used in nicotine dependence	0.0017	0.0013
N07B B	Drugs used in alcohol dependence	0.0014	0.0007
N07B C	Drugs used in opioid dependence	0.1678	0.2209

Table 21.4.2 : Use of Drugs in Addictive Disorders by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N07B A	**Drugs used in nicotine dependence**			
N07B A01	Nicotine	Public	0.0005	0.0002
		Private	0.0011	0.0011
		Total	0.0017	0.0013
N07B B	**Drugs used in alcohol dependence**			
N07B B04	Naltrexone	Public	0.0010	0.0006
		Private	0.0004	<0.0001
		Total	0.0014	0.0007
N07B C	**Drugs used in opioid dependence**			
N07B C01	Buprenorphine	Public	0.0018	0.0003
		Private	0.0715	0.0003
		Total	0.0733	0.0006
N07B C02	Methadone	Public	0.0713	0.1683
		Private	0.0251	0.0116
		Total	0.0964	0.1799
N07B C51	Buprenorphine, combinations	Public	-	0.0003
		Private	<0.0001	0.0400
		Total	<0.0001	0.0404

Table 21.5 : Use of Antidementia Drugs by Drugs Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	2006	2007
N06D	Antidementia drugs	0.0236	0.0655
N06D A	Anticholinesterases	0.0225	0.0644
N06D X	Other antidementia drugs	0.0011	0.0011

Table 21.5.1 : Use of Antidementia Drugs by Drugs Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
N06D A	**Anticholinesterases**			
N06D A01	Tacrine	Public	-	-
		Private	-	-
		Total	-	-
N06D A02	Donepezil	Public	0.0091	0.0340
		Private	0.0028	0.0037
		Total	0.0119	0.0377
N06D A03	Rivastigmine	Public	0.0053	0.0257
		Private	0.0006	0.0009
		Total	0.0059	0.0265
N06D A04	Galantamine	Public	-	-
		Private	0.0047	0.0002
		Total	0.0047	0.0002
N06D X	**Other antidementia drugs**			
N06D X01	Memantine	Public	0.0009	<0.0001
		Private	0.0001	0.0010
		Total	0.0011	0.0011

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CHAPTER 22 | USE OF DRUGS FOR OBSTRUCTIVE AIRWAY DISEASES

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Many of the drugs used in the two common obstructive airway diseases, asthma and chronic obstructive pulmonary disease (COPD), are quite similar although the indications and the effects of drugs may differ considerably. Drug utilisation data in this survey did not differentiate between their use in asthma or COPD.

Based on this survey, comparing the use of various drugs for obstructive airway diseases between 2006 and 2007, the total use of inhaled short-acting beta agonists (SABA) in 2007 has increased considerably (4.696 to 5.9347 DDD/1000 population per day). This increase was more significantly seen in private sector (from 0.3621 to 0.7926) compared to that of public sector (4.334 to 5.1421). Besides, the total use of SABA + anticholinergic combination in 2007 has also increased slightly (from 0.5213 to 0.6794), both in public and private sectors. The use of anticholinergics in private and public sectors have remained largely unchanged, in 2006 and 2007 (0.5050 vs 0.4873).

In addition, compared to 2006, the use of long-acting beta agonists (LABA) in 2007 has also showed significant increase of these drugs (from 0.0273 to 0.0408). This increment is largely due to the increased usage in the public sector than the private sector. We believe that the increment is likely due to its increased usage for patients with COPD than asthma (as LABA alone therapy is not recommended for asthma). Besides, tiotropium, the long acting anticholinergic, which is indicated for COPD, has also shown an increase usage in 2007 (0.0361 to 0.1259).

One notable trend is the decreasing use of inhaled single-agent glucocorticoids since 2005. In 2007, the use of inhaled glucocorticoids was showing a further downward trend (2.4159 to 1.7426) in the public sector as well as private sector. This reduction was particularly more marked in the public sector. One of the reasons could be the use of glucocorticoids + LABA combination that had increased substantially. Underuse of glucocorticoids in the treatment of asthma may lead to more patients with uncontrolled asthma and an increase use of rescue ß2 agonists.

The use of oral ß2-agonists was unchanged from 2006 to 2007 (1.3484 vs 1.4171). This suggests that efforts towards encouraging doctors to change the prescription of reliever drugs from oral to inhaled route has not gained much success. The use of systemic xanthines has also remained largely unchanged in the corresponding years (1.5931 vs 1.5432).

Leukotriene receptor antagonists (e.g. montelukast) are recommended for those who have mild to moderate asthma as a monotherapy or as an add-on therapy for asthmatic whose disease remains uncontrolled despite receiving other agents.[1] In 2007 survey, the use of leukotriene receptor antagoists has tripled in public sector (0.0374 to 0.0978). However, the use of these agents in private sector remained unchanged (0.1075 vs 0.0933). It is likely that more leukotriene receptor antagonists were being used as an add-on to manage poorly controlled asthma. The other reason could be that the use of this agent has increased in asthmatic with concomitant allergic rhinitis.

The consumption for drugs used for obstructive airway disease in Malaysia was lower as compared to Nordic countries (12.6 vs 28.5 to 61.0).[2] Among uses of the individual drugs, the use of R03C (systemic adrenergic) was higher in Malaysia as compared to Nordic countries (1.4 versus 0.1-1.0). This is probably due to lower cost of this drug as compared to inhaled reliever therapy. The use of other respiratory agents was lower, with the exception of R03AK (adrenergic combine with other drugs) and R03D (other systemic drugs i.e xanthines and leukotriene antagonists) which were higher in Malaysia compared to Greenland.

The use of drugs for obstructive airway disease in Malaysia was generally also lower as compared to Australia, where the use of combination therapy and high potency steroids (fluticasone & ciclesonide) in the treatment of asthma was higher.[3] There was also more use of inhaled long acting anticholinergics for COPD. In the case of xanthines, aminophylline was not used in Australia, while the use of theophylline in Malaysia was 5 times more than that used in Australia. In addition, the combination of SABA + short acting anticholinergics was used more often in Malaysia compared to Australia. This might suggest that in Australia, the guidelines for asthma and COPD management are more strictly adhered to, and a healthcare system which allows better access to these drugs.

Table 22.1 : Use of Medicines for Obstructive Airway Diseases by Drug Class, in DDD/1000 population/day 2006-2007

ATC	Drug Class	AdmRCode	2006	2007
R03A A	Alpha- and beta- adrenoreceptor agonists	Inhal.aerosol Inhal.solution	-	-
R03A C	Selective beta-2-adrenoreceptor agonists	Inhal.aerosol Inhal.powder Inhal.solution	4.7234	5.9756
R03A K	Adrenergics and other drugs for obstructive airway diseases	Inhal.aerosol Inhal.powder Inhal.solution	0.9553	1.2247
R03B A	Glucocorticoids	Inhal.aerosol Inhal.powder Inhal.solution	2.4159	1.7426
R03B B	Anticholinergics	Inhal.aerosol Inhal.powder Inhal.solution	0.5050	0.4834
R03B C	Antiallergic agents, excl. corticosteroids	Inhal.aerosol Inhal.powder Inhal.solution	-	-
R03C A	Alpha- and beta-adrenoreceptor agonists	Oral Parenteral	0.0496	0.0149
R03C B	Non-selective beta-adrenoreceptor agonists	Oral Parenteral	- -	- -
R03C C	Selective beta-2-adrenoreceptor agonists	Oral Parenteral Rectal	1.3484	1.4171
R03D A	Xanthines	Oral Parenteral Rectal	1.5931	1.5432
R03D C	Leukotriene receptor antagonists	Oral	0.1449	0.1912

Table 22.2 : Use of Medicines for Obstructive Airway Diseases by Drug Class and Agents, in DDD/1000population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
R03A A	**Alpha- and beta- adrenoreceptor agonists**			
R03A A01	Epinephrine	Public	-	-
		Private	-	-
		Total	-	-
R03A C	**Selective beta-2-adrenoreceptor agonists**			
R03A C02	Salbutamol	Public	4.0240	4.9464
		Private	0.3231	0.7211
		Total	4.3471	5.6675
R03A C03	Terbutaline	Public	0.3027	0.1933
		Private	0.0380	0.0458
		Total	0.3406	0.2391
R03A C04	Fenoterol	Public	0.0073	0.0024
		Private	0.0010	0.0257
		Total	0.0083	0.0281
R03A C12	Salmeterol	Public	0.0050	0.0309
		Private	<0.0001	<0.0001
		Total	0.0051	0.0309
R03A C13	Formoterol	Public	0.0162	0.0091
		Private	0.0060	0.0008
		Total	0.0222	0.0099

ATC	Drug Class and Agents	Sector	2006	2007
R03A K	**Adrenergics and other drugs for obstructive airway diseases**			
R03A K03	Fenoterol and other drugs for obstructive airway diseases	Public	-	-
		Private	0.0226	0.0592
		Total	0.0226	0.0592
R03A K04	Salbutamol and other drugs for obstructive airway diseases	Public	0.3963	0.5112
		Private	0.1024	0.1091
		Total	0.4987	0.6202
R03A K06	Salmeterol and other drugs for obstructive airway diseases	Public	0.1136	0.1733
		Private	0.1931	0.2136
		Total	0.3067	0.3869
R03A K07	Formoterol and other drugs for obstructive airway diseases	Public	0.0228	0.0705
		Private	0.1046	0.0879
		Total	0.1274	0.1584
R03B A	**Glucocorticoids**			
R03B A01	Beclometasone	Public	0.5609	0.4617
		Private	0.0336	0.0226
		Total	0.5945	0.4843
R03B A02	Budesonide	Public	1.5698	1.0263
		Private	0.2171	0.1722
		Total	1.7870	1.1984
R03B A05	Fluticasone	Public	0.0048	0.0267
		Private	0.0020	0.0119
		Total	0.0067	0.0386
R03B A07	Mometasone	Public	-	0.0006
		Private	-	-
		Total	-	0.0006
R03B A08	Ciclesonide	Public	<0.0001	0.0027
		Private	0.0276	0.0180
		Total	0.0277	0.0207
R03B B	**Anticholinergics**			
R03B B01	Ipratropium bromide	Public	0.4135	0.3336
		Private	0.0554	0.0240
		Total	0.4689	0.3576
R03B B04	Tiotropium bromide	Public	0.0166	0.0812
		Private	0.0195	0.0446
		Total	0.0361	0.1259
R03B C	**Antiallergic agents, excl. corticosteroids**			
R03B C01	Cromoglicic acid	Public	-	-
		Private	-	-
		Total	-	-
R03C A	**Alpha- and beta-adrenoreceptor agonists**			
R03C A02	Ephedrine	Public	0.0445	0.0092
		Private	0.0051	0.0057
		Total	0.0496	0.0149
R03C B	**Non-selective beta-adrenoreceptor agonists**			
R03C B03	Orciprenaline	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
R03C C	**Selective beta-2-adrenoreceptor agonists**			
R03C C02	Salbutamol	Public	0.6610	0.6723
		Private	0.4139	0.5031
		Total	1.0749	1.1754
R03C C03	Terbutaline	Public	0.1697	0.1360
		Private	0.0914	0.0871
		Total	0.2611	0.2231
R03C C04	Fenoterol	Public	-	-
		Private	0.0030	0.0085
		Total	0.0030	0.0085
R03C C05	Hexoprenaline	Public	-	-
		Private	-	-
		Total	-	-
R03C C08	Procaterol	Public	-	-
		Private	0.0064	0.0096
		Total	0.0064	0.0096
R03C C12	Bambuterol	Public	-	-
		Private	0.0030	0.0005
		Total	0.0030	0.0005
R03D A	**Xanthines**			
R03D A01	Diprophylline	Public	-	-
		Private	-	-
		Total	-	-
R03D A02	Choline theophyllinate	Public	-	-
		Private	-	-
		Total	-	-
R03D A03	Proxyphylline	Public	-	-
		Private	-	-
		Total	-	-
R03D A04	Theophylline	Public	1.1004	1.0632
		Private	0.4886	0.4774
		Total	1.5890	1.5407
R03D A05	Aminophylline	Public	0.0028	0.0023
		Private	0.0014	0.0003
		Total	0.0042	0.0026
R03D C	**Leukotriene receptor antagonists**			
R03D C03	Montelukast	Public	0.0374	0.0978
		Private	0.1075	0.0933
		Total	0.1449	0.1912

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CHAPTER 23 | USE OF ANTIHISTAMINES AND NASAL DECONGESTANTS

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Nasal decongestions and antihistamines are commonly used drugs for allergy and nasal symptoms in Otorhinolaryngology clinics in Malaysia. The 2007 survey showed usage of nasal preparations as 1.5919 DDD/population/year and usage of antihistamines for systemic use was 4.1218 DDD/population/year.

For plain sympathomimetic ephedrine, usage was not common. This was probably because of its short acting properties and rebound phenomena. The use of oxymethazoline has increased from 2006 in private sector but not in the public sector. However, the overall use of sympathomimetic plain was rather low.

There was a general increase in the usage of corticosteroid-based nasal decongestants such as budesonide and mometasone in both private and public sector in 2006 and 2007. Fluticasone showed lower usage in public sector compared to private sector. However, the usage in private sector decreased from 2006.

Budesonide nasal spray which has comparable efficacy with other corticosteroid nasal decongestions at lower costs of treatment is most commonly used. In comparing with Australian data,[1] mometasone usage is higher with survey DDD/1000 population/day of 2.119, compared with 0.4203 in Malaysia. Studies have reported that in addition to lower costs of treatment, patient preferences and efficacy of nasal corticosteroids contribute to the increase of usage.[2,3,4,5] Generic substitution has been approached to counteract the increase in drug expenditure.[6]

Antihistamines can be divided into several subgroups that are sedative and non-sedative. The usage of sedative antihistamines (old generation), dexchlorpheniramine and chlorpheniramine, has slight increase from 2006 to 2007, with the latter being more favourable. Among the new generation antihistamines, cetirizine, levocetirizine, loratadine and desloratadine showed an increasing trend in 2007. Usage of desloratadine and levocetirizine were much less as compared to loratadine and cetirizine because they are only recently available in the Ministry of Health (MOH) Drug Formulary. Chlorpheniramine is the most frequently used as it is readily available in MOH and used in many allergic conditions. In comparison with Australia, usage of antihistamines was higher in Malaysia.

Table 23.1 : Use of Antihistamines and Nasal Decongestants, in DDD/1000 population/day and DDD/ population/year 2006-2007

ATC	Drug Class	DDDs/1000population/day		DDDs/population/year	
		2006	2007	2006	2007
R01	Nasal preparations	3.1327	4.3614	1.1434	1.5919
R06	Antihistamines for systemic use	9.9147	11.2925	3.6189	4.1218

Table 23.2.1 : Use of Nasal Decongestants by Drug Class, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class	DDDs/1000population/day		DDDs/population/year	
		2006	2007	2006	2007
R01A	Decongestants and other nasal preparations for topical use	1.5876	2.0993	0.5795	0.7663
R01A A	Sympathomimetics, plain	0.2769	0.3296	0.1011	0.1203
R01A C	Antiallergic agents, excl. corticosteroids	<0.0001	0.0018	<0.0001	0.0006
R01A D	Corticosteroids	1.3107	1.7680	0.4784	0.6453
R01B	Nasal decongestants for systemic use	1.5451	2.2621	0.5640	0.8257
R01B A	Sympathomimetics	1.5451	2.2621	0.5640	0.8257

Table 23.2.2 : Use of Nasal Decongestants by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDDs/1000 population/day		DDDs/population/year	
			2006	2007	2006	2007
R01A A	**Sympathomimetics, plain**					
R01A A03	Ephedrine	Public	0.0007	0.0003	0.0003	0.0001
		Private	0.0002	0.0004	<0.0001	0.0001
		Total	0.0008	0.0008	0.0003	0.0003
R01A A04	Phenylephrine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R01A A05	Oxymetazoline	Public	0.0516	0.0339	0.0188	0.0124
		Private	0.2132	0.2741	0.0778	0.1000
		Total	0.2648	0.3080	0.0966	0.1124
R01A A07	Xylometazoline	Public	-	-	-	-
		Private	0.0112	0.0208	0.0041	0.0076
		Total	0.0112	0.0208	0.0041	0.0076
R01A A08	Naphazoline	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R01A C	**Antiallergic agents, excl. corticosteroids**					
R01A C01	Cromoglicic acid	Public	-	-	-	-
		Private	<0.0001	0.0018	<0.0001	0.0006
		Total	<0.0001	0.0018	<0.0001	0.0006
R01A D	**Corticosteroids**					
R01A D01	Beclometasone	Public	0.0897	0.1030	0.0327	0.0376
		Private	0.0370	0.0644	0.0135	0.0235
		Total	0.1267	0.1674	0.0463	0.0611
R01A D05	Budesonide	Public	0.4937	0.5859	0.1802	0.2139
		Private	0.2443	0.4881	0.0892	0.1782
		Total	0.7380	1.0740	0.2694	0.3920
R01A D06	Betamethasone	Public	-	-	-	-
		Private	-	0.0019	-	0.0007
		Total	-	0.0019	-	0.0007
R01A D08	Fluticasone	Public	0.0003	0.0134	0.0001	0.0049
		Private	0.1214	0.0626	0.0443	0.0229
		Total	0.1217	0.0760	0.0444	0.0278
R01A D09	Mometasone	Public	0.1251	0.2213	0.0457	0.0808
		Private	0.1662	0.1990	0.0607	0.0727
		Total	0.2914	0.4203	0.1064	0.1534
R01A D11	Triamcinolone	Public	<0.0001	0.0018	<0.0001	0.0007
		Private	0.0328	0.0265	0.0120	0.0097
		Total	0.0329	0.0283	0.0120	0.0103

ATC	Drug Class and Agents	Sector	DDDs/1000 population/day		DDDs/population/year	
			2006	2007	2006	2007
R01B A	**Sympathomimetics**					
R01B A01	Phenylpropanolamine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R01B A02	Pseudoephedrine	Public	-	-	-	-
		Private	0.0147	0.0235	0.0054	0.0086
		Total	0.0147	0.0235	0.0054	0.0086
R01B A52	Pseudoephedrine, combinations	Public	0.4124	0.4270	0.1505	0.1559
		Private	1.1180	1.8116	0.4081	0.6612
		Total	1.5304	2.2387	0.5586	0.8171

Table 23.3.1 : Use of Antihistamines by Drug Class, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class	DDDs/1000population/ day		DDDs/population/year	
		2006	2007	2006	2007
R06A	Antihistamines for systemic use	9.9147	11.2925	3.6189	4.1218
R06A A	Aminoalkyl ethers	0.1739	0.1526	0.0635	0.0557
R06A B	Substituted alkylamines	4.2429	4.8354	1.5487	1.7649
R06A C	Substituted ethylene diamines	-	-	-	-
R06A D	Phenothiazine derivatives	1.1347	0.9363	0.4142	0.3418
R06A E	Piperazine derivatives	1.6064	2.5005	0.5863	0.9127
R06A X	Other antihistamines for systemic use	2.7567	2.8678	1.0062	1.0467

Table 23.3.2 : Use of Antihistamines by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2006-2007

ATC	Drug Class and Agents	Sector	DDDs/ 1000 population/day		DDDs/population/ year	
			2006	2007	2006	2007
R06A A	**Aminoalkyl ethers**					
R06A A02	Diphenhydramine	Public	-	-	-	-
		Private	0.1575	0.1379	0.0575	0.0503
		Total	0.1575	0.1379	0.0575	0.0503
R06A A04	Clemastine	Public	-	-	-	-
		Private	0.0086	0.0036	0.0032	0.0013
		Total	0.0086	0.0036	0.0032	0.0013
R06A A06	Chlorphenoxamine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A A07	Diphenylpyraline	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A A08	Carbinoxamine	Public	-	-	-	-
		Private	0.0078	0.0111	0.0028	0.004
		Total	0.0078	0.0111	0.0028	0.004

ATC	Drug Class and Agents	Sector	DDDs/ 1000 population/day		DDDs/population/ year	
			2006	2007	2006	2007
R06A B	**Substituted alkylamines**					
R06A B01	Brompheniramine	Public	-	-	-	-
		Private	0.0114	0.0011	0.0042	0.0004
		Total	0.0114	0.0011	0.0042	0.0004
R06A B02	Dexchlorpheniramine	Public	0.0486	0.0259	0.0177	0.0095
		Private	0.6212	0.7649	0.2267	0.2792
		Total	0.6697	0.7908	0.2444	0.2887
R06A B04	Chlorphenamine	Public	2.5648	2.6324	0.9361	0.9608
		Private	0.9970	1.4110	0.3639	0.5150
		Total	3.5618	4.0434	1.3000	1.4759
R06A C	**Substituted ethylene diamines**					
R06A C04	Tripelennamine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A D	**Phenothiazine derivatives**					
R06A D01	Alimemazine	Public	-	-	-	-
		Private	-	0.0001	-	<0.0001
		Total	-	0.0001	-	<0.0001
R06A D02	Promethazine	Public	0.8526	0.6567	0.3112	0.2397
		Private	0.2776	0.2773	0.1013	0.1012
		Total	1.1302	0.934	0.4125	0.3409
R06A D05	Hydroxyethylpromethazine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A D06	Thiazinam	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A D07	Mequitazine	Public	-	-	-	-
		Private	0.0045	0.0022	0.0017	0.0008
		Total	0.0045	0.0022	0.0017	0.0008
R06A D08	Oxomemazine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A E	**Piperazine derivatives**					
R06A E01	Buclizine	Public	0.0004	0.0004	0.0001	0.0001
		Private	0.0306	0.0458	0.0112	0.0167
		Total	0.0310	0.0461	0.0113	0.0168
R06A E03	Cyclizine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A E04	Chlorcyclizine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

ATC	Drug Class and Agents	Sector	DDDs/ 1000 population/day		DDDs/population/ year	
			2006	2007	2006	2007
R06A E	**Piperazine derivatives**					
R06A E05	Meclozine	Public	0.0002	-	<0.0001	-
		Private	0.0041	0.0013	0.0015	0.0005
		Total	0.0044	0.0013	0.0016	0.0005
R06A E07	Cetirizine	Public	0.2259	0.3330	0.0824	0.1215
		Private	1.2548	1.9108	0.4580	0.6975
		Total	1.4807	2.2438	0.5405	0.8190
R06A E09	Levocetirizine	Public	0.0005	0.0031	0.0002	0.0011
		Private	0.0898	0.2061	0.0328	0.0752
		Total	0.0903	0.2092	0.0330	0.0764
R06A X	**Other antihistamines for systemic use**					
R06A X01	Bamipine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A X02	Cyproheptadine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A X07	Triprolidine	Public	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
R06A X09	Azatadine	Public	-	-	-	-
		Private	0.0014	0.0005	0.0005	0.0002
		Total	0.0014	0.0005	0.0005	0.0002
R06A X12	Terfenadine	Public	-	-	-	-
		Private	0.0014	-	0.0005	-
		Total	0.0014	-	0.0005	-
R06A X13	Loratadine	Public	0.7417	0.8946	0.2707	0.3265
		Private	1.4358	1.4514	0.5241	0.5298
		Total	2.1775	2.3460	0.7948	0.8563
R06A X17	Ketotifen	Public	-	<0.0001	-	<0.0001
		Private	0.2121	0.2099	0.0774	0.0766
		Total	0.2121	0.2099	0.0774	0.0766
R06A X18	Acrivastine	Public	-	-	-	-
		Private	0.0019	0.0052	0.0007	0.0019
		Total	0.0019	0.0052	0.0007	0.0019
R06A X26	Fexofenadine	Public	0.0080	0.0012	0.0029	0.0004
		Private	0.1455	0.0949	0.0531	0.0346
		Total	0.1535	0.0961	0.0560	0.0351
R06A X27	Desloratadine	Public	0.0463	0.0299	0.0169	0.0109
		Private	0.1627	0.1801	0.0594	0.0657
		Total	0.2089	0.2101	0.0763	0.0767

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CHAPTER 24 | USE OF OPHTHALMOLOGICALS

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The National Medicine Use Survey 2007 has results on common ophthalmological agents used in Malaysia. The source data producers are from the government hospitals (100%), university hospitals (100%), army hospitals (100%), private hospitals (23.2%), general practitioners and retail pharmacies. However many of the private ophthalmology services in this country are run as non-hospital based ophthalmic clinics that were not captured in these source data.

The groups of drug analysed included anti-infectives, steroids and steroids in combination with anti-infectives, non-steroidal anti-inflammatories, intraocular pressure (IOP) reducing agents for glaucoma, mydriatics, antiallergics, topical anaesthetics and antineovascularisation agents in the treatment of various retinal vascular conditions such as proliferative diabetic retinopathy and age-related macular degeneration.

Drug utilisation statistics are generally expressed as Defined Daily Dose (DDD), the assumed average dose per day of a drug used for its main indication by adults, as the standard unit for reference. However, except for antiglaucoma agents, no DDD have been assigned yet by the WHO for the ophthalmologicals. Thus, for the purpose of this report on the Malaysian statistics on drug utilisation, the total usage in this chapter is expressed in gram or ml or cc, per 1000 population per day.

The most common topical antibiotic used in both public and private sector for 2007 was chloramphenicol (1.4357g/ml/cc per 1000 population/day), followed by gentamicin (0.0799g/ml/cc per 1000 population/day) and combination antibiotics (0.0475g/ml/cc per 1000 population/day). For the past two consecutive years, chloramphenicol was the most commonly prescribed topical anti-infective. It is an easily accessible and affordable drug which can be prescribed by all medical personnel. Anti-infectives are used to treat conjunctivitis, the most common eye condition presenting to primary care centres.[1,2] Neomycin has shown an increase of about 10 times (0.0002g/ml/cc per 1000 population/day in 2006 to 0.0032 g/ml/cc per 1000 population/day in 2007). In addition, moxifloxacin and ciprofloxacin have also shown an increasing prescribing trend. The clinical practice guidelines for management of post-operative endophthalmitis has shown that moxifloxacin has better penetration in inflamed tissue and this may explain its increased use.[3]

Topical steroids can be used as individual preparations or in combination with antibiotics. The overall use of topical steroids has dropped for dexamethasone, betamethasone and fluorometholone. However, topical dexamethasone and anti-infectives in combination are now the most commonly used steroids (0.1655g/ml/cc per 1000 population/day). Steroidal and anti-infective combinations were prescribed more than plain steroidal agents because of their better compliance and cost saving factors. Among non-steroidal anti-inflammatory eye drops, the trend remains similar, with ketorolac being the more commonly used agent as compared to diclofenac and indomethacin.

The 2007 survey has results on 12 antiglaucoma agents. The pattern of antiglaucoma agent use is similar to 2006. Among them, timolol, a beta blocker was the most commonly used (0.5522DDD/1000 population/day in 2006 to 0.5922DDD/1000 population/day in 2007), followed by latanoprost (0.344DDD/1000 population/day), dorzolamide (0.1203DDD/1000 population/day) and betaxolol (0.0826DDD/1000 population/day). The other less commonly used antiglaucoma agents were: brimonidine, pilocarpine, brinzolamide, travoprost and bimatoprost. The usage of combination drugs has more than doubled from 2006 to 2007 (0.0123 DDD/1000 population/day vs 0.0283 DDD/1000 population/day). This could be due to the advantages of combination therapy such as better compliance, simpler dosing regimes and less ocular surface toxicity.[4] Although the use of combination agents has increased, it is still one of the least commonly prescribed drugs. This could be because combination agents were not available in the Ministry of Health (MOH) Drug Formulary. Clinical practice guidelines on the management of primary open angle glaucoma recommended that topical beta blocker and prostaglandin analogues are the most cost effective IOP lowering agents.[5] The findings in this survey indicated that prescribing patterns among ophthalmologists seemed to be in accordance to the recommendations.

Cromoglicic acid remains as the commonest antiallergic agent followed by olopatadine. Olopatadine has shown an increase in prescribing pattern in the public sector. This could be due to its introduction into the MOH Drug Formulary. Among the antineovascularisation agents, verteporfin was the most commonly used drug in 2007, however there was a decline in its use due to the availability of the new antineovascularisation agent, ranibizumab.

The most commonly used dilating agent is tropicamide followed by homatropine. Tropicamide, cyclopentolate and homatropine have shown an increased usage with homatropine doubling in quantity.

In conclusion, there have not been many changes in the use of opthalmologicals for the last two years.

Table 24.1 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01A A	**Antibiotics**				
S01A A01	Chloramphenicol	g/ml/cc	Public	0.8457	0.9715
			Private	0.2754	0.4642
			Total	1.1211	1.4357
S01A A02	Chlortetracycline	g/ml/cc	Public	0.0005	<0.0001
			Private	0.0012	0.0003
			Total	0.0017	0.0004
S01A A03	Neomycin	g/ml/cc	Public	-	-
			Private	0.0002	0.0032
			Total	0.0002	0.0032
S01A A04	Oxytetracycline	g/ml/cc	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001
S01A A09	Tetracycline	g/ml/cc	Public	-	-
			Private	0.0009	0.0018
			Total	0.0009	0.0018
S01A A10	Natamycin	g/ml/cc	Public	0.0005	<0.0001
			Private	0.0002	0.0002
			Total	0.0007	0.0002
S01A A11	Gentamicin	g/ml/cc	Public	0.0168	0.0114
			Private	0.0725	0.0686
			Total	0.0893	0.0799
S01A A12	Tobramycin	g/ml/cc	Public	0.0001	0.0002
			Private	0.0050	0.0043
			Total	0.0051	0.0045
S01A A13	Fusidic acid	g/ml/cc	Public	0.0087	0.0107
			Private	0.0231	0.0324
			Total	0.0318	0.0431
S01A A17	Erythromycin	g/ml/cc	Public	-	-
			Private	0.0010	0.0008
			Total	0.0010	0.0008
S01A A18	Polymyxin B	g/ml/cc	Public	-	-
			Private	<0.0001	0.0003
			Total	<0.0001	0.0003
S01A A20	Antibiotics in combination with other drugs	g/ml/cc	Public	-	-
			Private	0.0010	-
			Total	0.0010	-
S01A A30	Combinations of different antibiotics	g/ml/cc	Public	0.0012	0.0063
			Private	0.0211	0.0413
			Total	0.0222	0.0475
S01A B	**Sulfonamides**				
S01A B04	Sulfacetamide	g/ml/cc	Public	0.0030	0.0009
			Private	-	-
			Total	0.0030	0.0009

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01A D	**Antivirals**				
S01A D03	Aciclovir	g/ml/cc	Public	0.0020	0.0022
			Private	0.0009	0.0008
			Total	0.0029	0.0031
S01A D05	Interferon	g/ml/cc	Public	-	-
			Private	<0.0001	-
			Total	<0.0001	-
S01A X	**Other anti-infectives**				
S01A X11	Ofloxacin	g/ml/cc	Public	0.0015	<0.0001
			Private	0.0002	-
			Total	0.0016	<0.0001
S01A X12	Norfloxacin	g/ml/cc	Public	0.0006	0.0003
			Private	0.0066	0.0180
			Total	0.0071	0.0183
S01A X13	Ciprofloxacin	g/ml/cc	Public	0.0104	0.0194
			Private	0.0090	0.0105
			Total	0.0194	0.0299
S01A X17	Lomefloxacin	g/ml/cc	Public	-	0.0001
			Private	0.0019	0.0021
			Total	0.0019	0.0022
S01A X19	Levofloxacin	g/ml/cc	Public	<0.0001	-
			Private	0.0005	0.0003
			Total	0.0005	0.0003
S01A X21	Gatifloxacin	g/ml/cc	Public	-	-
			Private	-	0.0007
			Total	-	0.0007
S01A X22	Moxifloxacin	g/ml/cc	Public	-	0.0003
			Private	0.0003	0.0044
			Total	0.0003	0.0047

Table 24.2 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01B A	**Corticosteroids, plain**				
S01B A01	Dexamethasone	g/ml/cc	Public	0.0191	0.0121
			Private	0.0030	0.0062
			Total	0.0221	0.0183
S01B A04	Prednisolone	g/ml/cc	Public	0.0006	0.0017
			Private	0.0117	0.0119
			Total	0.0123	0.0136
S01B A06	Betamethasone	g/ml/cc	Public	0.0223	0.0150
			Private	0.0011	0.0019
			Total	0.0234	0.0168
S01B A07	Fluorometholone	g/ml/cc	Public	0.0023	0.0024
			Private	0.0071	0.0053
			Total	0.0094	0.0077

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01B C	**Anti-inflammatory agents, non-steroids**				
S01B C01	Indometacin	g/ml/cc	Public	0.0004	-
			Private	-	-
			Total	0.0004	-
S01B C03	Diclofenac	g/ml/cc	Public	-	-
			Private	0.0002	0.0003
			Total	0.0002	0.0003
S01B C05	Ketorolac	g/ml/cc	Public	0.0025	0.0026
			Private	0.0043	0.0028
			Total	0.0068	0.0055

Table 24.3 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01C A	**Corticosteroids and anti-infectives in combination**				
S01C A01	Dexamethasone and anti-infectives	g/ml/cc	Public	0.0292	0.0354
			Private	0.1044	0.1300
			Total	0.1335	0.1655
S01C A05	Betamethasone and anti-infectives	g/ml/cc	Public	0.0083	0.0341
			Private	0.0062	0.0039
			Total	0.0145	0.0380
S01C A07	Fluorometholone and anti-infectives	g/ml/cc	Public	-	-
			Private	0.0011	0.0008
			Total	0.0011	0.0008
S01C B	**Corticosteroids/anti-infectives/mydriatics in combination**				
S01C B02	Prednisolone	g/ml/cc	Public	-	0.0005
			Private	-	-
			Total	-	0.0005
S01C B04	Betamethasone	g/ml/cc	Public	-	-
			Private	0.0006	-
			Total	0.0006	-
S01C C	**Anti-inflammatory agents, non-steroids and anti-infectives in combination**				
S01C C01	Diclofenac and anti-infectives	g/ml/cc	Public	-	-
			Private	0.0084	-
			Total	0.0084	-

Table 24.4. Use of Ophthalmologicals by Drug Class and Agents, in DDD/1000 population/day 2006-2007

ATC	Drug Class and Agents	Sector	2006	2007
S01E A	**Sympathomimetics in glaucoma therapy**			
S01E A01	Epinephrine	Public	-	-
		Private	-	-
		Total	-	-
S01E A02	Dipivefrine	Public	-	-
		Private	-	-
		Total	-	-
S01E A03	Apraclonidine	Public	-	-
		Private	-	-
		Total	-	-
S01E A05	Brimonidine	Public	0.0309	0.0339
		Private	0.0196	0.0352
		Total	0.0505	0.0691
S01E B	**Parasympathomimetics**			
S01E B01	Pilocarpine	Public	0.0378	0.0610
		Private	0.0075	0.0057
		Total	0.0453	0.0667
S01E B02	Carbachol	Public	0.0033	0.0045
		Private	0.0010	0.0008
		Total	0.0042	0.0053
S01E B03	Ecothiopate	Public	-	-
		Private	-	-
		Total	-	-
S01E B05	Physostigmine	Public	-	-
		Private	-	-
		Total	-	-
S01E B06	Neostigmine	Public	-	-
		Private	-	-
		Total	-	-
S01E C	**Carbonic anhydrase inhibitors**			
S01E C01	Acetazolamide	Public	0.0214	0.0161
		Private	0.0058	0.0051
		Total	0.0273	0.0212
S01E C02	Diclofenamide	Public	-	-
		Private	-	-
		Total	-	-
S01E C03	Dorzolamide	Public	0.1007	0.1090
		Private	0.0046	0.0113
		Total	0.1053	0.1203
S01E C04	Brinzolamide	Public	0.0356	0.0278
		Private	0.0055	0.0042
		Total	0.0410	0.0320
S01E C05	Methazolamide	Public	-	-
		Private	-	-
		Total	-	-

ATC	Drug Class and Agents	Sector	2006	2007
S01E D	**Beta blocking agents**			
S01E D01	Timolol	Public	0.4858	0.4972
		Private	0.0671	0.0632
		Total	0.5529	0.5604
S01E D02	Betaxolol	Public	0.0683	0.0693
		Private	0.0268	0.0133
		Total	0.0951	0.0826
S01E D03	Levobunolol	Public	-	-
		Private	0.0012	0.0021
		Total	0.0012	0.0021
S01E D51	Timolol, combinations	Public	0.0015	0.0058
		Private	0.0131	0.0225
		Total	0.0146	0.0283
S01E E	**Prostaglandin analogues**			
S01E E01	Latanoprost	Public	0.2684	0.3226
		Private	0.0159	0.0214
		Total	0.2843	0.3440
S01E E03	Bimatoprost	Public	<0.0001	<0.0001
		Private	0.0128	0.0109
		Total	0.0129	0.0110
S01E E04	Travoprost	Public	0.0052	0.0055
		Private	0.0127	0.0194
		Total	0.0179	0.0249

Table 24.5 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01F A	**Anticholinergics**				
S01F A01	Atropine	g/ml/cc	Public	0.0063	0.0060
			Private	0.0010	0.0006
			Total	0.0073	0.0066
S01F A04	Cyclopentolate	g/ml/cc	Public	0.0042	0.0081
			Private	0.0024	0.0013
			Total	0.0066	0.0094
S01F A05	Homatropine	g/ml/cc	Public	0.0108	0.0208
			Private	0.0027	0.0016
			Total	0.0136	0.0224
S01F A06	Tropicamide	g/ml/cc	Public	0.0202	0.0221
			Private	0.0057	0.0043
			Total	0.0260	0.0264
S01F B	**Sympathomimetics excl. antiglaucoma preparations**				
S01F B01	Phenylephrine	g/ml/cc	Public	0.0090	0.0095
			Private	0.0026	0.0021
			Total	0.0116	0.0116

Table 24.6 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01G A	**Sympathomimetics used as decongestants**				
S01G A01	Naphazoline	g/ml/cc	Public	-	-
			Private	0.0073	-
			Total	0.0073	-
S01G A02	Tetryzoline	g/ml/cc	Public	-	0.0011
			Private	0.0228	0.0632
			Total	0.0228	0.0643
S01G A51	Naphazoline, combinations	g/ml/cc	Public	-	0.0026
			Private	0.0072	0.0332
			Total	0.0072	0.0357
S01G A52	Tetryzoline, combinations	g/ml/cc	Public	0.0082	0.0159
			Private	0.0165	0.0456
			Total	0.0247	0.0615
S01G A55	Phenylephrine, combinations	g/ml/cc	Public	0.0004	-
			Private	0.0018	-
			Total	0.0021	-
S01G X	**Other antiallergics**				
S01G X00	Other antiallergics	g/ml/cc	Public	-	-
			Private	0.0002	0.0023
			Total	0.0002	0.0023
S01G X01	Cromoglicic acid	g/ml/cc	Public	0.0308	0.0300
			Private	0.0284	0.0336
			Total	0.0592	0.0636
S01G X05	Lodoxamide	g/ml/cc	Public	-	0.0002
			Private	0.0029	0.0039
			Total	0.0029	0.0040
S01G X06	Emedastine	g/ml/cc	Public	-	<0.0001
			Private	0.0026	0.0025
			Total	0.0026	0.0025
S01G X08	Ketotifen	g/ml/cc	Public	-	-
			Private	-	0.0007
			Total	-	0.0007
S01G X09	Olopatadine	g/ml/cc	Public	0.0007	0.0013
			Private	0.0060	0.0044
			Total	0.0068	0.0057

Table 24.7 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01H A	**Local anaesthetics**				
S01H A02	Oxybuprocaine	g/ml/cc	Public	0.0003	<0.0001
			Private	0.0002	0.0002
			Total	0.0006	0.0002
S01H A03	Tetracaine	g/ml/cc	Public	0.0006	0.0001
			Private	0.0001	<0.0001
			Total	0.0007	0.0002
S01H A04	Proxymetacaine	g/ml/cc	Public	0.0167	0.0272
			Private	0.0060	0.0043
			Total	0.0227	0.0315
S01H A07	Lidocaine	g/ml/cc	Public	-	<0.0001
			Private	-	-
			Total	-	<0.0001

Table 24.8 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01L A	**Antineovascularisation agents**				
S01L A01	Verteporfin	mg	Public	0.0003	0.0001
			Private	-	<0.0001
			Total	0.0003	0.0002
S01L A03	Pegaptanib	g/ml/cc	Public	<0.0001	-
			Private	-	-
			Total	<0.0001	-
S01L A04	Ranibizumab	g/ml/cc	Public	<0.0001	<0.0001
			Private	<0.0001	<0.0001
			Total	<0.0001	<0.0001

Table 24.9 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S01X A	**Other ophthalmologicals**				
S01X A13	Alteplase	g/ml/cc	Public	-	-
			Private	<0.0001	-
			Total	<0.0001	-
S01X A18	Ciclosporin	g/ml/cc	Public	-	-
			Private	-	0.0007
			Total	-	0.0007

Table 24.10 : Use of Ophthalmologicals by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S03A A	**Anti-infectives**				
S03A A06	Gentamicin	g/ml/cc	Public	0.0022	0.0010
			Private	0.0136	0.0253
			Total	0.0158	0.0263
S03A A08	Chloramphenicol	g/ml/cc	Public	-	-
			Private	0.0005	-
			Total	0.0005	-

Table 24.11 : Use of Ophthalmological by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S03B A	**Corticosteroids**				
S03B A03	Betamethasone	g/ml/cc	Public	0.0022	0.0036
			Private	0.0012	0.0136
			Total	0.0033	0.0172

Table 24.12 : Use of Ophthalmological by Drug Class and Agents, in total dosage/1000 population/ day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S03C A	**Corticosteroids and anti-infectives in combination**				
S03C A01	Dexamethasone and anti-infectives	g/ml/cc	Public	<0.0001	0.0006
			Private	0.1409	0.2651
			Total	0.1410	0.2657
S03C A06	Betamethasone and anti-infectives	g/ml/cc	Public	0.0028	0.0033
			Private	0.0096	0.0575
			Total	0.0124	0.0608

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CHAPTER 25 | USE OF OTOLOGICALS

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Drug utilisation statistics are generally expressed as Defined Daily Dose (DDD), the assumed average dose per day of a drug used for its main indication by adult, as standard unit for reference.[1] However, no DDD have been assigned yet by WHO for otologicals. Thus, for the purpose of this chapter report, the total usage for otological drugs is expressed in gram or ml or cc, per 1000 population, per day, irrespective of the strength of the preparations.

Otological preparations used in Malaysia are classified into local antibiotic ear drops, local corticosteroid ear drops and combination antibiotic and corticosteroid ear drops. There are two types of otological drugs that are mainly used, corticosteroid and non-corticosteroid anti-infective preparations. The most commonly used anti-infective is chloramphenicol which is widely available in both government and private sectors. Other drugs such as gentamicin, polymixin B are used less commonly.

The most common otological anti-infectives used are in combination with corticosteroid that is Hydrocortisone with anti-infectives. Generally, there is a decreasing trend in the usage of steroidal anti-infectives between 2006 and 2007.

Table 25.1 : Use of Otologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S02A A	**Anti-infectives**				
S02A A01	Chloramphenicol	g/ml/cc	Public	0.1605	0.1555
			Private	0.0507	0.0669
			Total	0.2112	0.2224
S02A A07	Neomycin	g/ml/cc	Public	-	-
			Private	0.0007	0.0007
			Total	0.0007	0.0007
S02A A11	Polymyxin B	g/ml/cc	Public	-	-
			Private	0.0067	-
			Total	0.0067	-
S02A A14	Gentamicin	g/ml/cc	Public	-	<0.0001
			Private	0.0014	-
			Total	0.0014	<0.0001
S02A A16	Anti-infectives	g/ml/cc	Public	-	0.0091
			Private	-	0.0052
			Total	-	0.0143
S02A A30	Anti-infectives, combinations	g/ml/cc	Public	-	0.0220
			Private	-	0.0212
			Total	-	0.0431

Table 25.2: Use of Otologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S02B A	**Corticosteroids**				
S02B A00	Corticosteroids	g/ml/cc	Public	-	0.0004
			Private	-	-
			Total	-	0.0004
S02B A07	Betamethasone	g/ml/cc	Public	0.0017	-
			Private	-	-
			Total	0.0017	-

Table 25.3: Use of Otologicals by Drug Class and Agents, in total dosage/1000 population/day 2006-2007

ATC	Drug Class and Agents	Unit	Sector	2006	2007
S02C A	**Corticosteroids and anti-infectives in combination**				
S02C A03	Hydrocortisone and anti-infectives	g/ml/cc	Public	0.0013	0.0055
			Private	0.0091	0.0026
			Total	0.0104	0.0082
S02C A04	Triamcinolone and anti-infectives	g/ml/cc	Public	0.0083	0.0051
			Private	0.0055	0.0022
			Total	0.0138	0.0073
S02C A06	Dexamethasone and anti-infectives	g/ml/cc	Public	0.0259	0.0015
			Private	0.0007	0.0031
			Total	0.0266	0.0046

References:

1. WHO Collaborating Centre for Drug Statistics Methodology. Guidelines for ATC Classification and DDD Assignment 2009. Oslo December 2008.

PARTICIPANTS OF THE NATIONAL MEDICINES USE SURVEY

Hospitals participating in NMUS survey

No.	Ministry of Health Hospitals
1	Alor Gajah Hospital
2	Ampang Hospital
3	Bahagia Hospital, Ulu Kinta
4	Balik Pulau Hospital
5	Baling Hospital
6	Banting Hospital
7	Batu Gajah Hospital
8	Batu Pahat Hospital
9	Bau Hospital
10	Beaufort Hospital
11	Beluran Hospital
12	Bentong Hospital
13	Besut Hospital
14	Betong Hospital
15	Bintulu Hospital
16	Bukit Mertajam Hospital
17	Cameron Highlands Hospital
18	Changkat Melintang Hospital
19	Dalat Hospital
20	Daro Hospital
21	Duchess of Kent Hospital, Sandakan
22	Dungun Hospital
23	Gerik Hospital
24	Gua Musang Hospital
25	Hulu Terengganu Hospital
26	Jasin Hospital
27	Jelebu Hospital
28	Jeli Hospital
29	Jempol Hospital
30	Jengka Hospital
31	Jerantut Hospital
32	Jitra Hospital
33	Kajang Hospital
34	Kampar Hospital
35	Kanowit Hospital
36	Kapit Hospital
37	Kemaman Hospital
38	Keningau Hospital
39	Kepala Batas Hospital
40	Kinabatangan Hospital
41	Kluang Hospital
42	Kota Belud Hospital
43	Kota Marudu Hospital
44	Kota Tinggi Hospital
45	Kuala Kangsar Hospital
46	Kuala Krai Hospital
47	Kuala Kubu Bharu Hospital
48	Kuala Lipis Hospital
49	Kuala Lumpur Hospital
50	Kuala Nerang Hospital
51	Kuala Penyu Hospital
52	Kudat Hospital
53	Kulim Hospital
54	Kunak Hospital
55	Labuan Hospital
56	Lahad Datu Hospital
57	Langkawi Hospital
58	Lawas District Hospital
59	Likas Hospital
60	Limbang Hospital
61	Lundu District Hospital
62	Machang Hospital
63	Marudi Hospital
64	Melaka Hospital
65	Mersing Hospital
66	Mesra Hospital, Bukit Padang
67	Miri Hospital
68	Muadzam Shah Hospital
69	Mukah Hospital
70	Papar Hospital
71	Parit Buntar Hospital
72	Pasir Mas Hospital
73	Pekan Hospital
74	Permai Hospital
75	Pitas Hospital
76	Pontian Hospital
77	Port Dickson Hospital
78	Pulau Pinang Hospital
79	Putrajaya Hospital
80	Queen Elizabeth Hospital
81	Raja Perempuan Zainab II Hospital, Kota Bharu
82	Raja Permaisuri Bainun Hospital, Ipoh
83	Rajah Charles Brooke Memorial Hospital
84	Ranau Hospital
85	Raub Hospital
86	Saratok Hospital
87	Sarawak General Hospital
88	Sarikei Hospital
89	Seberang Jaya Hospital
90	Segamat Hospital
91	Selama Hospital
92	Selayang Hospital
93	Semporna Hospital
94	Sentosa Hospital
95	Serdang Hospital
96	Seri Manjung Hospital
97	Serian Hospital
98	Setiu Hospital
99	Sibu Hospital
100	Sik Hospital
101	Simunjan Hospital
102	Sipitang Hospital
103	Slim River Hospital
104	Sri Aman Hospital
105	Sultan Abdul Halim Hospital, Sungai Petani
106	Sultan Haji Ahmad Shah Hospital, Temerloh
107	Sultan Ismail Hospital, Johor Bahru
108	Sultanah Aminah Hospital, Johor Bahru
109	Sultanah Bahiyah Hospital, Alor Setar
110	Sultanah Fatimah Specialist Hospital, Muar
111	Sultanah Nur Zahirah Hospital, Kuala Terengganu
112	Sungai Bakap Hospital
113	Sungai Buloh Hospital
114	Sungai Siput Hospital
115	Taiping Hospital
116	Tambunan Hospital
117	Tampin Hospital
118	Tanah Merah Hospital
119	Tangkak Hospital
120	Tanjong Karang Hospital
121	Tapah Hospital
122	Tawau Hospital
123	Teluk Intan Hospital
124	Temenggung Seri Maharaja Tun Ibrahim Hospital, Kulai
125	Tengku Ampuan Afzan Hospital, Kuantan
126	Tengku Ampuan Jemaah Hospital, Sabak Bernam
127	Tengku Ampuan Rahimah Hospital, Klang
128	Tengku Anis Hospital, Pasir Puteh
129	Tenom Hospital
130	Tuanku Ampuan Najihah Hospital, Kuala Pilah
131	Tuanku Fauziah Hospital, Kangar
132	Tuanku Ja'afar Hospital, Seremban
133	Tuaran Hospital
134	Tumpat Hospital
135	Yan Hospital

Hospitals participating in NMUS survey

No.	University Hospitals
1	Pusat Perubatan Universiti Kebangsaan Malaysia
2	University Malaya Medical Centre
3	Hospital Universiti Sains Malaysia

No.	Armed Forces Hospitals
1	Lumut Armed Forces Hospital
2	Terendak Armed Forces Hospital

No.	Private Hospitals
1	Al-Islam Specialist Hospital (Formerly known as Kampong Baru Medical Centre @ KBMC)
2	Amanjaya Specialist Centre
3	Columbia Asia Extended Care Hospital
4	Columbia Asia Hospital – Miri
5	Columbia Asia Hospital Seremban
6	Darul Ehsan Medical Centre
7	Gleneagles Intan Medical Centre
8	Gleneagles Medical Centre, Penang
9	Hospital Pantai Ayer Keroh Sdn. Bhd.
10	Island Hospital
11	KPJ Ampang Puteri Specialist Hospital
12	KPJ Damansara Specialist Hospital
13	KPJ Johor Specialist Hospital
14	KPJ Perdana Specialist Hospital
15	KPJ Puteri Specialist Hospital / Hospital Pakar Puteri
16	KPJ Sentosa Medical Centre Sdn. Bhd.
17	Lam Wah Ee Hospital
18	Medical Specialist Centre (JB) Sdn. Bhd.
19	Metro Specialist Hospital
20	National Heart Institute Sdn. Bhd.
21	NCI Cancer Hospital
22	N. S. Chinese Maternity Hospital & Medical Centre
23	Pantai Hospital Ampang
24	Pantai Hospital Cheras
25	Pantai Hospital Ipoh
26	Pantai Hospital Klang
27	Pantai Hospital Penang (formerly Pantai Mutiara Hospital)
28	Pantai Hospital Sungai Petani
29	Penang Adventist Hospital (Adventist Hospital & Clinic Services (M)
30	PUSRAWI Hospital Sdn. Bhd.
31	Putra Medical Centre
32	Putra Specialist Hospital (Batu Pahat) Sdn. Bhd.
33	Putra Specialist Hospital (Melaka) Sdn. Bhd.
34	Rafflesia Medical Centre
35	Sabah Medical Centre Sdn. Bhd.
36	Sime Darby Medical Centre Subang Jaya
37	Sunway Medical Centre
38	Tanjung Medical Centre
39	Timberland Medical Centre
40	Tung Shin Hospital

Public Health Authorities participating in NMUS survey

No.	State/ District/Area Health Departments
1	Pejabat Kesihatan Daerah Alor Gajah
2	Pejabat Kesihatan Daerah Bachok
3	Pejabat Kesihatan Daerah Baling
4	Pejabat Kesihatan Daerah Barat Daya
5	Pejabat Kesihatan Daerah Batang Padang
6	Pejabat Kesihatan Daerah Batu Pahat
7	Pejabat Kesihatan Daerah Besut
8	Pejabat Kesihatan Daerah Cameron Highlands
9	Pejabat Kesihatan Daerah Dungun
10	Pejabat Kesihatan Daerah Gombak
11	Pejabat Kesihatan Daerah Gua Musang
12	Pejabat Kesihatan Daerah Hilir Perak
13	Pejabat Kesihatan Daerah Hulu Langat
14	Pejabat Kesihatan Daerah Hulu Perak
15	Pejabat Kesihatan Daerah Hulu Selangor
16	Pejabat Kesihatan Daerah Hulu Terengganu
17	Pejabat Kesihatan Daerah Jasin
18	Pejabat Kesihatan Daerah Jeli
19	Pejabat Kesihatan Daerah Jempol
20	Pejabat Kesihatan Daerah Johor Bharu
21	Pejabat Kesihatan Daerah Kemaman
22	Pejabat Kesihatan Daerah Kerian
23	Pejabat Kesihatan Daerah Kinta
24	Pejabat Kesihatan Daerah Klang
25	Pejabat Kesihatan Daerah Kluang
26	Pejabat Kesihatan Daerah Kota Bharu
27	Pejabat Kesihatan Daerah Kota Setar
28	Pejabat Kesihatan Daerah Kota Tinggi
29	Pejabat Kesihatan Daerah Kuala Kangsar
30	Pejabat Kesihatan Daerah Kuala Krai
31	Pejabat Kesihatan Daerah Kuala Langat
32	Pejabat Kesihatan Daerah Kuala Muda
33	Pejabat Kesihatan Daerah Kuala Pilah
34	Pejabat Kesihatan Daerah Kuala Terengganu
35	Pejabat Kesihatan Daerah Kuantan
36	Pejabat Kesihatan Daerah Kubang Pasu
37	Pejabat Kesihatan Daerah Kulim
38	Pejabat Kesihatan Daerah Langkawi
39	Pejabat Kesihatan Daerah Larut, Matang dan Selama
40	Pejabat Kesihatan Daerah Machang
41	Pejabat Kesihatan Daerah Manjung
42	Pejabat Kesihatan Daerah Maran
43	Pejabat Kesihatan Daerah Marang
44	Pejabat Kesihatan Daerah Melaka Tengah
45	Pejabat Kesihatan Daerah Muar
46	Pejabat Kesihatan Daerah Padang Terap
47	Pejabat Kesihatan Daerah Pasir Mas
48	Pejabat Kesihatan Daerah Pasir Puteh
49	Pejabat Kesihatan Daerah Penampang
50	Pejabat Kesihatan Daerah Pendang
51	Pejabat Kesihatan Daerah Perak Tengah
52	Pejabat Kesihatan Daerah Petaling
53	Pejabat Kesihatan Daerah Port Dickson
54	Pejabat Kesihatan Daerah Sabak Bernam
55	Pejabat Kesihatan Daerah Seberang Perai Selatan
56	Pejabat Kesihatan Daerah Seberang Perai Tengah
57	Pejabat Kesihatan Daerah Seberang Perai Utara
58	Pejabat Kesihatan Daerah Segamat
59	Pejabat Kesihatan Daerah Semporna
60	Pejabat Kesihatan Daerah Sepang
61	Pejabat Kesihatan Daerah Seremban
62	Pejabat Kesihatan Daerah Setiu
63	Pejabat Kesihatan Daerah Sik
64	Pejabat Kesihatan Daerah Tampin
65	Pejabat Kesihatan Daerah Tanah Merah
66	Pejabat Kesihatan Daerah Temerloh
67	Pejabat Kesihatan Daerah Timur Laut

Public Health Authorities participating in NMUS survey

No.	State/ District/Area Health Departments
68	Pejabat Kesihatan Daerah Tumpat
69	Pejabat Kesihatan Daerah Yan
70	Pejabat Kesihatan Jelebu
71	Pejabat Kesihatan Kawasan Beaufort
72	Pejabat Kesihatan Kawasan Beluran
73	Pejabat Kesihatan Kawasan Keningau
74	Pejabat Kesihatan Kawasan Kota Kinabalu
75	Pejabat Kesihatan Kawasan Kudat
76	Pejabat Kesihatan Kawasan Lahad Datu
77	Pejabat Kesihatan Kawasan Sandakan
78	Pejabat Kesihatan Kawasan Tawau
79	Pejabat Kesihatan Kawasan Tuaran
80	Pejabat Kesihatan Kuala Selangor
81	Pejabat Kesihatan Putrajaya
82	Pejabat Pergigian Bahagian Kuching
83	Pejabat Pergigian Bahagian Sri Aman
84	Pejabat Pergigian Bahagian Samarahan
85	Pejabat Pergigian Bahagian Sarikei
86	Pejabat Pergigian Bahagian Sibu
87	Pejabat Pergigian Bahagian Miri
88	Pejabat Pergigian Beaufort
89	Pejabat Pergigian Daerah Hulu Langat
90	Pejabat Pergigian Daerah Petaling
91	Pejabat Pergigian Daerah Seberang Perai Utara
92	Pejabat Pergigian Sandakan
93	Pejabat Pergigian Tawau
94	Pejabat Perkhidmatan Pergigian Daerah Kemaman

No.	Others
1	Department of Public Health
2	Disease Control Division, National Public Health Laboratory
3	Disease Control Division, Vector Borne Diseases Control Section
4	Ibu Pejabat Tibi / Kusta - Kota Kinabalu
5	Jabatan Kesihatan Negeri Johor
6	Jabatan Kesihatan Negeri Kelantan
7	Jabatan Kesihatan Negeri Perlis
8	Jabatan Kesihatan Negeri Sabah
9	Jabatan Kesihatan Wilayah Persekutuan Kuala Lumpur
10	National Leprosy Control Center

Ministry of Health Institutions participating in NMUS survey

No.	Ministry of Health Institutions
1	College of Allied Health Science, Kuching
2	College of Medical Laboratory Technology
3	College of Nursing, Ipoh
4	College of Nursing, Kuala Terengganu
5	College of Nursing, Kubang Kerian
6	Divisional Store Kapit
7	Divisional Store Limbang
8	Divisional Store Sibu
9	Institute for Medical Research (IMR)
10	Institut Kesihatan Umum
11	Kolej Kejururawatan Johor Bahru
12	Kolej Kejururawatan Melaka
13	Kolej Radiografi (Pengimejan Perubatan)
14	Makmal Kesihatan Awam Kota Kinabalu
15	Makmal Perubatan dan Stor Kuching
16	Makmal Ubat & Stor Miri
17	Makmal Ubat & Stor Sarikei
18	Makmal Ubat & Stor Sri Aman
19	National Blood Centre
20	Pusat Bekalan Farmasi Negeri Sabah, Kota Kinabalu
21	Stor Pergigian Negeri Selangor
22	Stor Pergigian Pusat Kota Kinabalu

Primary Care Clinics participating in NMUS survey

No.	Ministry of Health Clinics
1	Klinik Kesihatan Bandar Baharu
2	Klinik Kesihatan Bandar Miri
3	Klinik Kesihatan Bintangor
4	Klinik Kesihatan Bintulu
5	Klinik Kesihatan Jalan Masjid Kuching
6	Klinik Kesihatan Jalan Oya
7	Klinik Kesihatan Kapit
8	Klinik Kesihatan Kota Sentosa
9	Klinik Kesihatan Lawas
10	Klinik Kesihatan Sri Aman
11	Klinik Kesihatan Tanah Puteh
12	Klinik Kesihatan Lanang
13	Klinik Kesihatan Sarikei
14	Klinik Pergigian Bentong
15	Klinik Pergigian Besar Baling
16	Klinik Pergigian Besar Jitra
17	Klinik Pergigian Besar Kulim
18	Klinik Pergigian Besar Langkawi
19	Klinik Pergigian Besar Sungai Petani
20	Klinik Pergigian Besar Telok Wanjah
21	Klinik Pergigian Betong
22	Klinik Pergigian Bintulu
23	Klinik Pergigian Daerah Kerian
24	Klinik Pergigian Hospital Kuala Kangsar
25	Klinik Pergigian Hospital Teluk Intan
26	Klinik Pergigian Hulu Perak
27	Klinik Pergigian Keningau
28	Klinik Pergigian Kinta
29	Klinik Pergigian Komuniti Tapah
30	Klinik Pergigian Kubang Semang
31	Klinik Pergigian Kudat
32	Klinik Pergigian Labuan
33	Klinik Pergigian Limbang
34	Klinik Pergigian Pakar, Hospital Lahad Datu
35	Klinik Pergigian Pakar Kuching
36	Klinik Pergigian Perak Tengah
37	Klinik Pergigian Rompin
38	Klinik Kesihatan Tudan
39	Klinik Pergigian Wilayah Persekutuan Kuala Lumpur

Primary Care Clinics participating in NMUS survey

No.	Private Clinics
1	Ali Klinik
2	Asia Clinic
3	B. Kong's Clinic
4	Bina Kelinik
5	Chan Clinic, Kuching
6	Cheah & Lim Medical Associates
7	Chee Hwa Dispensary
8	Chua Kelinik
9	City Medical Centre
10	City Poliklinik
11	Clinic Joseph
12	Dindings Poliklinik
13	Dispensary Martin dan Lalita
14	Dispensary Sharil
15	Dora Medical Clinic
16	Dr. Amir Abbas-KMA Sdn. Bhd.
17	Dr. Jaafar Dan Rakan-Rakan
18	Dr. Kueh's Clinic
19	Dr. Leela Ratos dan Rakan-Rakan (Pudu) Sdn. Bhd.
20	Dr. Mohamed Mydin & Rakan-Rakan Sdn. Bhd., Jln. Ampang
21	Dr. Mohamed Mydin & Rakan-Rakan Sdn. Bhd., Jln. Tun Razak
22	Drs. Abraham George & Partners
23	Drs. Tong, Leow, Chiam & Partners, Chong Dispensary - Jln Ampang
24	Drs. Tong, Leow, Chiam & Partners (Chong Dispensary) - Jln Leboh Ampang

Primary Care Clinics participating in NMUS survey

No.	Private Clinics
25	Dr. S. Vijayakumar
26	Dr. Yap's Clinic
27	Elizabeth Medical Centre Sdn. Bhd.
28	Gill Medical Centre
29	Goay Klinik
30	Healthcare Medical Centre S/B
31	Jose Clinic & Surgery
32	Kelinik Chan
33	Kelinik Chong
34	Kelinik Gopi, Jln. Market
35	Kelinik Gopi, Tmn. Desa Permai
36	Kelinik Liu
37	Kelinik Mersing
38	Kelinik Poorni
39	Kelinik Radha Ampang
40	Khong Klinik
41	Klinik & Surgeri Bakti
42	Klinik & Surgeri Delima
43	Klinik & Surgeri Dorai
44	Klinik & Surgeri Dr. Harvinder
45	Klinik & Surgeri Lee
46	Klinik & Surgeri Ong
47	Klinik & Surgeri Sipitang
48	Klinik & Surgeri Stanley Chong
49	Klinik & Wisma Bersalin Bhajan
50	Klinik Al' Azhim, Klebang
51	Klinik Al Farabi Jaya Gading
52	Klinik Al'azhim Tampin
53	Klinik Ali
54	Klinik Al-Insaan
55	Klinik Aman, Shah Alam
56	Klinik Aminah
57	Klinik Anita
58	Klinik Anthony
59	Klinik Ariffin
60	Klinik Asean
61	Klinik Australia
62	Klinik Awana Kijal
63	Klinik Baling
64	Klinik Ban
65	Klinik Bandaran Sdn. Bhd, SS 15/4D
66	Klinik Bandaran, Jalan Bunga Melor
67	Klinik Bandaran, Section 15
68	Klinik Baru Jerteh
69	Klinik Berkat
70	Klinik Bersatu
71	Klinik Bersatu (Tikam Batu)
72	Klinik Bersatu 16 Jam
73	Klinik Bersatu 24 Jam
74	Klinik Bersatu Kulim
75	Klinik Bintulu
76	Klinik Bukit Beruang
77	Klinik Bukit Maluri & Surgeri
78	Klinik Catterall, Khoo and Raja Malek, Bangunan Ming
79	Klinik C F Chong
80	Klinik Cempaka
81	Klinik Ceria
82	Klinik Chai
83	Klinik Chang
84	Klinik Chen
85	Klinik Cheryan
86	Klinik Chew
87	Klinik Chiew
88	Klinik Chin
89	Klinik Chon
90	Klinik Choo
91	Klinik Cinta Sayang, Jln. Ibrahim
92	Klinik C. S. Ooi

No.	Private Clinics
93	Klinik dan Surgeri Dr. Gan
94	Klinik dan Surgeri Putra
95	Klinik Dedap (Tmn. Johor Jaya)
96	Klinik Desa, Desa Petaling
97	Klinik Doktor Wong
98	Klinik Dorai
99	Klinik Doshi
100	Klinik Dr. Bazlan
101	Klinik Dr. C.H. Kong
102	Klinik Dr. Che Ku
103	Klinik Dr. Cheu Sdn. Bhd.
104	Klinik Dr. Chew
105	Klinik Dr. Elvin Chong & Surgeri
106	Klinik Dr. Fateh Mohd dan Rakan-Rakan
107	Klinik Dr. Hamid
108	Klinik Dr. Husna, Tmn. Ria
109	Klinik Dr. Jamaludin Dan Surgeri
110	Klinik Dr. Leela Ratos dan Rakan-Rakan, Jln. Ipoh
111	Klinik Dr. Lilian Hong
112	Klinik Dr. Mohamad
113	Klinik Dr. Rahim Omar & Rakan-Rakan
114	Klinik Dr. Roslan
115	Klinik Dr. Syed
116	Klinik Dr. Ting
117	Klinik Dr. Tuan Yusof
118	Klinik Dr. Umi
119	Klinik Dr. Yasiman Perdana
120	Klinik Dr. Yong
121	Klinik Dr. Zakaria & Rakan-Rakan
122	Klinik Efendi
123	Klinik Ehsan
124	Klinik Eirena
125	Klinik Endau
126	Klinik Everlasting Sdn. Bhd.
127	Klinik Faiza Woon
128	Klinik Famili, Wangsa Melawati
129	Klinik Fateh Mohd & Rakan-Rakan
130	Klinik Ganesha Vijayam
131	Klinik George Jinivon
132	Klinik Glugor
133	Klinik Grace
134	Klinik G.S
135	Klinik Gurdip
136	Klinik Haji Ayaz
137	Klinik Halizah
138	Klinik Hikmah
139	Klinik Hisham
140	Klinik Hock-San
141	Klinik Hossana
142	Klinik Hsu dan Ng
143	Klinik H.T. Lee
144	Klinik Husin
145	Klinik Ian Ong
146	Klinik Ibu Kota, Satok
147	Klinik Idaman
148	Klinik Idzham Sdn. Bhd., Danau Kota
149	Klinik Ikhwan & Surgeri
150	Klinik Imbi
151	Klinik Ishak dan Surgeri
152	Klinik Jaafar & Partners
153	Klinik Jalan Templer Sdn. Bhd.
154	Klinik Jauhar
155	Klinik Jaya
156	Klinik Jaya, Subang Jaya
157	Klinik J.D.
158	Klinik Jelebu
159	Klinik Johor (Jalan Dedap)
160	Klinik Joseph & Surgeri

Primary Care Clinics participating in NMUS survey

No.	Private Clinics
161	Klinik K S Tan
162	Klinik K V Tan
163	Klinik Kaulsay
164	Klinik Keluarga Aishah
165	Klinik Keluarga Dr. Hj. Mohd. Khadzil
166	Klinik Khairat
167	Klinik Khizan
168	Klinik Koidupan
169	Klinik Kok
170	Klinik Kok dan Surgeri
171	Klinik Kok dan Wendy
172	Klinik Kok Wah
173	Klinik Kok, Jln 17/1A
174	Klinik Kong
175	Klinik Kuantan
176	Klinik Kwok
177	Klinik Langkawi, Pusat Bandar Kuah
178	Klinik Lau
179	Klinik Lee, Petaling Jaya
180	Klinik Leong, Selangor
181	Klinik Leong, Terengganu
182	Klinik Leong, Tmn. Maluri
183	Klinik Lim
184	Klinik Lim & Lau
185	Klinik Lim Chin Chong Sdn. Bhd.
186	Klinik Lo
187	Klinik Low, Setapak
188	Klinik Ludher, Jln. Kelang Lama
189	Klinik Maamor
190	Klinik Maharani
191	Klinik Makbul
192	Klinik Malaysia
193	Klinik Malaysia, Tampoi
194	Klinik Maniraj
195	Klinik Maria
196	Klinik Mariam
197	Klinik Masjid Tanah
198	Klinik Medi Pembangunan
199	Klinik Medi Pesona
200	Klinik Medicare, Jln. Bangsar
201	Klinik Medijaya
202	Klinik Medijaya, Jln SS 25/2, Tmn. Bkt. Emas
203	Klinik Medik 24-7, Bandar Country Homes
204	Klinik Mediviron, Tmn. Sentosa
205	Klinik Metro, Puchong
206	Klinik Mitter dan Rakan-Rakan
207	Klinik Mogan
208	Klinik Muhibbah, Kedah
209	Klinik Muhibbah, Melaka
210	Klinik Mutiara Inanam
211	Klinik Naga
212	Klinik Nagiah
213	Klinik Nanda
214	Klinik Nasha
215	Klinik Nathan, Bgn. Mas
216	Klinik Noh
217	Klinik Noorleza
218	Klinik Nur Aqila
219	Klinik Nur'Aina
220	Klinik Nuraini
221	Klinik Ong dan Surgeri
222	Klinik Pakatan Medik
223	Klinik Papar Medical Group
224	Klinik Perdana - Wisma Suara Muda
225	Klinik Perdana Cawangan Islah
226	Klinik Perkasa
227	Klinik Permata
228	Klinik Pertama, Pulau Pinang
229	Klinik Pertama, Sg. Besi
230	Klinik Pertama (Tmn. Johor Jaya)
231	Klinik Perubatan Lita Alis
232	Klinik Petaling Jaya
233	Klinik Prihatin
234	Klinik Public
235	Klinik Pushpa
236	Klinik Rabiah
237	Klinik Radha
238	Klinik Rahimah
239	Klinik Rahmat
240	Klinik Raj (Jasin) Sdn. Bhd.
241	Klinik Raj dan Rakan-Rakan, Sentul
242	Klinik Rakyat
243	Klinik Rakyat, Jln. Besar Kepong
244	Klinik Ramachandran
245	Klinik Ratnam
246	Klinik Rawatan Keluarga
247	Klinik Rawatan Utama
248	Klinik Reddy
249	Klinik Reddy PJ
250	Klinik Reddy Setapak
251	Klinik Ria
252	Klinik Roberts
253	Klinik Rohana & Seripah Sdn. Bhd.
254	Klinik S K Leong
255	Klinik Sada
256	Klinik Saujana, Melaka
257	Klinik Saujana, Selangor
258	Klinik Segamat
259	Klinik Segara, Jln. Bangsar
260	Klinik Sekeluarga Ipoh
261	Klinik Sentosa
262	Klinik Sentosa Sdn. Bhd.
263	Klinik Seremban, Senawang Jaya
264	Klinik Setapak & Surgeri, Sri Rampai
265	Klinik Sharani
266	Klinik Shatin
267	Klinik Sibu
268	Klinik Sihat - Putrajaya
269	Klinik Simee
270	Klinik Sinar
271	Klinik Siti Zariah
272	Klinik Siva
273	Klinik Soo
274	Klinik Soon, Sarawak
275	Klinik Soon, Selangor
276	Klinik Soong
277	Klinik Sri Puteri
278	Klinik Sri Sulong
279	Klinik Subang Perdana
280	Klinik Suhaini
281	Klinik Sulaiman
282	Klinik Sulaiman Jerantut
283	Klinik Sungai Besar
284	Klinik T.A.R.
285	Klinik TA
286	Klinik Tampin
287	Klinik Tan
288	Klinik Tan Cheng Leng
289	Klinik Tan See Kin
290	Klinik Tan, Sg. Petani
291	Klinik Teh, Negeri Sembilan
292	Klinik Teh, Selangor
293	Klinik Templer
294	Klinik Tengku Amir & Surgeri
295	Klinik Teo
296	Klinik Teow & Teo Medicare

Primary Care Clinics participating in NMUS survey

No.	Private Clinics
297	Klinik Ting
298	Klinik Toh & Lim
299	Klinik Ummu Roihan Sdn. Bhd.
300	Klinik Union
301	Klinik Utama, Selangor
302	Klinik Utama, Kuala Lumpur
303	Klinik Vigneshwer
304	Klinik Voon
305	Klinik Wawasan
306	Klinik Wawasan 14 Jam
307	Klinik Wee
308	Klinik Wee (Woo Dispensary)
309	Klinik Wong, Sabah
310	Klinik Wong, Selangor
311	Klinik Wong Ching Seh
312	Klinik Yeoh
313	Klinik Yii
314	Klinik Zahar
315	Klinik Zain
316	Klinik Zainab
317	Klinik Zainiati
318	Klinik Zaleha
319	Kumpulan Medic, Subang Jaya
320	Kumpulan Perubatan SMP Sdn. Bhd. (Klinik Pertama)
321	Loh & Lim Sdn. Bhd.
322	Maha Klinik
323	Medi Klinik Shahrol
324	Medic-Klinik Lim
325	Mediklinik TTDI Jaya
326	Ophir Clinic
327	Perak Medical Centre Sdn. Bhd., Kampar
328	Perdana Polyclinic Lumut
329	Perdana Polyclinics Selayang
330	Poli Klinik, Jln. P. Ramlee
331	Poliklinik & Surgeri Seapark
332	Poliklinik Albukhari
333	Poliklinik Al-Haj
334	Poliklinik An-Nisa
335	Poliklinik Bukit Mayang Emas
336	Poliklinik Central & Surgeri, Jln. Genting Klang
337	Poliklinik dan Surgeri Ren-Ai
338	Poliklinik Dinamik, Beranang
339	Poliklinik Dinamik, Kajang
340	Poliklinik Dinamik, Semenyih
341	Poliklinik Dr. Azhar, Jeniang
342	Poliklinik Dr. Norliza
343	Poliklinik Family
344	Poliklinik Fitrah
345	Poliklinik Harmoni
346	Poliklinik Hidayah, Perak
347	Poliklinik Hidayah, Selangor
348	Poliklinik Kumpulan City - Capital Square
349	Poliklinik Kumpulan City - Dataran Templer
350	Poliklinik Kumpulan City – Jln. Inai
351	Poliklinik Kumpulan City – Jln. Pahang
352	Poliklinik Kumpulan City – Tmn. Connaught
353	Poliklinik Lai
354	Poliklinik Lim & Leong
355	Poliklinik Md. Top
356	Poliklinik Medic
357	Poliklinik Meranti
358	Poliklinik Mindaku
359	Poliklinik Murni
360	Poliklinik Mutiara, Tmn. Desa Aman
361	Poliklinik Perubatan Kubang Pasu
362	Poliklinik Pusat Rawatan Islam (PCSB)
363	Poliklinik Rakyat, Bahau
364	Poliklinik Raub & Surgery
365	Poliklinik Ravi
366	Poliklinik S. Naga
367	Poliklinik Samudera, Sitiawan
368	Poliklinik Sandhu
369	Poliklinik Sentosa
370	Poliklinik Seri Mas
371	Poliklinik SM Lee & Rakan-Rakan
372	Poliklinik Star Puchong
373	Poliklinik Tan, Lee & Cheong
374	Poliklinik Tang
375	Poliklinik Teoh & Ding
376	Poliklinik Zul Dan Rakan-Rakan Sdn. Bhd.
377	Poly Klinik dan Surgery Kampung Pandan
378	Polyklinik Rajoo
379	Pusat Bersalin & Poliklinik Dr. C.Y.Ong Sdn. Bhd.
380	Pusat Rawatan Desa Pandan
381	Shri Senthil Clinic
382	Sim's Medical Clinic, Miri
383	Somu Kelinik
384	Sushila Clinic
385	The Key Clinic
386	The Merican Dispensary
387	The People's Dispensary Sdn Bhd., Johor Bahru
388	Tiram Medical Centre
389	Uma Klinik
390	Union Clinic
391	Union Clinic (S.A)
392	Yoong Clinic Sdn. Bhd.

Pharmacies participating in NMUS survey

No.	Private Pharmacies
1	Apo's Pharmacy
2	Baling Pharmacy Sdn. Bhd.
3	C S Lo Pharmacy
4	Daya Pharma Sdn. Bhd.
5	Delima Farmasi Sdn. Bhd.
6	Far East Pharmacy Sdn. Bhd.
7	Farmasi Alychem Sdn. Bhd - Selayang, Batu Caves
8	Farmasi Alychem Sdn. Bhd - Sg. Long, Kajang
9	Farmasi Alychem Sdn. Bhd - Bdr. Baru Sg. Buloh
10	Farmasi Alychem Sdn. Bhd - Paya Jaras, Sg. Buloh
11	Farmasi Bintang
12	Farmasi Carrie Sdn. Bhd.
13	Farmasi Chia
14	Farmasi Goh – Bdr. Puchong Jaya
15	Farmasi Komuniti UKM
16	Farmasi Lim
17	Farmasi Nazifa
18	Farmasi Pendang
19	Farmasi Ruby
20	Gaya Pharmacy Supplies
21	GP Pharmacy
22	Health-Care Pharmacy
23	Jitra Pharmacy Sdn. Bhd.
24	K H Hoe Pharmacal Sdn. Bhd.
25	Karamunsing Pharmacy Sdn. Bhd.
26	KNL Medicare
27	Kumpulan Farmasi Vitacare Sdn. Bhd.
28	Nori Care Pharmacy
29	Pahang Pharmacy Sdn. Bhd - Karak
30	Pharmachem Labuan Sdn. Bhd.
31	Pharmalink Pharmacy Sdn. Bhd.
32	Pusat Farmasi USM (Kedai Koop)
33	Rheco Pharmacy
34	Sentosa Pharmacy
35	Zuffa Pharmacy Sdn Bhd – Jln. Petani