MINISTRY OF HEALTH MALAYSIA

MALAYSIAN STATISTICS ON MEDICINES 2008

A publication of the

PHARMACEUTICAL SERVICES DIVISION AND THE CLINICAL RESEARCH CENTRE
MINISTRY OF HEALTH MALAYSIA

MALAYSIAN STATISTICS ON MEDICINES 2008

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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 intention to continuously and systematically collect data on medicines with the hope that the findings will help promote rational use as well as provide a tool for better decision making in the allocation of healthcare resources for the Malaysian population.

The NMUS is into its eighth year and this report, the Malaysian Statistics on Medicines (MSOM) 2008, is its fifth publication. From the first publication of MSOM 2004, we have progressively improved and enhanced the data processing and statistical analysis methodologies. For this report, the 2007 data was reanalysed using the updated statistical methodology, taking into consideration also changes in WHO Guidelines for ATC and DDD Assignment, thus allowing comparison with the 2008 data. The drug utilisation data in this report is tabulated in such a way as to allow this comparison.

The scope of NMUS and the MSOM reports are limited by data collection logistics and availability of defined daily doses (DDD) for a drug in the WHO Guidelines for ATC Classification and DDD Assignment. Nonetheless, for MSOM 2008 we are able to add two new chapters i.e. Chapter 26: Use of Drugs for Cough and Cold and Chapter 27: Use of Vaccines, using locally established DDDs based on WHO general guidelines. We are optimistic that as NMUS matures, more chapters will be added to deliberate on more classes of drugs, and future MSOM reports will continue to produce accurate and reliable statistics on Malaysian medicines consumption.

The NMUS faces many challenges, not the least the varied and non-standardised form of source data and its volume. This has made data-processing and data quality assurance an almost insurmountable task. However, with perseverance, we have managed to come out with data which reflect the general quantum and pattern of medicines consumption in this country. Continued efforts will be made to improve all aspects of the survey and report, and to ensure timely publication of the data in future.

We sincerely hope that this MSOM 2008 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.

The author(s) would like to thank the Director General Of Health Malaysia for permission to publish this report. We also would like to thank all staff, past and present, 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 and everyone who has in one way or another contributed enthusiastically to the success of the NMUS and the writing of this report.

Pharmaceutical Services Division
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- 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
- Senior Director of Oral Health Division, MOH
- 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 which provided or allowed access to their medicines procurement data
- University of 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)
- Pharmaniaga Logistics Sdn Bhd. and Forte Tech Solutions Sdn. Bhd.
- Dr. Lim Teck Onn, former Director, Clinical Research Centre, who played a pivotal role in the initiation and development of the NMUS project
- All who have in one way or another supported and/or contributed to the success of the NMUS and this report

Dr. Salmah binti Bahri
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National Medicines Use Survey,
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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 utilization 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 utilization at various levels of our health care system, whether national, regional, local or institutional.

Routinely compiled statistics on medicines utilization 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 its utilization 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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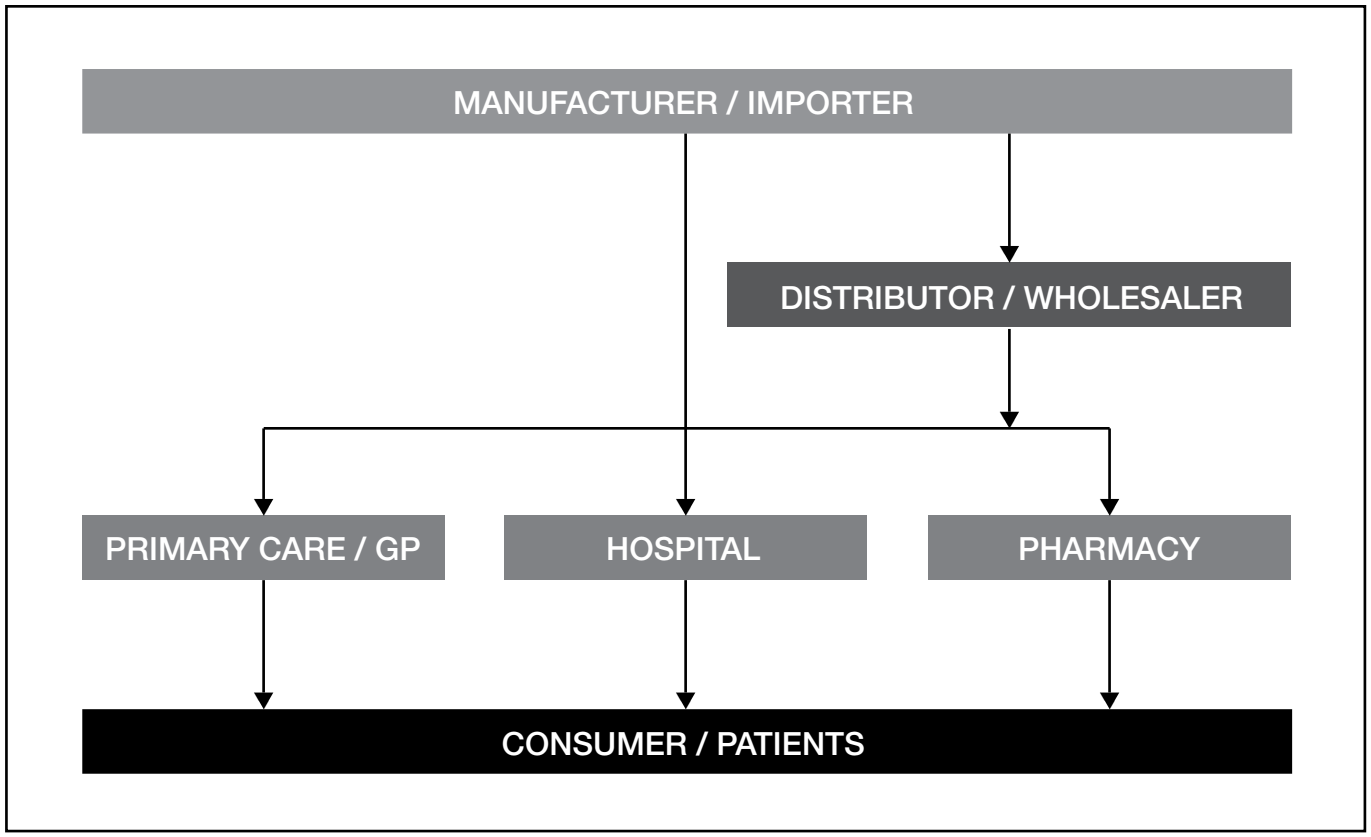
Introduction

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 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 2008 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)	2007, 2008	Yes
	b. MOH individual hospital local purchase (NonAPPL)	2007, 2008	Yes
	c. University and Armed Forces hospitals procurement	2007, 2008	Yes
3.2	Private hospitals procurement	2007, 2008	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	2007, 2008	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	2007, 2008	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 utilization 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 specialized 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 medicine 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 2008, the survey population and sampling unit, sample size and survey response or coverage rates are summarized in the table below:

NO.	SURVEYS	SURVEY POPULATION AND SAMPLING UNIT	SAMPLE SIZE	COVERAGE OR RESPONSE RATE, AND COMPLETENESS
1.	MOH pharmaceutical procurement	a. APPL b. Non APPL	338 189	100%
2.	Private hospitals pharmaceutical procurement	137 Private hospitals	58	42.3 %
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	5,104	363	7.11%
5.	Private pharmacy dispensing	1,767	814	46.01%

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 hospital's pharmaceutical procurement databases
3.	University and Armed Forces hospital pharmaceutical procurement	Individual hospital's 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 three 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 and 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 normalized 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 one record, to speed up subsequent query performance
5.	The data were then 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* The 'prescription' products from the list of products registered with BPFK 2010, 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 one 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 one 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 one 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) according to the Guidelines for ATC Classification and DDD Assignment 2011, WHO Collaborating Centre for Drug Statistics Methodology.[2] This system is recommended by the WHO for drug utilization research, comparisons of drug consumption statistics such as between countries, between regions or population groups within country and for evaluation of 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, e.g. C cardiovascular, M musculo-skeletal, R respiratory, etc
2	Therapeutic main group
3	Therapeutic subgroup
4	Chemical or Therapeutic subgroup
5	Drug chemical substance

An example should make this clear. 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 a simple technical measurement of drug utilization; 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 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, their DDDs/1000 inhabitants/day are 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 medicine use statistics are 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 utilization is equivalent to the treatment of every inhabitant with a 5-days course in the year.

In interpreting drug utilization statistics expressed using DDD as in this report; readers are caution 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 or prescribed or dispensed, as presented here, may not necessarily be consumed.
- DDD may be difficult to assign or not assign 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 it.
- 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 utilization statistics. However, a few groups of drugs which do not have WHO-assigned DDDs, namely the Antineoplastics, Dermatologicals, Ophthalmologicals, Otologicals, Cough and Cold Combinations and Vaccines were given DDDs based on the WHO general guidelines to enable us to present the national utilization and patterns of use, relative to drugs within the respective groups only.

Statistical Methods

In NMUS report, the quantity of use of a medicine is expressed as, depending on the type of medicine, 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

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

where

$\hat{T}$ is an estimate of the total quantity of the drug utilized 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_{2008} = 27,728,700),

365 refers to the 365 days in a year

In either case, an estimate of the total quantity of the drug being utilized 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 due to fully 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 $\hat{T} = \sum_{i=1}^{I} \sum_{j=1}^{7} w_i T_{ij}$ where T_{ij} is the value of the quantity of drug prescribed by the i^{th} GP or pharmacy on the j^{th} day. $w_i = \frac{N}{n} \times \frac{D}{d_i}$ 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 GP or pharmacy in a year.

Where there is sampling or where response rate of the survey was less than 100%, the procedures described above incorporate 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 utilization, such as bed strength, staff strength, scope of services for hospitals etc.

EXPENDITURE ESTIMATION METHODOLOGY

Study Population

The MSOM encompasses private & public healthcare providers in Malaysia consisting of:

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 and general practitioners in Malaysia.

c. Private sector retail pharmacies.

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.

Total expenditure = Quantity of drug utilization *Price of drug

Quantity of drug utilization is determined from the drug utilization 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 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 for 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 calculated as $E_i = p50_i * DDD_i$ where p50 is the median price, DDD is the quantity of utilization 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 items in that sector. The total expenditure for the country is the sum of total expenditure in all the sectors.

References:

1. Percetakan National 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 2011. Oslo, 2011, (www.whocc.no).

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ABBREVIATIONS

3rd GCS	Third-Generation Cephalosporins
5HT$_1$	Serotonin
5-ARI	5 Alpha-reductase inhibitor
ABC	Alternative Birth Centre
ACEI	Angiotensin Converting Enzyme Inhibitors
ACS	Acute Coronary Syndrome
ACTH	Adrenocorticotropic Hormone
AdmR	Administration Route
ADT	Androgen Deprivation Treatment
AED	Antiepileptics
AEFI	Adverse Events Following Immunization
ALL	Acute Lymphoblastic Leukemia
ALLHAT	The Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial
Anti-HIV	Anti-Human Immunodeficiency Virus
APML	Acute Promyelocytic Leukemia
APPL	Approve Product Purchase List
ARB	Angiotensin II Antagonists/ Angiotensin Receptor Blocker
ASR	Age Standardised Incidence Rate
ATC	Anatomical Therapeutic Chemical
BCG	Bacille Calmette–Guérin
BPH	Benign Prostatic Hyperplasia
BSA	Body Surface Area
CCB	Calcium Channel Blockers
CNI	Calcineurin Inhibitors
CNS	Central Nervous System
COMT	Catechol-O-Methytransferase
COPD	Chronic Obstructive Pulmonary Disease
COX-2	Cyclooxygenase-2
CPG	Clinical Practice Guidelines
CTZ	Chlorothiazide
CV	Cardiovascular
DAs	Dopamine Agonists
DCA	Drug Control Authority
DDA	Dangerous Drugs Act
DDD	Defined Daily Dose
DES	Drug Eluting Stents
DM	Diabetes Mellitus
DMARD	Disease-Modifying Antirheumatic Drugs
DPP-4	Dipeptidyl peptidase-4
DTaP	Diphtheria Tetanus and Pertussis
EPI	Expanded Programme for Immunization
EPS	Extrapyramidal Syndrome
ESAC	European Surveillance of Antimicrobial Consumption
ESBL	Extended Spectrum Beta-Lactamase
ESRD	End-Stage Renal Disease
ESRF	End-Stage Renal Failure
EGFR	Epidermal Growth Factor Receptor
Exclud.	Excluding
FEIBA	Factor VIII Inhibitor Bypassing Activity
GORD/GERD	Gastro-Oesophageal Reflux Disease
GRACE	Global Registry of Acute Coronary Events
H$_2$RA	H$_2$ Receptor Antagonist

HAART	Highly Active Anti-Retroviral Therapy
HCTZ	Hydrochlorothiazide
HIV	Human Immunodeficiency Virus
HMG CoA	3-hydroxy-3-methylglutaryl coenzyme A
HPV	Human Papillomavirus
ICS	Inhaled Corticosteroid
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
MDG	Millenium Development Goal
MG	Myasthenia Gravis
MMR	Measles Mumps Rubella
MOH	Ministry of Health
MRSA	Methicillin-resistant *Staphylococcus aureus*
MSSA	Methicillin-sensitive *Staphylococcus aureus*
NCVD	National Cardiovascular Database
NEDL	National Essential Drugs List
NHMS	National Health and Morbidity Survey
NIP	National Immunization Programmes
Non-APPL	Non Approve Product Purchase List
NMP	National Medicines Policy
NMUS	National Medicines Use Survey
NSAIDs	Non Steroidal Anti-Inflammatory Drugs
O	Oral
O&G	Obstetrics and Gynaecology
OTC	Over-the-Counter
P	Parenteral
PCP	*Pneumocystic carinii* pneumonia
PCOS	Polycystic Ovarian Syndrome
PD	Parkinson's Disease
PDE5	Phosphodiesterase Type-5
PPI	Proton Pump Inhibitors
RAS	Renin-Angiotensin System
rHuEPO	Recombinant Human Erythropoietin
RRMS	Remitting-Relapsing Multiple Sclerosis
RTI	Respiratory Tract Infection
SABA	Short-Acting Beta Agonists
SERMS	Selective Estrogen Receptor Modulators
SL	Sublingual
SORMs/SERMs	Selective Oestrogen Receptor Modulators
SSRIs	Selective Serotonin Reuptake Inhibitors
STD	Sexually Transmitted Diseases
T3	Liothyronine sodium
TD	Transdermal
TNF	Tumor Necrosis Factor
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 the national estimates for use of medicines in Malaysia from the National Medicines Use Survey 2008. Statistics for the most commonly used medicines by therapeutic group and by drugs are shown in the tables below. Detailed statistics for all drugs are given in other chapters for specific therapeutic groups. Relevant 2007 statistics are tabulated to facilitate comparison with 2008 utilisation.

As in previous years, the National Medicines Use Survey (NMUS) 2008 included only drugs which were prescription medicines; Over-the-Counter (OTC) medicines, traditional and complimentary medicines which were not controlled drugs were excluded.

The unit of measure adopted for utilisation estimates in this report is the Defined Daily Doses (DDDs) according to the World Health Organisation (WHO) Anatomical Therapeutic Chemical (ATC) classification and DDD assignment system[1]; the statistics are expressed as number of DDDs per 1000 population per day. This report, the Malaysian Statistics on Medicines (MSOM) 2008, covers mainly medicines which have WHO-assigned DDDs. However, statistics for several classes of drugs which do not have WHO-assigned DDDs, i.e.Antineoplastics, Dermatologicals, Ophthalmologicals, Otologicals, Cough & Cold preparations and Vaccines, are also reported in the respective chapters using DDDs assigned locally, based on WHO Guidelines.

In this chapter, only drugs with WHO assigned DDDs are presented in ranking tables for therapeutic groups and individual drugs, to enable comparison with other countries.

There have not been many changes over the two year period for the top 10 therapeutic groups of drugs utilised, except antibacterials for systemic use have moved into the top 10 list whilst antithrombotic agents were no longer in the top 10 therapeutic groups utilised in 2008.

Among the therapeutic groups, drugs used in diabetes (ATC code A10) were still the highest in terms of utilisation in Malaysia for the year 2008 (Table 1.1) as was in 2007 (Table 1.2). An estimate of 4.67% of the Malaysian population was on drugs from this therapeutic group.

The therapeutic groups used for cardiovascular disorders, namely agents acting on the renin angiotensin system (C09) were consumed by 2.88% of the population, calcium channel blockers (C08) 2.61%, beta blocking agents (C07) 2.27%, lipid modifying agents (C10) 1.63%, and diuretics by 1.44%. These groups ranked from 2nd to 6th respectively (Table 1.1). However, it is noted that the utilisation of the beta-blocking agents was less in 2008 compared to 2007.

Antiinflammatory and Antirheumatic medicines constituted the next highest ranking group of drugs. However, there was a notable 11.3% reduction in total utilisation for 2008 (11.22 DDD/1000 population/day) compared to 2007 (12.66 DDD/1000 population/day). It was also clearly shown that the private sector utilisation of anti-inflammatory and antirheumatic drugs were more than double that of the public sector in both years. Both sectors showed reduction in usage in 2008 compared to 2007.

Overall, there was not much difference in 2008 ranking for the top 5 individual drugs by utilisation when compared to 2007 (Table 1.3 and Table 1.4 respectively).

Gliclazide was the most utilised drug in 2008. It was also the most utilised drug for 2007 based on the revised ddd of 60mg according ATC 2011. Metformin, the second most utilised antidiabetic ranked third among the top 10 drugs utilised for 2008, with a decrease in total usage compared to 2007. Usage of insulin (human) intermediate combined with fast-acting, on the other hand, increased by 19.1% from 1.41ddd/1000pop/day (2007) to 1.68ddd/1000pop/day (2008), although there was not much difference its ranking, 34th (2007) and 35th (2008) respectively.

Drugs for cardiovascular diseases dominated the top rankings, with amlodipine ranking 2nd amongst the top 40 drugs utilised in 2008 (13.61 DDD/1000population/day). Usage increased tremendously in both the public and private sectors, resulting in an overall 51.2% increase in total utilised compared to 2007. Perindopril moved up to 4th rank in 2008 from rank 8th in 2007. 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.[2] Also, generic versions of amlodipine became available following expiration of its patent in 2007. Lovastatin, a lipid modifying drug, made a notable jump from rank 13th in 2007 to 9th in 2008, with 51.3% increase in usage due to increase primarily in the public sector. There was a significant five-fold increase in use of hydrochlorothiazide in 2008, moving it up to rank to 12th from rank 43rd in 2007. This was due to a policy change in the public sector to replace chlorothiazide, resulting in a corresponding 66.5% reduction in its usage from 2007.

The most utilised drugs in other therapeutic groups were salbutamol (rank 16th) for respiratory drugs, mefenamic acid followed closely by diclofenac (rank 17th and 18th respectively) for Non-Steroidal Anti-Inflammatory Drugs (NSAIDs), chorphenamine (rank 19th) and prednisolone (rank 20th) for antihistamines and systemic corticosteroids respectively. Cetirizine was the most utilised non-sedating antihistamine in 2008, moving up to rank 23rd overtaking loratadine which was used more in 2007. Similarly omeprazole overtook ranitidine as the top amongst drugs for acid-related disorders. Amoxicillin remained the most used antibiotic for 2007 and 2008.

The top15 drugs utilised in 2008 and the top 11 drugs for 2007 were drugs for diabetes and cardiovascular disorders. This is consistent with the increasing prevalence of chronic diseases in the country. The NHMS 2011[3], reported that the overall prevalence of diabetes was 15.2% compared to 2006 (11.6%), hypertension 32.7% compared to 2006 (32.2%) and dyslipidaemia 35.1% compared to 20.7% in year 2006, for patients ≥ 18 years.

For both 2007 and 2008, the overall drug utilisation in the public sector was double that of the private sector for the top 30 therapeutic groups. Seventeen of the thirty most utilised classes of drugs were for chronic diseases, and public sector utilisation exceeded that of private sector for both years, indicating that the burden in the management of these diseases was borne mainly by the public sector.

There was a reduction of utilisation of the short term symptomatic relief such as antihistamines, anti-inflammatoryand antirheumatic drug, nasal preparations, and corticosteroids in year 2008. However, the drugs for functional gastrointestinal disorders showed a higher consumption. Overall, the usage of these drugs in the private sector remained higher than public sector.

Comparing the Malaysian drug utilisation pattern with that of Australia[4] and Norway[5], whilst cardiovascular drugs still 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. Gliclazide, the most highly utilised drug in Malaysia but did not feature among the top 10 drugs for Norway and in fact, neither did any of the other antidiabetic drugs make it to the top 10 list for Norway.

In conclusion, the overall utilisation pattern of medicines in the country for 2007-2008 appeared to be in accordance with the general healthcare needs.

Table 1.1: Top 30 Therapeutic groups by Utilisation in DDD/1000 population/day 2008

RANK	ATC	THERAPEUTIC GROUP	PUBLIC	PRIVATE	TOTAL
1	A10	Drugs used in diabetes	37.7589	8.9353	46.6942
2	C09	Agents acting on the renin-angiotensin system	22.8609	5.9444	28.8053
3	C08	Calcium channel blockers	20.3044	5.7699	26.0743
4	C07	Beta blocking agents	18.7549	3.9353	22.6902
5	C10	Lipid modifying agents	11.9061	4.4209	16.327
6	C03	Diuretics	11.9285	2.4678	14.3963
7	M01	Antiinflammatory and antirheumatic products	3.4921	7.7326	11.2247
8	R03	Drugs for obstructive airway diseases	8.0791	2.536	10.6152
9	J01	Antibacterials for systemic use	3.3329	6.3874	9.7204
10	R06	Antihistamines for systemic use	3.6713	5.8136	9.4849
11	G03	Sex hormones and modulators of the genital system	4.8141	4.2156	9.0297
12	B01	Antithrombotic agents	5.8983	2.6942	8.5926
13	A02	Drugs for acid related disorders	3.3538	2.766	6.1197
14	C01	Cardiac therapy	3.3332	1.4864	4.8196
15	N05	Psycholeptics	2.8959	1.3195	4.2154
16	H02	Corticosteroids for systemic use	1.9628	2.1117	4.0745
17	R01	Nasal preparations	1.4927	2.5658	4.0585
18	C02	Antihypertensives	2.7776	0.2345	3.0121
19	A03	Drugs for functional gastrointestinal disorders	0.6609	1.9771	2.638
20	H03	Thyroid therapy	1.3944	0.4859	1.8803
21	N06	Psychoanaleptics	1.3563	0.4012	1.7575
22	M04	Antigout preparations	1.0007	0.595	1.5957
23	N03	Antiepileptics	1.3916	0.1841	1.5757
24	S01	Ophthalmologicals	1.3601	0.1142	1.4744
25	N07	Other nervous system drugs	0.7789	0.4487	1.2277
26	G04	Urologicals	0.8468	0.2744	1.1212
27	J04	Antimycobacterials	0.8359	0.1064	0.9423
28	A11	Vitamins	0.8699	0.0493	0.9192
29	N04	Anti-parkinson drugs	0.8042	0.0741	0.8784
30	J05	Antivirals for systemic use	0.7818	0.0619	0.8437
Total utilisation for top 30 therapeutic groups			**180.699**	**76.1092**	**256.8087**

Table 1.2: 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	41.5972	11.4613	53.0585
2	C09	Agents acting on the renin-angiotensin system	19.0866	7.8401	26.9267
3	C07	Beta blocking agents	21.5385	4.8947	26.4332
4	C08	Calcium channel blockers	18.9675	4.1969	23.1644
5	C10	Lipid modifying agents	8.9231	5.2676	14.1906
6	C03	Diuretics	11.1078	3.0298	14.1375
7	R03	Drugs for obstructive airway diseases	9.8788	2.8689	12.7476
8	M01	Antiinflammatory and antirheumatic products	4.1627	8.493	12.6558
9	R06	Antihistamines for systemic use	4.59	6.9903	11.5803
10	B01	Antithrombotic agents	6.4694	3.6034	10.0728
11	J01	Antibacterials for systemic use	3.6833	6.1907	9.874
12	G03	Sex hormones and modulators of the genital system	3.1440	5.2733	8.4172
13	A02	Drugs for acid related disorders	3.1286	3.321	6.4496
14	H02	Corticosteroids for systemic use	1.9477	4.0805	6.0282
15	N05	Psycholeptics	3.4276	1.5606	4.9882
16	C01	Cardiac therapy	3.4079	1.5771	4.985
17	R01	Nasal preparations	1.3870	3.1108	4.4978
18	C02	Antihypertensives	3.1732	0.1939	3.3671
19	A03	Drugs for functional gastrointestinal disorders	0.7151	1.446	2.1611
20	H03	Thyroid therapy	1.4859	0.546	2.0319
21	N06	Psychoanaleptics	1.2468	0.5838	1.8306
22	M04	Antigout preparations	1.1506	0.6537	1.8042
23	N03	Antiepileptics	1.3802	0.275	1.6553
24	S01	Ophthalmologicals	1.2472	0.2431	1.4903
25	N07	Other nervous system drugs	0.5756	0.559	1.1346
26	G04	Urologicals	0.7837	0.3077	1.0915
27	J04	Antimycobacterials	0.8616	0.1265	0.9881
28	N04	Anti-parkinson drugs	0.7411	0.0694	0.8105
29	M03	Muscle relaxants	0.0976	0.6721	0.7697
30	A07	Antidiarrheals, intestinal antiinflammatory/antiinfective agents	0.2742	0.4848	0.7590
Total utilisation for top 30 therapeutic groups			**180.1805**	**89.921**	**270.1013**

Table 1.3: Top 40 Drugs by Utilisation in DDD/1000 population/day 2008

RANK	ATC	DRUG	PUBLIC	PRIVATE	TOTAL
1	A10B B09	Gliclazide	15.7901	3.0156	18.8057
2	C08C A01	Amlodipine	9.1411	4.4649	13.6059
3	A10B A02	Metformin	10.2373	3.3167	13.554
4	C09A A04	Perindopril	10.2666	0.8315	11.0981
5	C07A B02	Metoprolol	10.4686	0.4227	10.8913
6	C07A B03	Atenolol	7.6974	2.4910	10.1883
7	C08C A05	Nifedipine	8.9409	0.6251	9.566
8	A10B B01	Glibenclamide	7.4417	1.0611	8.5029
9	C10A A02	Lovastatin	7.2106	0.2105	7.4211
10	B01A C06	Acetylsalicylic acid	4.3807	1.6469	6.0275
11	C09A A02	Enalapril	4.7625	0.9805	5.743
12	C03A A03	Hydrochlorothiazide	4.6351	0.8399	5.475
13	C03C A01	Furosemide	3.9783	0.6788	4.657
14	C10A A01	Simvastatin	2.6120	1.7068	4.3188
15	C09A A01	Captopril	3.8599	0.0923	3.9522
16	R03A C02	Salbutamol	3.2000	0.5646	3.7646
17	M01A G01	Mefenamic acid	0.9575	2.5206	3.4781
18	M01A B05	Diclofenac	1.0936	2.0781	3.1717
19	R06A B04	Chlorphenamine	1.7750	1.0482	2.8233
20	H02A B06	Prednisolone	1.1914	1.5177	2.7091
21	J01C A04	Amoxicillin	0.5955	2.0297	2.6252
22	C08C A02	Felodipine	1.979	0.4071	2.3861
23	R06A E07	Cetirizine	0.3205	1.8055	2.126
24	C10A A05	Atorvastatin	0.9169	1.1551	2.0721
25	R06A X13	Loratadine	0.8055	1.2091	2.0146
26	G03A A09	Desogestrel and estrogen	1.3492	0.6568	2.0061
27	C02C A01	Prazosin	1.8660	0.0896	1.9556
28	C03A A04	Chlorothiazide	1.9016	0.0234	1.9251
29	A02B C01	Omeprazole	1.0151	0.8307	1.8458
30	G03A A07	Levonorgestrel and estrogen	1.2237	0.6064	1.8301
31	A02B A02	Ranitidine	1.3430	0.4844	1.8273
32	R01B A52	Pseudoephedrine, combinations	0.4211	1.3843	1.8053
33	C09C A07	Telmisartan	1.4467	0.3527	1.7994
34	G03A C06	Medroxyprogesterone	0.4950	1.2406	1.7356
35	A10A D01	Insulin (human)	1.5571	0.1227	1.6798
36	C01E B15	Trimetazidine	1.0699	0.5588	1.6288
37	C03E A01	Hydrochlorothiazide and potassium-sparing agents	1.0581	0.3205	1.3786
38	R03B A02	Budesonide	1.258	0.0678	1.3258
39	M04A A01	Allopurinol	0.9032	0.3707	1.2739
40	R03C C02	Salbutamol	0.4458	0.6595	1.1053

Table 1.4: Top 40 Drugs by Utilisation in DDD/1000 population/day 2007

RANK	ATC	DRUG	PUBLIC	PRIVATE	TOTAL
1	A10B B09	Gliclazide	15.0149	5.0624	20.0773
2	A10B A02	Metformin	11.9382	2.4504	14.3887
3	A10B B01	Glibenclamide	11.0468	1.8122	12.8590
4	C07A B03	Atenolol	9.4742	3.3074	12.7816
5	C07A B02	Metoprolol	11.4399	0.6686	12.1085
6	C08C A05	Nifedipine	10.646	0.8402	11.4862
7	C08C A01	Amlodipine	6.4489	2.5493	8.9983
8	C09A A04	Perindopril	6.9654	1.0243	7.9897
9	B01A C06	Acetylsalicylic acid	4.7894	2.2701	7.0595
10	C09A A02	Enalapril	4.7364	1.428	6.1644
11	C03A A04	Chlorothiazide	5.7098	0.0472	5.7570
12	R03A C02	Salbutamol	4.9632	0.7656	5.7288
13	C10A A02	Lovastatin	4.5976	0.3055	4.9031
14	C03C A01	Furosemide	3.9851	0.7609	4.7460
15	H02A B06	Prednisolone	1.1432	3.4858	4.6290
16	C09A A01	Captopril	4.4033	0.1500	4.5533
17	C10A A01	Simvastatin	2.488	2.0597	4.5477
18	M01A B05	Diclofenac	1.1058	3.0511	4.1569
19	R06A B04	Chlorphenamine	2.6345	1.4605	4.095
20	M01A G01	Mefenamic acid	1.4249	2.1448	3.5697
21	G03A A07	Levonorgestrel and estrogen	1.3678	1.3727	2.7405
22	J01C A04	Amoxicillin	0.7419	1.8492	2.5912
23	R06A X13	Loratadine	0.9022	1.5124	2.4147
24	C02C A01	Prazosin	2.2975	0.0701	2.3676
25	R06A E07	Cetirizine	0.333	2.0058	2.3388
26	R01B A52	Pseudoephedrine, combinations	0.4273	1.8941	2.3214
27	C10A A05	Atorvastatin	0.8415	1.3053	2.1467
28	C08C A02	Felodipine	1.5873	0.4668	2.0540
29	C01E B15	Trimetazidine	1.1154	0.7182	1.8337
30	A02B A02	Ranitidine	1.1542	0.6743	1.8285
31	A02B C01	Omeprazole	0.8549	0.9565	1.8114
32	R03D A04	Theophylline	1.0649	0.4957	1.5606
33	M04A A01	Allopurinol	1.0867	0.4478	1.5345
34	A10A D01	Insulin (human)	1.2492	0.1635	1.4127
35	C01D A08	Isosorbide dinitrate	1.2257	0.1000	1.3257
36	C03E A01	Hydrochlorothiazide and potassium-sparing agents	0.8597	0.4646	1.3242
37	C09C A01	Losartan	0.6054	0.6913	1.2968
38	G03A A09	Desogestrel and estrogen	0.4085	0.8334	1.2418
39	R03B A02	Budesonide	1.0278	0.1776	1.2054
40	R03C C02	Salbutamol	0.6757	0.5230	1.1987

Table 1.5: Top 40 Drugs by Utilisation in DDD/1000 population/day 2008 versus 2007

RANK 2008	ATC	DRUG	2008			2007			RANK 2007
			PUBLIC	PRIVATE	TOTAL	PUBLIC	PRIVATE	TOTAL	
1	A10B B09	Gliclazide	15.7901	3.0156	18.8057	15.0149	5.0624	20.0773	1
2	C08C A01	Amlodipine	9.1411	4.4649	13.6059	6.4489	2.5493	8.9983	7
3	A10B A02	Metformin	10.2373	3.3167	13.554	11.9382	2.4504	14.3887	2
4	C09A A04	Perindopril	10.2666	0.8315	11.0981	6.9654	1.0243	7.9897	8
5	C07A B02	Metoprolol	10.4686	0.4227	10.8913	11.4399	0.6686	12.1085	5
6	C07A B03	Atenolol	7.6974	2.491	10.1883	9.4742	3.3074	12.7816	4
7	C08C A05	Nifedipine	8.9409	0.6251	9.566	10.646	0.8402	11.4862	6
8	A10B B01	Glibenclamide	7.4417	1.0611	8.5029	11.0468	1.8122	12.859	3
9	C10A A02	Lovastatin	7.2106	0.2105	7.4211	4.5976	0.3055	4.9031	13
10	B01A C06	Acetylsalicylic acid	4.3807	1.6469	6.0275	4.7894	2.2701	7.0595	9
11	C09A A02	Enalapril	4.7625	0.9805	5.743	4.7364	1.428	6.1644	10
12	C03A A03	Hydrochlorothiazide	4.6351	0.8399	5.475	0.1982	0.8992	1.0975	43
13	C03C A01	Furosemide	3.9783	0.6788	4.657	3.9851	0.7609	4.746	14
14	C10A A01	Simvastatin	2.612	1.7068	4.3188	2.488	2.0597	4.5477	17
15	C09A A01	Captopril	3.8599	0.0923	3.9522	4.4033	0.15	4.5533	16
16	R03A C02	Salbutamol	3.2000	0.5646	3.7646	4.9632	0.7656	5.7288	12
17	M01A G01	Mefenamic acid	0.9575	2.5206	3.4781	1.4249	2.1448	3.5697	20
18	M01A B05	Diclofenac	1.0936	2.0781	3.1717	1.1058	3.0511	4.1569	18
19	R06A B04	Chlorphenamine	1.7750	1.0482	2.8233	2.6345	1.4605	4.0950	19
20	H02A B06	Prednisolone	1.1914	1.5177	2.7091	1.1432	3.4858	4.6290	15
21	J01C A04	Amoxicillin	0.5955	2.0297	2.6252	0.7419	1.8492	2.5912	22
22	C08C A02	Felodipine	1.9790	0.4071	2.3861	1.5873	0.4668	2.0540	28
23	R06A E07	Cetirizine	0.3205	1.8055	2.1260	0.3330	2.0058	2.3388	25
24	C10A A05	Atorvastatin	0.9169	1.1551	2.0721	0.8415	1.3053	2.1467	27
25	R06A X13	Loratadine	0.8055	1.2091	2.0146	0.9022	1.5124	2.4147	23
26	G03A A09	Desogestrel and estrogen	1.3492	0.6568	2.0061	0.4085	0.8334	1.2418	38
27	C02C A01	Prazosin	1.8660	0.0896	1.9556	2.2975	0.0701	2.3676	24
28	C03A A04	Chlorothiazide	1.9016	0.0234	1.9251	5.7098	0.0472	5.7570	11
29	A02B C01	Omeprazole	1.0151	0.8307	1.8458	0.8549	0.9565	1.8114	31
30	G03A A07	Levonorgestrel and estrogen	1.2237	0.6064	1.8301	1.3678	1.3727	2.7405	21
31	A02B A02	Ranitidine	1.3430	0.4844	1.8273	1.1542	0.6743	1.8285	30
32	R01B A52	Pseudoephedrine, combinations	0.4211	1.3843	1.8053	0.4273	1.8941	2.3214	26
33	C09C A07	Telmisartan	1.4467	0.3527	1.7994	0.5629	0.4538	1.0167	46
34	G03A C06	Medroxyprogesterone	0.495	1.2406	1.7356	0.127	0.7257	0.8527	61
35	A10A D01	Insulin (human)	1.5571	0.1227	1.6798	1.2492	0.1635	1.4127	34
36	C01E B15	Trimetazidine	1.0699	0.5588	1.6288	1.1154	0.7182	1.8337	29
37	C03E A01	Hydrochlorothiazide and potassium-sparing agents	1.0581	0.3205	1.3786	0.8597	0.4646	1.3242	36
38	R03B A02	Budesonide	1.258	0.0678	1.3258	1.0278	0.1776	1.2054	39
39	M04A A01	Allopurinol	0.9032	0.3707	1.2739	1.0867	0.4478	1.5345	33
40	R03C C02	Salbutamol	0.4458	0.6595	1.1053	0.6757	0.523	1.1987	40

Table 1.6: Comparison of Top 10 Drugs by Utilisation in DDD/1000 population/day 2008 Malaysia, Australia and Norway

RANK	MALAYSIA			AUSTRALIA			NORWAY		
	ATC	DRUG	USE	ATC	DRUG	USE	ATC	DRUG	USE
1	A10BB09	Gliclazide	18.81	C10AA05	Atorvastatin	68.13	B01AC06	Acetylsalicyclic acid	n/a
2	C08CA01	Amlodipine	13.61	C09AA05	Ramipril	39.96	C10AA01	Simvastatin	n/a
3	A10BA02	Metformin	13.55	C09AA04	Perindopril	30.92	A01AA01	Sodium Fluoride	n/a
4	C09AA04	Perindopril	11.10	C10AA01	Simvastatin	24.96	N05CF01	Zopiclone	n/a
5	C07AB02	Metoprolol	10.89	C09CA04	Irbesartan	23.58	R06AE07	Cetirizine	n/a
6	C07AB03	Atenolol	10.19	R03AC02, R03CC02	Salbutamol	21.28	C08CA01	Amlodipine	n/a
7	C08CA05	Nifedipine	9.57	A02BC05	Esomeprazole	20.55	N02BE01	Paracetamol	n/a
8	A10BB01	Glibenclamide	8.50	N06AB06	Sertraline	19.83	R01AA07	Xylometazoline	n/a
9	C10AA02	Lovastatin	7.42	B01AC06	Acetylsalicyclic acid	19.68	C09AA05	Ramipril	n/a
10	B01AC06	Acetylsalicylic acid	6.03	C03CA01	Frusemide	19.12	C07AB02	Metoprolol	n/a

Note: n/a = not available

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CHAPTER 2 | EXPENDITURE ON MEDICINES IN MALAYSIA

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This chapter covers the drug expenditure for 2008, which was studied in comparison to that of 2007. Drug expenditure was compared by therapeutic groups as well as by individual drugs. This analysis includes all drugs in the National Medicines Use Survey (NMUS) 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. The 2008 report includes for the first time, vaccines and cough and cold preparations using locally assigned DDDs based WHO guidelines; these groups were not analysed in the 2007 report.

There was a 9.7% increase in drug expenditure in 2008 as compared to 2007 for the top 50 drugs. This increase was mainly due to an estimated 20.2% increase in public sector expenditure compared to an estimated 3.0% 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 increase in expenditure in both sectors, accounting for all the growth in expenditure from 2007 to 2008. 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) and this is same as presented in the previous year (2007), with the public sector exceeding the private sector expenditure. This was expected given the high prevalence of hypertension[1] and high usage of this drug (utilisation rank 2nd). The drugs which were common in the top 10 list for 2007 and 2008 expenditure were amlodipine, atorvastatin, diclofenac, clopidogrel, gliclazide, cefuroxime and metformin.

Generally for both 2007 and 2008, the top 10 therapeutic groups were similar except that vaccines and antihistamines for systemic use appeared in 2008 list. Psycholeptics and antithrombotic agents which ranked 3rd and 8th respectively in 2007, were not ranked as the top 10 therapeutic groups in 2008

In 2008, antibacterials for systemic use (J01) topped the expenditure by therapeutic group list as in 2007. Ciprofloxacin, cefuroxime, amoxicillin and enzyme inhibitor, amoxicillin and ceftriaxone were the top 5 antibiotics spent in 2008. Ciprofloxacin moved from the 16th position in 2007 to 9th most spent drug in 2008. The bulk of the expenditure was contributed by the private sector.

Not unexpectedly, antidiabetics and cardiovascular drugs were next in the expenditure ranking. There was a vast increase in the expenditure for antihypertensives, lipid modifying agents and antidiabetic drugs as tabulated in Table 2.6. This was consistent with the increase in utilisation of relevant medicines used in the treatment of the hypertension, hyperlipidaemia and diabetes mellitus. The total usage (ddd/1000 population/day) for these groups of drugs was higher in the public sector when compared to private. However, it was reversed in terms of expenditure, with private sector costs being almost double that of the public sector. This could be attributed the higher usage of generic medicines in the public sector and the cost-saving concessionaire, tender systems in drug procurement.

Expenditure for vaccines (J07) constituted 11.6% of the total expenditure for the top 50 drugs in the public sector for 2008. It ranked third in the top 10 therapeutic groups in the public sector. This reflects the importance of preventive measures in the public health system. Usage and expenditure of vaccines were not analysed in 2007.

The expenditure for the antineoplastic in public sector and private sector is comparable with in ranking (8th and 10th respectively). This is not unexpected in view of rising usage and the emergence of new specialised drugs in the market. In Australia, antineoplastics ranked 6th in the top 10 expenditure list for therapeutic groups for 2008-2009 period[2].

The Malaysian statistics were compared with Australian drug expenditure trends. In both public and private sectors, antibacterials for systemic use accounted for the highest costs for both 2007 and 2008 in Malaysia. Interestingly, this therapeutic group was not among the top 10 for Australia.

The seven drugs from the list of top 10 drugs by expenditure in Australia for the year 2008-9 were Atorvastatin, Esomeprazole, Clopidogrel, Rosuvastatin, Simvastatin, Olanzapine and Pantoprazole[2]. These drugs appeared in Malaysia top 50 drugs by expenditure for the year 2008.

The 2008 top therapeutic group by expenditure in Australia was lipid modifying agents (C10)[2], which took only the 5th rank in Malaysia.

In conclusion, there was a general increase in expenditure on medicines from 2007 to 2008 and the overall pattern for 2008 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 2008

RANK	ATC	DRUGS	PUBLIC	PRIVATE	TOTAL
1	C08C A01	Amlodipine	85812	60266	146078
2	C10A A05	Atorvastatin	25640	45837	71478
3	A02B C01	Omeprazole	6982	54810	61792
4	A10B B09	Gliclazide	16917	36726	53643
5	A10B A02	Metformin	15763	36668	52431
6	B03X A01	Erythropoietin	36817	15483	52300
7	M01A B05	Diclofenac	951	48720	49671
8	B01A C04	Clopidogrel	9349	39221	48570
9	J01M A02	Ciprofloxacin	1740	44668	46407
10	J01D C02	Cefuroxime	16290	24612	40902
11	J07C A06	Diphtheria-Hemophilus influenzae B-pertussis-poliomyelitis-tetanus	34039	4873	38913
12	A02B C02	Pantoprazole	12364	25938	38302
13	N05A H03	Olanzapine	35399	2718	38118
14	J01C R02	Amoxicillin and enzyme inhibitor	6062	30661	36723
15	C07A B03	Atenolol	7943	27695	35639
16	R01B A52	Pseudoephedrine, combinations	2721	32476	35196
17	C10A A01	Simvastatin	10948	22518	33466
18	A02B C05	Esomeprazole	2846	28976	31822
19	J01C A04	Amoxicillin	3431	28143	31575
20	C09A A04	Perindopril	16080	13825	29906
21	C07A B02	Metoprolol	23409	6411	29820
22	R06A E07	Cetirizine	181	29318	29499
23	J07B D52	Measles, combinations with mumps and rubella, live attenuated	26339	942	27281
24	R06A X13	Loratadine	961	26260	27220
25	J05A H02	Oseltamivir	27026	<1	27027
26	L03A B07	Interferon beta-1a	24319	135	24454
27	J01D D04	Ceftriaxone	5774	17895	23669
28	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	19801	3680	23481
29	R05D A20	Combinations	<1	23189	23189
30	A03F A03	Domperidone	572	22492	23064
31	J05A F05	Lamivudine	22148	893	23041
32	C09A A02	Enalapril	15563	6428	21991
33	C09C A07	Telmisartan	14787	6750	21537
34	J01F A10	Azithromycin	13798	7735	21534
35	A02B A02	Ranitidine	4901	15563	20464
36	M01A H05	Etoricoxib	3438	16815	20252
37	J05A B01	Aciclovir	1878	18326	20204
38	A11C C04	Calcitriol	15116	4702	19818
39	J01D D62	Cefoperazone, combinations	4751	14972	19722
40	C09C A01	Losartan	7495	12177	19671
41	C08C A05	Nifedipine	6841	12399	19240
42	M01A H01	Celecoxib	9449	9602	19051
43	N05A X08	Risperidone	18046	949	18995
44	J01D H02	Meropenem	13342	5513	18855
45	J07C A11	Diphtheria-Hemophilus influenzae B-pertussis-tetanus-hepatitis B	18827	-	18827
46	R06A B04	Chlorphenamine	16882	1233	18115
47	C10A A07	Rosuvastatin	1801	15827	17629
48	L03A A02	Filgrastim	14416	3009	17425
49	M01A C06	Meloxicam	706	16227	16933
50	R03D C03	Montelukast	4323	12264	16588
Total Top 20 drugs by Expenditure 08			**348096**	**624835**	**972931**
Total Top 50 drugs by Expenditure 08			**684986**	**936540**	**1621527**
Total Top 150 drugs by Expenditure 08			**1140693**	**1403839**	**2544532**

Table 2.2: Top 50 Drugs by Expenditure in RM '000 2007

RANK	ATC	DRUGS	PUBLIC	PRIVATE	TOTAL
1	C08C A01	Amlodipine	62790	38771	101561
2	N05A H03	Olanzapine	33772	37971	71742
3	C10A A05	Atorvastatin	22996	46612	69608
4	B01A C04	Clopidogrel	11340	51946	63287
5	M01A B05	Diclofenac	857	61389	62246
6	N05A X08	Risperidone	32439	28963	61403
7	J01C R02	Amoxicillin and enzyme inhibitor	6800	46510	53310
8	A10B B09	Gliclazide	15800	32712	48512
9	J01D C02	Cefuroxime	17158	24477	41635
10	A10B A02	Metformin	15914	22945	38859
11	R01B A52	Pseudoephedrine, combinations	797	31615	32411
12	C10A A01	Simvastatin	13745	18386	32131
13	C07A B02	Metoprolol	22245	9231	31476
14	R06A E07	Cetirizine	184	30504	30688
15	A02B C01	Omeprazole	6516	23484	30000
16	J01M A02	Ciprofloxacin	3203	26439	29642
17	C09A A02	Enalapril	21265	7847	29112
18	A10B G02	Rosiglitazone	6060	22652	28712
19	N05A H04	Quetiapine	14465	13920	28385
20	C09A A04	Perindopril	10662	15893	26555
21	B03X A01	Erythropoietin	15744	10615	26359
22	C08C A02	Felodipine	18315	7440	25755
23	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	20650	4468	25119
24	A10B F01	Acarbose	6135	18445	24580
25	J01D H02	Meropenem	18255	5295	23550
26	J01D D04	Ceftriaxone	6520	16430	22949
27	C08C A05	Nifedipine	8689	14167	22856
28	A02B A02	Ranitidine	4594	17935	22529
29	C09C A01	Losartan	7807	14628	22434
30	A02B C02	Pantoprazole	10225	12085	22310
31	C09A A01	Captopril	18603	2542	21145
32	C07A B03	Atenolol	8288	11604	19892
33	M01A H05	Etoricoxib	2506	16287	18793
34	J05A F05	Lamivudine	17809	948	18757
35	J05A B01	Aciclovir	1539	16899	18438
36	M01A H01	Celecoxib	9522	8276	17798
37	J01D H51	Imipenem and enzyme inhibitor	12846	3958	16804
38	J01C A04	Amoxicillin	2227	14051	16278
39	L03A A02	Filgrastim	12455	3609	16063
40	R06A X13	Loratadine	525	15361	15886
41	B01A C05	Ticlopidine	5311	10444	15755
42	J01F A09	Clarithromycin	216	15424	15640
43	C10A A07	Rosuvastatin	1145	14333	15478
44	A02B C05	Esomeprazole	3352	11720	15072
45	J01D D62	Cefoperazone, combinations	4656	10348	15004
46	N06A B08	Fluvoxamine	13350	1252	14602
47	C09D A01	Losartan and diuretics	3398	11159	14557
48	B01A B05	Enoxaparin	11208	3124	14331
49	J02A C01	Fluconazole	4399	9928	14327
50	C10B A02	Simvastatin and ezetimibe	508	13429	13937
Total Top 20 drugs by Expenditure 08			**319009**	**592266**	**911275**
Total Top 50 drugs by Expenditure 08			**569806**	**908470**	**1478276**
Total Top 150 drugs by Expenditure 08			**948308**	**1334884**	**2283192**

Table 2.3: Top 10 Therapeutic Groups by Expenditure in RM '000 2008

RANK	ATC	THERAPEUTIC	PUBLIC	PRIVATE	TOTAL
1	J01	Antibacterials for systemic use	140551	292672	433223
2	A10	Drugs used in diabetes	86482	130109	216591
3	C08	Calcium channel blockers	106375	84982	191357
4	C09	Agents acting on the renin-angiotensin system	85717	98790	184507
5	C10	Lipid modifying agents	55104	118320	173424
6	A02	Drugs for acid related disorders	28982	138111	167093
7	J07	Vaccines	100955	39658	140613
8	M01	Antiinflammatory and antirheumatic products	17799	117762	135561
9	R06	Antihistamines for systemic use	28478	94492	122970
10	L01	Antineoplastic agents	58231	56254	114485

Table 2.4: Top 10 Therapeutic Groups by Expenditure in RM '000 2007

RANK	ATC	THERAPEUTIC	PUBLIC	PRIVATE	TOTAL
1	J01	Antibacterials for systemic use	132804	253264	386068
2	A10	Drugs used in diabetes	84489	128059	212548
3	N05	Psycholeptics	101917	95758	197675
4	C09	Agents acting on the renin-angiotensin system	79879	108438	188317
5	C10	Lipid modifying agents	53005	118895	171900
6	C08	Calcium channel blockers	91561	67050	158611
7	M01	Antiinflammatory and antirheumatic products	16838	120128	136966
8	B01	Antithrombotic agents	44953	79427	124380
9	A02	Drugs for acid related disorders	29480	88914	118394
10	L01	Antineoplastic agents	49476	52033	101509

Table 2.5 Top 40 Drugs Ranked by Expenditure for year 2007 and 2008 in RM '000

RANK	ATC	DRUGS	PUBLIC		PRIVATE		TOTAL	
			2007	2008	2007	2008	2007	2008
1	C08C A01	Amlodipine	62790	85812	38771	60266	101561	146078
2	C10A A05	Atorvastatin	22996	25640	46612	45837	69608	71478
3	A02B C01	Omeprazole	6516	6982	23484	54810	30000	61792
4	A10B B09	Gliclazide	15800	16917	32712	36726	48512	53643
5	A10B A02	Metformin	15914	15763	22945	36668	38859	52431
6	B03X A01	Erythropoietin	15744	36817	10615	15483	26359	52300
7	M01A B05	Diclofenac	857	951	61389	48720	62246	49671
8	B01A C04	Clopidogrel	11340	9349	51946	39221	63287	48570
9	J01M A02	Ciprofloxacin	3203	1740	26439	44668	29642	46407
10	J01D C02	Cefuroxime	17158	16290	24477	24612	41635	40902
11	J07C A06	Diphtheria-Hemophilus influenzae B-pertussis- poliomyelitis-tetanus	n/a	34039	n/a	4873	n/a	38913
12	A02B C02	Pantoprazole	10225	12364	12085	25938	22310	38302
13	N05A H03	Olanzapine	33772	35399	37971	2718	71742	38118
14	J01C R02	Amoxicillin and enzyme inhibitor	6800	6062	46510	30661	53310	36723
15	C07A B03	Atenolol	8288	7943	11604	27695	19892	35639
16	R01B A52	Pseudoephedrine, combinations	797	2721	31615	32476	32411	35196
17	C10A A01	Simvastatin	13745	10948	18386	22518	32131	33466
18	A02B C05	Esomeprazole	3352	2846	11720	28976	15072	31822
19	J01C A04	Amoxicillin	2227	3431	14051	28143	16278	31575
20	C09A A04	Perindopril	10662	16080	15893	13825	26555	29906
21	C07A B02	Metoprolol	22245	23409	9231	6411	31476	29820
22	R06A E07	Cetirizine	184	181	30504	29318	30688	29499
23	J07B D52	Measles, combinations with mumps and rubella, live attenuated	n/a	26339	n/a	942	n/a	27281
24	R06A X13	Loratadine	525	961	15361	26260	15886	27220
25	J05A H02	Oseltamivir	9436	27026	4	<1	9439	27027
26	L03A B07	Interferon beta-1a	1238	24319	75	135	1313	24454
27	J01D D04	Ceftriaxone	6520	5774	16430	17895	22949	23669
28	A10A D01	Insulins and analogues, intermediate-acting combined with fast-acting (human)	20650	19801	4468	3680	25119	23481
29	R05D A20	Combinations	n/a	<1	n/a	23189	n/a	23189
30	A03F A03	Domperidone	501	572	7332	22492	7833	23064
31	J05A F05	Lamivudine	17809	22148	948	893	18757	23041
32	C09A A02	Enalapril	21265	15563	7847	6428	29112	21991
33	C09C A07	Telmisartan	5623	14787	5307	6750	10930	21537
34	J01F A10	Azithromycin	2665	13798	8111	7735	10776	21534
35	A02B A02	Ranitidine	4594	4901	17935	15563	22529	20464
36	M01A H05	Etoricoxib	2506	3438	16287	16815	18793	20252
37	J05A B01	Aciclovir	1539	1878	16899	18326	18438	20204
38	A11C C04	Calcitriol	12374	15116	1169	4702	13543	19818
39	J01D D62	Cefoperazone, combinations	4656	4751	10348	14972	15004	19722
40	C09C A01	Losartan	7807	7495	14628	12177	22434	19671

*ranking according to 2008; ** n/a = not available

Table 2.6: Expenditures for Drugs used in diabetes, cardiovascular system and dyslipidaemia RM'000

ATC	DRUG	2007			2008		
		PUBLIC	PRIVATE	TOTAL	PUBLIC	PRIVATE	TOTAL
A10	**DRUGS USED IN DIABETES**						
A10A	Insulins and analogues	36959	14692	51651	38216	13769	51985
A10B A	Biguanides	15914	22945	38859	15763	36668	52431
A10B B	Sulfonamides, urea derivatives	18613	40540	59153	19799	52872	72672
A10B D	Combinations of oral blood glucose lowering drugs	404	5653	6057	599	8477	9075
A10B F	Alpha glucosidase inhibitors	6135	18445	24580	8115	3271	11387
A10B G	Thiazolidinediones	6114	23443	29557	3666	9586	13252
A10B X	Other blood glucose lowering drugs, excl. Insulins	350	1015	1364	265	364	629
Subtotal		**84489**	**126733**	**211221**	**86423**	**125007**	**211431**
C	**CARDIOVASCULAR SYSTEM DRUGS**						
C02A	Antiadrenergic agents, centrally acting	2231	883	3115	3249	957	4207
C02C A	Alpha-adrenoreceptor antagonists	9424	2018	11442	8444	3596	12041
C02D	Arteriolar smooth muscle, agents acting on	566	221	787	802	449	1251
C02K	Other antihypertensives	0	2428	2428	70	1961	2031
C03A	Low-ceiling diuretics, thiazides	4002	325	4327	4248	523	4770
C03B	Low-ceiling diuretics, excl. Thiazides	371	9147	9518	479	7551	8029
C03E	Diuretics and potassium-sparing agents in combination	441	553	994	962	1377	2339
C07	Beta blocking agents	38448	38909	77357	42151	55140	97291
C08	Calcium channel blockers	91561	67050	158611	106375	84982	191357
C09A	Ace inhibitors, plain	51754	38477	90231	46804	31481	78285
C09B	Ace inhibitors, combinations	49	1613	1662	51	1624	1676
C09C	Angiotensin ii antagonists, plain	20975	38256	59231	30663	37826	68489
C09D	Angiotensin ii antagonists, combinations	7101	30092	37193	8199	27859	36057
Subtotal		**226923**	**229972**	**456896**	**252497**	**255326**	**507823**
C10	**LIPID MODIFYING AGENTS**						
C10A A	HMG CoA reductase inhibitors	45140	86571	131712	43739	89915	133653
C10A B	Fibrates	5854	12222	18077	8330	12488	20818
C10A C	Bile acid sequestrants	65	140	204	86	19	105
C10A D	Nicotinic acid and derivatives	0	8	8	0	9	9
C10A X	Other lipid modifying agents	1437	3904	5340	1887	3392	5279
C10B A	HMG CoA reductase inhibitors in combination with other lipid modifying agents	508	13429	13937	949	10043	10992
Subtotal		**53004**	**116274**	**169278**	**54991**	**115866**	**170856**
Grand Total		**364416**	**472979**	**837395**	**393911**	**496199**	**890110**

Table 2.7: Top 10 Therapeutic Groups, Ranked by Expenditure

RANK	MALAYSIA, 2008			AUSTRALIA, 2008-9[2]
	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	Calcium channel blockers (C08)	Drugs for acid related disorders (A02)	Drugs used in diabetes (A10)	Drugs for acid related disorders (A02)
3	Vaccines (J07)	Drugs used in diabetes (A10)	Calcium channel blockers (C08)	Agents acting on the renin-angiotensin system (C09)
4	Psycholeptics (N05)	Lipid modifying agents (C10)	Agents acting on the renin-angiotensin system (C09)	Drugs for obstructive airway diseases (R03)
5	Antivirals for systemic use (J05)	Antiinflammatory and antirheumatic products (M01)	Lipid modifying agents (C10)	Psychoanaleptics (N06)
6	Drugs used in diabetes (A10)	Agents acting on the renin-angiotensin system (C09)	Drugs for acid related disorders (A02)	Antineoplastic agents (L01)
7	Agents acting on the renin-angiotensin system (C09)	Antihistamines for systemic use (R06)	Vaccines (J07)	Psycholeptics (N05)
8	Antineoplastic agents (L01)	Calcium channel blockers (C08)	Antiinflammatory and antirheumatic products (M01)	Drugs used in diabetes (A10)
9	Drugs for obstructive airway diseases (R03)	Antithrombotic agents (B01)	Antihistamines for systemic use (R06)	Antithrombotic agents (B01)
10	Lipid modifying agents (C10)	Antineoplastic agents (L01)	Antineoplastic agents (L01)	Analgesics (N02)

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CHAPTER 3 | USE OF DRUGS FOR ACID RELATED DISORDERS

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Peptic ulcer disease and gastro-oesophageal reflux disease (GORD) remain the common causes of acid related gastrointestinal diseases. Even though the prevalence of GORD in Asian countries are lower compared to developed nations, the prevalence is steadily rising.[1,2] Data from Southeast and Western Asia shows that the prevalence of GORD is higher compared to Eastern Asia from 6.3% - 18.3% vs. 5.2% - 8.5% (2005-2010).[3] Malaysian data meanwhile shows that the prevalence of GORD to be between 0.9% and 13.4%.[4,5] whereas a study in the US shows up to 44% of adults experiencing it at least once monthly.[6]

In comparison to GORD, the prevalence of peptic ulcer disease is reducing in trend. This is reflected from the decreasing trend of *H. Pylori* associated peptic ulcer disease. The prevalence of *H. Pylori* associated duodenal ulcer dropped from 90.1% (1989-90) to 69.8% (1999-2000) while the prevalence in gastric ulcer dropped from 86.6% (1989-90) to 56.8% (1999-2000).[7]

The trend of medication used for acid related disorders has changed from being a predominant H_2-receptor antagonist (H_2RA) to proton pump inhibitors from 2007 to 2008, 3.4555 vs. 2.8689 and 2.9856 vs. 3.2423 DDD/1000 population/day respectively. This is similar in trend to those observed in developed countries, i.e. Sweden[8] where PPI (41.4 DDD/1000 population/day) was preferred over H_2RA (4.4 DDD/1000 population / day) and the US.[9]

In this survey, the total utilisation of medicines for acid related disorders in 2008 dropped to 6.1197 DDD/1000 population/day compared to 6.4497 DDD/1000 population/day in 2007, contributed mainly by a drop in H_2RA use. Among the PPI, the use of omeprazole, pantoprazole and esomeprazole has increased in 2008 whereas use of lansoprazole and rabeprazole has declined. H_2RA however has seen a decline among all its formulations.

Ranitidine remains the most widely prescribed H_2RA with 1.8273 DDD/1000 population/day followed by cimetidine 0.7071 DDD/1000 population/day, these two making up 88% of H_2RA prescribed. This trend is similarly seen in Australia where ranitidine was preferred over cimetidine 4.072 vs 0.117 DDD/1000 population/day respectively. The trend of ranitidine is seen to be more preferred in the public sector which used 73.5% of the total ranitidine prescribed in Malaysia. The other H_2RAs such as famotidine and nizatidine were rarely prescribed in Malaysia.

Among the PPI, the most commonly prescribed in 2008 remains omeprazole (1.8458 DDD/1000 population/day), accounting for 56.9% of total PPI prescribed, followed by pantoprazole 19. 6%, esomeprazole 16.8%, lansoprazole 3.9% and rabeprazole 2. 8%.10 The increase in PPI use may be attributed to improving access to the drugs, familiarity with prescription and cheaper cost with generic formulation. In Australia however, the trend is different where esomeprazole was the most commonly used (33%), followed by omeprazole (26%) and pantoprazole (21%).[10]

The data collected for eradication of *H. Pylori* regimen is inadequate to do a meaningful analysis. This may be due to lack of mechanism to capture the data where the individual drugs were prescribed separately in the presence of a high number of possible combinations of PPI and antibiotics.

For non acid related disorders, in the treatment of functional bowel disorders, mebeverine almost doubled from 0.0711 to 0.1075 DDD/1000 population/day in 2008 from the previous year. The use of trimebutine and dicycloverine however decreased from 0.0074 to 0.0049 and 0.0067 to 0.0014 DDD/1000 population/day respectively. Other drugs for functional bowel disorders such as silicone and alverine combinations have continued to drop from 2007 to 2008. This follows a similar trend in Australia where mebeverine is the most commonly prescribed drug for functional bowel disease (0.385 DDD/1000 population/day).[10]

The use of antispasmodic agents in Malaysia in 2008 decreased in general. The prescription for butylscopolamine was 0.6102 DDD/1000 population/day, drotaverine 0.0718 DDD/1000 population/day and atropine 0.0495 DDD/1000 population/day. In comparison to Australia, it uses butylscopolamine at 0.043 DDD/1000 population/day and atropine 0.006 DDD/1000 population/day.[10]

In the management of motility disorders, the prescription of domperidone overtook metoclopramide in 2008 by being the most commonly prescribed propulsive agent at 1.0889 DDD/1000 population/day (mainly contributed by increased usage in the private hospitals) vs. metoclopramide (0.6106 DDD/1000 population/day).

In 2008, there was no usage of tegaserod as it was withdrawn from the market for safety concerns while cisapride (0.01 DDD/1000 population/day) has marginal usage in the private hospitals for the same reason.

Conclusion

PPI use has overtaken that of H_2RA as the most widely prescribed drugs in the management of acid related disorders in Malaysia. This is in line with the use among the developed nations. This can be attributed to improved understanding of the acid related diseases and better availability of the medication with the introduction of generic preparation. Omeprazole still remains as the most prescribed PPI in 2008.

The treatment of non acid related diseases did not see many changes except for the predominance of domperidone over metoclopramide.

Table 3.1: Use of Medicines for Acid Related Disorders by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
A02B A	H2-receptor antagonists	3.4555	2.8689
A02B B	Prostaglandins	0.0016	0.0030
A02B C	Proton pump inhibitors	2.9856	3.2423
A02B D	Combinations for eradication of Helicobacter pylori	0.0063	0.0053
A02B X	Other drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)	0.0007	0.0002

Table 3.2: Use of Medicines for by Acid Related Disorders Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A02B A	**H2-receptor antagonists**			
A02B A01	Cimetidine	**Public**	0.5617	0.3993
		Private	0.5737	0.3078
		Total	1.1354	0.7071
A02B A02	Ranitidine	**Public**	1.1542	1.343
		Private	0.6743	0.4844
		Total	1.8285	1.8273
A02B A03	Famotidine	**Public**	0.0136	0.011
		Private	0.4778	0.3231
		Total	0.4914	0.3342
A02B A04	Nizatidine	**Public**	0	0
		Private	0.0002	0.0003
		Total	0.0002	0.0003
A02B B	**Prostaglandins**			
A02B B01	Misoprostol	**Public**	<0.0001	<0.0001
		Private	0.0015	0.003
		Total	0.0016	0.003
A02B C	**Proton pump inhibitors**			
A02B C01	Omeprazole	**Public**	0.8549	1.0151
		Private	0.9565	0.8307
		Total	1.8114	1.8458
A02B C02	Pantoprazole	**Public**	0.1823	0.3656
		Private	0.1904	0.269
		Total	0.3727	0.6346
A02B C03	Lansoprazole	**Public**	0.1419	0.0591
		Private	0.0824	0.0676
		Total	0.2243	0.1267
A02B C04	Rabeprazole	**Public**	0.023	0.0287
		Private	0.0742	0.061
		Total	0.0972	0.0898
A02B C05	Esomeprazole	**Public**	0.1971	0.1319
		Private	0.2828	0.4135
		Total	0.4799	0.5454
A02B D	**Combinations for eradication of Helicobacter pylori**			
A02B D04	Pantoprazole, amoxicillin and clarithromycin	**Public**	0	0
		Private	0.0063	0.0053
		Total	0.0063	0.0053
A02B X	**Other drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)**			
A02B X05	Bismuth subcitrate	**Public**	0	0
		Private	0.0007	0.0002
		Total	0.0007	0.0002

Table 3.3: Use of Medicines for Gastrointestinal Disorders by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A03A A	**Synthetic anticholinergics, esters with tertiary amino group**			
A03A A04	Mebeverine	**Public**	0.0157	0.0212
		Private	0.0553	0.0864
		Total	0.0711	0.1075
A03A A05	Trimebutine	**Public**	0	0
		Private	0.0074	0.0049
		Total	0.0074	0.0049
A03A A07	Dicycloverine	**Public**	0	0
		Private	0.0067	0.0014
		Total	0.0067	0.0014
A03A B	**Synthetic anticholinergics, quaternary ammonium compounds**			
A03A B02	Glycopyrronium	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	0.0002	0.0001
A03A B05	Propantheline	**Public**	0	0
		Private	0.0017	0.004
		Total	0.0017	0.004
A03A D	**Papaverine and derivatives**			
A03A D01	Papaverine	**Public**	0.0001	<0.0001
		Private	0.0002	0.0001
		Total	0.0003	0.0002
A03A D02	Drotaverine	**Public**	0	0
		Private	0.0914	0.0718
		Total	0.0914	0.0718
A03A E	**Drugs acting on serotonin receptors**			
A03A E02	Tegaserod	**Public**	0.0006	0
		Private	0.0032	0
		Total	0.0038	0
A03A X	**Other drugs for functional bowel disorders**			
A03A X08	Alverine	**Public**	0	0
		Private	0	0
		Total	0	0
A03A X13	Silicones	**Public**	0	0
		Private	0.036	0.0307
		Total	0.036	0.0307
A03A X58	Alverine, combinations	**Public**	0	0.024
		Private	0.0357	0.0222
		Total	0.0357	0.0463
A03B A	**Belladonna alkaloids, tertiary amines**			
A03B A01	Atropine	**Public**	0.0528	0.0411
		Private	0.0073	0.0084
		Total	0.0602	0.0495

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A03B B	**Belladonna alkaloids, semisynthetic, quaternary ammonium compounds**			
A03B B01	Butylscopolamine	**Public**	0.3838	0.2388
		Private	0.4787	0.3714
		Total	0.8625	0.6102
A03B B03	Methylscopolamine	**Public**	0	0
		Private	0.0003	0.0019
		Total	0.0003	0.0019
A03C A	**Synthetic anticholinergic agents in combination with psycholeptics**			
A03C A02	Clidinium and psycholeptics	**Public**	0	0
		Private	0	0
		Total	0	0
A03D B	**Belladonna and derivatives in combination with analgesics**			
A03D B04	Butylscopolamine and analgesics	**Public**	0	0
		Private	0	0
		Total	0	0
A03F A	**Propulsives**			
A03F A01	Metoclopramide	**Public**	0.2233	0.2947
		Private	0.346	0.3159
		Total	0.5692	0.6106
A03F A02	Cisapride	**Public**	0	0
		Private	0.0008	0.01
		Total	0.0008	0.01
A03F A03	Domperidone	**Public**	0.0385	0.041
		Private	0.3498	1.0479
		Total	0.3883	1.0889

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CHAPTER 4 | USE OF ANTIOBESITY AGENTS

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The total consumption of antiobesity agents in Malaysia for 2008 was 0.4705 DDD/1000 population/day. The 2008 data collected showed a decline in the use of all antiobesity drugs compared to 2007 except for rimonabant. Similar to 2007 data, 2008 also showed centrally acting antiobesity agents were the most commonly prescribed, representing 87.7% of total drugs used. Among the centrally acting agents used, phentermine was favoured (73.9% of all centrally acting antiobesity drugs) and this trend is similarly seen in Australia.[1] However, the peripherally acting drug, orlistat, had seen an increase in use (28.4%) compared to 2007, which was consistent to the trend seen in Australia[1]. Rimonabant, a new antiobesity agent was recently marketed and has shown an increasing usage of 0.0161 in 2008 compared to 0.0001 in 2007.

Of the antiobesity agents utilised, consumption in the private sector was higher (96.7%) compared to public sector (3.3%). 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 2007 to 2008 (25.9% reduction – from 0.6484 in 2007 to 0.4806 in 2008). 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.[2]

In the Finnish population, the obesity rate among adult middle aged population was 23.5%[4] and the overall consumption of antiobesity agents 2008 was 1.2 DDD/1000 population/day[5] 2.5 times more than the Malaysian consumption. The rate of overweight and obesity in Malaysia was comparable to Australia (43.1% versus 49.0%, respectively).3 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 medicine by Drug Class, in DDD/1000 population/day 2006

ATC	DRUG CLASS	2007	2008
A08A	Antiobesity preparations, excl. Diet products	0.6484	0.4705
A08A A	Centrally acting antiobesity products	0.5881	0.4130
A08A B	Peripherally acting antiobesity products	0.0602	0.0421
A08A X	Other antiobesity drugs	0.0001	0.0153

Table 4.2: Use of antiobesity medicine by Drug Class and Agents, in DDD/1000 population/day 2006

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A08A A	**Centrally acting antiobesity products**			
A08A A01	Phentermine	**Public**	0.0006	0.0002
		Private	0.4528	0.3042
		Total	0.4534	0.3044
A08A A10	Sibutramine	**Public**	0.0083	0.0097
		Private	0.1264	0.0990
		Total	0.1346	0.1086
A08A B	**Peripherally acting antiobesity products**			
A08A B01	Orlistat	**Public**	0.0046	0.0059
		Private	0.0556	0.0362
		Total	0.0602	0.0421
A08A X	**Other antiobesity drugs**			
A08A X01	Rimonabant	**Public**	-	-
		Private	0.0001	0.0153
		Total	0.0001	0.0153

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CHAPTER 5 | USE OF ANTI-DIABETIC DRUGS

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In the year 2008, the total consumption of anti-diabetic medications was 46.6941 DDD/1000 population/day which was almost similar to 2007 (53.0585 DDD/1000 population/day).[1]

Oral Hypoglycaemic Agents

The use of sulphonylurea has further decreased substantially by 5.72 DDD/1000 population/day. This has been the trend in the last few years with the availability of many other classes of oral drugs and the emphasis on metformin as first line. Gliclazide had overtaken glibenclamide as the most widely prescribed sulphonylurea. This, in part, could be due to the fact that since 2008, the DDD of gliclazide has been reduced from 160 mg to 60mg. Other reasons could be due to possible excessive procurement in 2007 by the public sector when there was a change in prescribing category from (List A to List B). One other reason is when patients are started on insulins, sulphonylurea may be stopped. Surprisingly, biguanides usage has decreased by 0.8347 DDD/1000 population/day which may be accounted for by several factors. One is the increase use of combination drugs (from 0.3988 to 0.6143 DDD/1000 population/day) which usually include metformin, which reduces pill count and improves compliance. There is also emphasis now in diabetic courses on the contraindication of metformin in late stages of renal impairment. It is also possible that there was excessive procurement in 2007 in the public sector which has made the 2008 consumption of biguanide seem to decrease.

For the first time there has been a reduction in the use of alpha glucosidase inhibitors but mainly as a result of reduction of use in the private sector. The availability of many new once-a-day drugs would probably account for this. However in the public sector, its use continued to rise – probably inappropriately as a third line when patients refuse insulin. As expected, thiazolidinediones use had reduced by half compared to the previous year due to the many controversies on its safety profile. The largest gain in use in 2008 had been in the DPP-4 inhibitors i.e. almost a fourfold rise compared to 2007[1] particularly in the private sector. The absence of hypoglycaemia and the fact that it is a once-a-day preparation are the main advantages. The use of repaglinide and nateglinide remained minimal.

Insulin

The use of insulin had also gone up substantially, from 3.2522 to 3.7146 DDD/1000 population/day both in the private and public sector. This is an encouraging trend as there has always been a problem of reluctance and apathy on both patient and health care workers in use of insulin. The most widely prescribed insulin is still premixed insulin – again secondary to patient's preference for less number of injections even though it may not mimic physiology. The overall analogue use was low, probably attributable to cost. However, its absolute use is increasing compared to the previous year. The advantages are lower incidence of hypoglycaemia and the ability to use just before a meal.

Comparison with Other Countries

Our insulin use of 3.7146 DDD/1000 population is much lower compared to countries like Denmark[2] and Norway[2] (16.2000 and 18.9000 DDD/1000 population respectively), despite the fact that these comparator countries has higher rate of Type 1 DM.

Our biguanide use of 13.554 DDD/1000 population is comparable to western countries such as Denmark[2] (12.4000 DDD/1000 population) and Norway[3] (15.4000 DDD/1000 population). Sulphonylurea use is very much higher in Malaysia (27.756 DDD/1000 population), in comparison with Denmark[2] (12.0000 DDD/1000 population), Norway[3] (12.3000 DDD/1000 population), and Australia[3] (10.9580 DDD/1000 population). Malaysia's DPP-4 inhibitor usage is much lower than Denmark[2] (0.7000 DDD/1000 population) but is comparable to Norway[2] (0.1000 DDD/1000 population). Acarbose's usage in Malaysia is four times higher than in Australia[3] (0.7108 DDD/1000 population vs. 0.1660 DDD/1000 population respectively), whereas Norway[2] and Denmark[2] hardly uses acarbose.

Overall, the total consumption of antidiabetics in Malaysia (46.69 DDD/1000 population) is still comparable to Denmark[2] (42.5000 DDD/1000 population), Norway[3] (46.3000 DDD/1000 population) and Australia (48.5120 DDD/1000 population). [4]

Conclusion

There was an encouraging rise in the use of insulin in the country; however it is still much less compared to the other countries. It is noted that there is an appropriate reduction of sulphonylureas and alpha glucosidase inhibitors, though the consumption is still much higher in comparison with other countries. We also speculate that the reduction in metformin consumption may be due to over procurement in one particular year or due to the emphasis on the contraindication of metformin in renal impairment. The use of the new class of DPP-4 inhibitor and combination drugs has substantially gone up.

Table 5.1: Use of Anti-Diabetics by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
A10A	Insulins and Analogues	3.2522	3.7146
A10B A	Biguanides	14.3887	13.554
A10B B	Sulfonamides, urea derivatives	33.4783	27.756
A10B D	Combinations of oral blood glucose lowering drugs	0.3988	0.6143
A10B F	Alpha glucosidase inhibitors	0.9895	0.7108
A10B G	Thiazolidinediones	0.4681	0.2108
A10B H	Dipeptidyl peptidase 4 (DPP-4) inhibitors	0.0258	0.0978
A10B X	Other blood glucose lowering drugs, excl. insulins	0.0571	0.0358

Table 5.2: Use of Anti-Diabetics by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A10A B	**Insulins and analogues for injection, fast-acting**			
A10A B01	Insulins and analogues, fast-acting (human)	**Public**	0.7497	0.8157
		Private	0.0574	0.0987
		Total	0.8070	0.9144
A10A B04	Insulins and analogues, fast-acting; insulin lispro	**Public**	0.0008	0.0052
		Private	0.0058	0.0054
		Total	0.0066	0.0106
A10A B05	Insulins and analogues, fast-acting; Insulin aspart	**Public**	0.0107	0.0124
		Private	0.0037	0.0077
		Total	0.0145	0.0201
A10A C	**Insulins and analogues for injection, intermediate-acting**			
A10A C01	Insulins and analogues, intermediate-acting (human)	**Public**	0.7819	0.8842
		Private	0.1061	0.0257
		Total	0.8880	0.9100
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**	1.2492	1.5571
		Private	0.1635	0.1227
		Total	1.4127	1.6798
A10A D04	Insulin lispro	**Public**	-	-
		Private	-	0.0002
		Total	-	0.0002
A10A D05	Insulins and analogues, intermediate-acting combined with fast-acting; Insulin aspart	**Public**	0.0117	0.0263
		Private	0.0526	0.0613
		Total	0.0644	0.0876

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A10A E	**Insulins and analogues for injection, long-acting**			
A10A E04	Insulins and analogues, long-acting; Insulin glargine	**Public**	0.0304	0.0446
		Private	0.0275	0.0420
		Total	0.0579	0.0865
A10A E05	Insulins and analogues, long-acting; Insulin detemir	**Public**	-	0.0001
		Private	0.0011	0.0053
		Total	0.0011	0.0054
A10B A	**Biguanides**			
A10B A02	Metformin	**Public**	11.9382	10.2373
		Private	2.4504	3.3167
		Total	14.3887	13.554
A10B B	**Sulfonamides, urea derivatives**			
A10B B01	Glibenclamide	**Public**	11.0468	7.4417
		Private	1.8122	1.0611
		Total	12.859	8.5029
A10B B02	Chlorpropamide	**Public**	0.0066	0.0018
		Private	0.0272	0.0100
		Total	0.0338	0.0118
A10B B07	Glipizide	**Public**	0.0204	0.0015
		Private	0.0684	0.0400
		Total	0.0888	0.0415
A10B B09	Gliclazide	**Public**	15.0149	15.7901
		Private	5.0624	3.0156
		Total	20.0773	18.8057
A10B B12	Glimepiride	**Public**	0.0477	0.0446
		Private	0.3717	0.3495
		Total	0.4195	0.3941
A10B D	**Combinations of oral blood glucose lowering drugs**			
A10B D02	Metformin and sulfonamides	**Public**	0.0572	0.1769
		Private	0.2891	0.3667
		Total	0.3463	0.5436
A10B D03	Metformin and rosiglitazone	**Public**	0.0051	0.0038
		Private	0.0474	0.0525
		Total	0.0526	0.0562
A10B D07	Metformin and sitagliptin	**Public**	-	-
		Private	-	0.0145
		Total	-	0.0145
A10B F	**Alpha glucosidase inhibitors**			
A10B F01	Acarbose	**Public**	0.4729	0.6228
		Private	0.5166	0.0881
		Total	0.9895	0.7108

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
A10B G	**Thiazolidinediones**			
A10B G02	Rosiglitazone	**Public**	0.1321	0.0753
		Private	0.3230	0.1025
		Total	0.4550	0.1778
A10B G03	Pioglitazone	**Public**	0.0010	0.0022
		Private	0.0121	0.0308
		Total	0.0130	0.0330
A10B H	**Dipeptidyl peptidase 4 (DPP-4) inhibitors**			
A10B H01	Sitagliptin	**Public**	-	0.0007
		Private	0.0258	0.0971
		Total	0.0258	0.0978
A10B X	**Other blood glucose lowering drugs, excl. insulins**			
A10B X02	Repaglinide	**Public**	0.0194	0.0142
		Private	0.0106	0.0065
		Total	0.0300	0.0207
A10B X03	Nateglinide	**Public**	0.0005	0.0004
		Private	0.0036	0.0020
		Total	0.0041	0.0025
A10B X04	Exenatide	**Public**	-	-
		Private	-	0.0002
		Total	-	0.0002
A10B X06	Benfluorex	**Public**	-	-
		Private	0.0230	0.0125
		Total	0.0230	0.0125

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CHAPTER 6 | USE OF ANTIANAEMIC DRUGS

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The most commonly prescribed antianaemic in 2008 were erythropoietin injection (0.3258 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.

Erythropoietin use in Australia in 2008 was 0.058 DDD/1000 population/day.[2] Erythropoietin utilisation in Malaysia in 2008 was higher (0.3258 DDD/1000 population/day) compared to 2007 (0.1552). Usage in the government sector was 5.2 times higher than the private sector.

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 not enough data on iron usage in Malaysia as iron preparations are OTC which was not included in the NMUS. The results shown in the tables below do not reflect actual total consumption of all iron preparations. It is recommended that ferrous preparations be included in this survey in the future to enable assessment of the trend of use and consumption of these drugs.

Table 6.1: Use of Anti-Anemic, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
B03	Antianemic preparations	0.1552	0.3277

Table 6.2.1: Use of Anti-Anemic by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
B03A	Iron Preparations	<0.0001	0.0019
B03A A	Iron bivalent, oral preparations	-	0.0019
B03A C	Iron trivalent, parenteral preparations	<0.0001	-
B03X	Other antianemic preparations	0.1552	0.3258
B03X A	Other antianemic preparations	0.1552	0.3258

Table 6.2.2: Use of Anti-Anemic by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
B03A A	**Iron bivalent, oral preparations**			
B03A A02	Ferrous fumarate	**Public**	-	-
		Private	-	0.0019
		Total	-	0.0019
B03A C	**Iron trivalent, parenteral preparations**			
B03A C02	Saccharated iron oxide	**Public**	-	-
		Private	<0.0001	-
		Total	<0.0001	-
B03X A	**Other antianemic preparations**			
B03X A01	Erythropoietin	**Public**	0.1148	0.2732
		Private	0.0404	0.0526
		Total	0.1552	0.3258

References:

1. British National Formulary September 2006

2. Australian Government Department of Health and Ageing. Australian Statistics on Medicines 2008. Commonwealth of Australia 2009

3. WHO Collaborating Centre for Drug Statistics Methodology, Guidelines for ATC Classification and DDD Assignment 2011. Oslo 2010

CHAPTER 7 | USE OF ANTIHAEMORRHAGICS

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Antihaemorrhagics did not differ much in usage trends from 2007 to 2008. The most used class of antihaemorrhagics was still the class of amino acids, namely tranexamic acid (0.0618 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. Aprotinin, a proteinase inhibitor was indicated for the reduction or prevention of blood loss in patients undergoing open heart surgeries only.[1] Aprotinin was temporarily withdrawn worldwide in 2007 following studies suggested that it's used increased complications of death, renal failure and stroke. Sales were subsequently suspended in May 2008 and tranexamic acid use was encouraged. This is reflected in the reduction of DDD from 0.0003 (2007) to <0.0001 (2008). In February 2012, the ban was lifted with a black box warning and thus we recommend continuous monitoring.[2]

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.[3] 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, haemophilia patients largely obtain factor concentrates from the public hospitals at no cost. It appears that the blood coagulation factors VIII and Factor IX concentrates were minimally used in private while recording a low DDD in public sector for both 2007 and 2008. However, these numbers are estimated to be higher in reality. The committee feels that the usages of these factors are under reported as factor concentrates are largely supplied by the National Blood Bank.

Recombinant factor VIIa or eptacog alfa (activated) is one of the few agents available for haemophiliacs with inhibitors. 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.[4] 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.[5] In fact, eptacog alfa (activated) was remain little used in both sectors of the healthcare industry. Its similar longer acting counterpart, Factor VIII inhibitor bypassing activity (FEIBA) had hardly any usage reported in 2008.

Table 7.1: Use of Antihaemorrhagics, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
B02	Antihaemorrhagics	0.0700	0.0734

Table 7.2.1: Use of Antihaemorrhagics by Drug Class, in DDD/1000 population/day 2007- 2008

ATC	DRUG CLASS	2007	2008
B02A	Antifibrinolytics	0.0685	0.0618
B02A A	Amino acids	0.0681	0.0618
B02A B	Proteinase inhibitors	0.0003	<0.0001
B02B	Vitamin K and other haemostatics	0.0015	0.0116
B02B A	Vitamin K	-	0.0101
B02B D	Blood coagulation factors	0.0015	0.0015

Table 7.2.2: Use of Antihaemorrhagics by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
B02A A	**Amino acids**			
B02A A02	Tranexamic acid	**Public**	0.0535	0.0469
		Private	0.0146	0.0148
		Total	0.0681	0.0618
B02A B	**Proteinase inhibitors**			
B02A B01	Aprotinin	**Public**	0.0001	<0.0001
		Private	0.0002	<0.0001
		Total	0.0003	<0.0001
B02B A	**Vitamin K**			
B02B A01	Phytomenadione	**Public**	-	0.0083
		Private	-	0.0018
		Total	-	0.0101
B02B D	**Blood coagulation factors**			
B02B D02	Coagulation factor VIII	**Public**	0.0006	0.0004
		Private	<0.0001	<0.0001
		Total	0.0006	0.0004
B02B D03	Factor VIII inhibitor bypassing activity	**Public**	<0.0001	-
		Private	-	-
		Total	<0.0001	-
B02B D04	Coagulation factor IX	**Public**	0.0008	0.0010
		Private	-	-
		Total	0.0008	0.0010
B02B D06	Von Willebrand factor and coagulation factor VIII in combination	**Public**	<0.0001	-
		Private	-	-
		Total	<0.0001	-
B02B D07	Coagulation factor XIII	**Public**	-	-
		Private	-	-
		Total	-	-
B02B D08	Eptacog alfa (activated)	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

References:

1. British National Formulary September 2006
2. European Medicines Agency. European Medicines Agency recommends lifting suspension of aprotinin 2012. Accessed 30/8/12.
3. Stonebraker J.S., Bolton-Maggs P.H.B., Soucie J.M., Walker I., Brooker M. A study of variations in the reported haemophilia A prevalence around the world. Haemophilia 2010;16: 20-32
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5. Lyseng-Williamson K.A., Plosker G.L. Recombinant Factor VIIa (Eptacog alfa): A pharmacoeconomic review of its use in haemophilia in patients with inhibitors to clotting factors VIII and IX. Pharmacoeconomics 2007; 25: 1007-1029
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CHAPTER 8 | USE OF DRUGS FOR CARDIOVASCULAR DISORDERS

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This chapter presents information on the use of antithrombotic agents (B01) and all drugs for cardiovascular system excluding antihypertensives (C02) and lipid modifying agents (C10).

Listed in Table 8.1 are the DDD/1000population/day for antithromboticagents and cardiovascular drugs (CV) by therapeutic subgroup. Overall, from 2007 to 2008, there was a decrease of 14.7% in the use of antithrombotic agents and 3.3% for cardiovascular drugs.

Table 8.2.1 shows that of all types of antithrombotic agents, the use of platelet aggregation inhibitors decreased considerably (15.8%). Even though there was a decreased use of acetylsalicylic acid, it remained the most widely used agent constituting more than 50% of the total use of all antithrombotic agents. Surprisingly, there was also a decrease in use of other oral platelet aggregation inhibitors such as clopidogrel, ticlopidine and dipyridamole (Table 8.2.2). The reduction in the use of clopidogrel could be associated with the shift from use of Drug Eluting Stents (DES) to the bare-metal stents in 2007-2008 period.[1] The evidence published in the late 2006 showed that DES might increase a person's risk of having thrombosis compared to bare-metal stent. Thus, the dramatic drop in utilisation of clopidogrel is expected because DES requires 12 months of adjunctive usage while bare-metal stents require only 1 month of adjunctive use. It is interesting to note that there was an increase in use of fondaparinox (16-fold) over the 1-year period while use of heparin group (BO1AB) actually fell. The probable explanation for this is that porcine derived medicines (heparin group) could potentially be an issue for patients of Islamic faith.

The five most commonly used CV drugs in 2008 were agents acting on the renin-angiotensin system (RAS) (28.8053 DDD/1000 population/day), followed by calcium channel blockers (26.0743 DDD/1000population/day), beta blockers (22.6902 DDD/1000population/day), angiotensin converting enzyme inhibitor (22.1691 DDD/1000population/day), and diuretics (14.3963 DDD/1000population/day). Compared to the 2007 data, the use of three CV drugs increased in 2008 (RAS, calcium channel blockers, diuretics) while the use of cardiac therapy decreased slightly (0.03%) and beta blocking agents decreased considerably (14.2%). Compared with countries for which similar data are available, Australia[2] and Finland[3] are also among countries that show an increase in the use of agents acting on RAS. However their uses of these agents are about six-fold higher than Malaysia.

Among the agents for cardiac therapy, the use of digoxin has slightly decreased (Table 8.3.1), while in Australia[2] and Finland[3] its use did not show any considerable change over the same period. The finding was suprising, as there are more establishments of cardiac services in Malaysia, which help to increase the identification of patients with heart failure and moreover based on clinical evidence that support digoxin, it is the only oral inotrope that does not increase long-term mortality in the management of chronic heart failure.[4] In addition, cardiologists and electrophysiologists might have more confidence in digoxin's usage as it being a well- established cardiac glycoside.

Table 8.4.1 shows overall use of anti-arrhythmic drugs, especially Class I agents, did not change and remained almost consistently low (<0.0001 - 0.018 DDD/1000population/day).It was interesting to note that there was a five-fold increased in the use of flecainide in the public sector. The increase might be due to new found evidence from clinical trials which demonstrates flecainide superiority as compared to amiodarone and propafenone in chemical cardioversion for rhythm control of atrial fibrillation.[5] For a class III agents, there was also slight increase in amiodarone used. The DDDs value for all anti-arrhythmic agents in Malaysia was lower (0.2122 DDD/1000population/day) compared to Australia[2] (1.77 DDD/1000population/day) and Finland[3] (1.76 DDD/1000population/day). Except for adrenaline, the intravenous cardiac stimulants which are normally used in acute cardiac emergencies has remained low (<0.0001 - 0.0322 DDD/1000population/day) (Table 8.5.1).

Similar to data from Australia[2] and Finland[3], the overall use of vasodilators and diuretics (Table 8.6.2 and 8.7.1) in cardiac diseases for 2008 did not change much from 2007. However, considerable change was noted within the organic nitrates and thiazide group. There was a three-fold increase in use of glyceryl trinate (private sector) and a two-fold increase of isosorbide mononitrate (public sector) (Table 8.6.1). This change directly reflects the increase in patients with symptomatic coronary artery disease who were being diagnosed and treated by medical professionals. The use of isosorbide mononitrate is increased by 36% and the use of isosorbide dinitrate decreased by 19.6% (Table 8.6.1). The decrease in the use of isosorbide dinitrate was clearly compensated by the reciprocal increase of isosorbide mononitrate as the latter is a once daily preparation while the former is a drug that is used three times daily. Within the diuretic group, hydrochlorothiazide used increased five-fold whereas chlorothiazide fell about four-fold (Table 8.7.1). This is expected due to the switch of chlorothiazide to hydrocholorothiazide in the Ministry of Health Drug Formulary. In Malaysia, drugs approved for use in public sectors are listed in the Drug Formulary. On the other hand, the use of furosemide has only decreased slightly.

Overall, the utilisation of peripheral vasodilators showed an increase, particularly with pentoxifylline for peripheral arterial disease (Table 8.8.1). As more patients are being diagnosed with atherosclerotic disease, it is expected that we observe the surge in the usage of pentoxifylline as peripheral arterial disease is also atherosclerotic disease of the vascular tree.

Unlike Australia[2] and Finland[3], where the use of beta blockers did not show considerable change from 2007 to 2008, the overall use of beta blockers especially metoprolol and atenolol in Malaysia fell by 14.0% (Table 8.9.1).However, the use of bisoprolol and carvedilol has increased slightly, continuing the trend from 2006. This is because beta-adrenergic blockers such as bisoprolol and carvedilol have been proven to reduce mortality in patients with heart failure.[6-8] In line with clinical trials data, their increased use may be justified as they serve as better options as compared to conventional beta-blockers.

For calcium channel blockers, overall there was a slight increase in use particularly for amlodipine and felodipine while there was a substantial decrease for nifedipine and diltiazem (Table 8.10.1). This may be in part, because of the convenience of once-a-day dosing of amlodipine compared to thrice-a-day dosing for nifidipine and diltiazem. It is encouraging to see that amlodipine is commonly used in Malaysia as several studies,[9-10] including ALLHAT11 support the effectiveness and safety of amlodipine.

Table 8.11.1 shows that among the agents acting on RAS, the highest usage were ACE inhibitors (22.1691 DDD/1000population/day), followed by angiotensin II antagonists (4.8293 DDD/1000population/day) and combination of angiotensin II antagonists with diuretics (1.71 DDD/1000population/day). Overall, there was no considerable change in the use ACE inhibitor agents from 2007 to 2008. However, the long acting perindopril appears to be more commonly used and appears to replace the shorter acting captopril and enalapril.

The use of angiotensin II antagonists has been almost similar in the two years data. Only Telmisartan showed increase use of almost two-fold in the public sector, most probably due to its introduction into Drug Formulary in 2008 and therefore was probably the angiotensin receptor blocker (ARB) of choice in 2008.

The difference in DDDs of antithrombotic agents and the cardiovascular medicines between Malaysia and the countries compared were rather big. These differences in DDDs values might reflect differences in patients' preferences, and affordability of medicines between Malaysia and the countries compared.

Table 8.1: Use of Drugs for Cardiovascular disorders, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
B01	Antithrombic agents	10.0728	8.5926
C01	Cardiac therapy	4.9850	4.8196
C01A	Cardiac glycosides	0.6488	0.5083
C01B	Antiarrhythmics, class I and III	0.1413	0.2122
C01C	Cardiac stimulants excl. Cardiac glycosides	0.2034	0.2505
C01D	Vasodilators used in cardiac diseases	2.1566	2.2188
C01E	Other cardiac preparations	1.8350	1.6299
C02	Antihypertensives	3.3671	3.0121
C03	Diuretics	14.1375	14.3963
C04	Peripehral vasodilators	0.0698	0.1267
C05	Vasoprotectives	-	-
C07	Beta blocking agents	26.4332	22.6902
C08	Calcium chanel blockers	23.1644	26.0743
C09	Agents acting on the rennin-angiotensin system	26.9267	28.8053
C09A	Ace inhibitors, plain	20.6945	22.1691
C09B	Ace inhibitors, combinations	0.0964	0.0931
C09C	Angiotensin II antagonists, plain	4.3899	4.8293
C09D	Angiotensin II antagonists, combinations	1.7459	1.7138

Table 8.2.1: Use of Anti-Thrombotic drugs by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
B01A A	Vitamin K antagonists	0.4475	0.4753
B01A B	Heparin group	0.3898	0.3357
B01A C	Platelet aggregation inhibitors excl. heparin	9.2343	7.7768
B01A D	Enzymes	0.0008	0.0008
B01A X	Other antithrombotic agents	0.0003	0.0040

Table 8.2.2: Use of Anti-Thrombotic drugs by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
B01A A	**Vitamin K antagonists**			
B01A A03	Warfarin	**Public**	0.2958	0.3779
		Private	0.1517	0.0974
		Total	0.4475	0.4753
B02A B	**Proteinase inhibitors**			
B01A B01	Heparin	**Public**	0.1835	0.1883
		Private	0.0258	0.0313
		Total	0.2093	0.2196
B01A B05	Enoxaparin	**Public**	0.1232	0.0781
		Private	0.0244	0.0185
		Total	0.1476	0.0966
B01A B06	Nadroparin	**Public**	0.0033	0.0012
		Private	0.0014	0.0013
		Total	0.0047	0.0026
B01A B10	Tinzaparin	**Public**	0.0006	0.0004
		Private	0.0007	0.0011
		Total	0.0014	0.0014
B01A B11	Sulodexide	**Public**	0.0010	0.0006
		Private	0.0259	0.0149
		Total	0.0270	0.0155
B01A C	**Platelet aggregation inhibitors excl. heparin**			
B01A C04	Clopidogrel	**Public**	0.2079	0.1686
		Private	0.7482	0.6469
		Total	0.9561	0.8155
B01A C05	Ticlopidine	**Public**	0.8016	0.6522
		Private	0.3510	0.2220
		Total	1.1526	0.8742
B01A C06	Acetylsalicylic acid	**Public**	4.7894	4.3807
		Private	2.2701	1.6469
		Total	7.0595	6.0275
B01A C07	Dipyridamole	**Public**	0.0620	0.0462
		Private	0.0039	0.0055
		Total	0.0659	0.0517
B01A C11	Iloprost	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A C13	Abciximab	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A C17	Tirofiban	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0001
B01A C18	Triflusal	**Public**	-	-
		Private	-	0.0001
		Total	-	0.0001
B01A C23	Cilostazol	**Public**	-	0.0002
		Private	-	0.0073
		Total	-	0.0075

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
B01A D	**Enzymes**			
B01A D01	Streptokinase	**Public**	0.0007	0.0007
		Private	<0.0001	<0.0001
		Total	0.0008	0.0008
B01A D02	Alteplase	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<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	<0.0001
		Private	-	-
		Total	<0.0001	<0.0001
B01A D11	Tenecteplase	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
B01A X	**Other antithrombotic agents**			
B01A X05	Fondaparinux	**Public**	0.0002	0.0031
		Private	0.0001	0.0009
		Total	0.0003	0.0040

Table 8.3.1: Use of Cardiac Glycosides by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C01A	**Cardiac glycosides**			
C01A A05	Digoxin	**Public**	0.4177	0.3569
		Private	0.2310	0.1514
		Total	0.6488	0.5083

Table 8.4.1: Use of Anti-Arrhythmics by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C01B A	**Antiarrhythmics, class Ia**			
C01B A05	Ajmaline	**Public**	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C01B B	**Antiarrhythmics, class Ib**			
C01B B01	Lidocaine	**Public**	<0.0001	0.0003
		Private	-	<0.0001
		Total	<0.0001	0.0003
C01B B02	Mexiletine	**Public**	<0.0001	-
		Private	-	-
		Total	<0.0001	-
C01B C	**Antiarrhythmics, class Ic**			
C01B C03	Propafenone	**Public**	0.0004	0.0017
		Private	0.0044	0.0033
		Total	0.0048	0.0050
C01B C04	Flecainide	**Public**	0.0019	0.0104
		Private	0.0067	0.0076
		Total	0.0086	0.0180
C01B D	**Antiarrhythmics, class III**			
C01B D01	Amiodarone	**Public**	0.0465	0.0543
		Private	0.0813	0.1346
		Total	0.1278	0.1889
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 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
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**	0.0333	0.0308
		Private	0.0017	0.0014
		Total	0.0350	0.0322
C01C A04	Dopamine	**Public**	0.0055	0.0050
		Private	0.0038	0.0059
		Total	0.0093	0.0109
C01C A06	Phenylephrine	**Public**	0.0014	0.0050
		Private	0.0023	0.0018
		Total	0.0037	0.0068
C01C A07	Dobutamine	**Public**	0.0106	0.0137
		Private	0.0013	0.0022
		Total	0.0119	0.0159
C01C A09	Metaraminol	**Public**	-	-
		Private	-	<0.0001
		Total	-	<0.0001
C01C A24	Epinephrine	**Public**	0.1283	0.1389
		Private	0.0148	0.0359
		Total	0.1431	0.1748
C01C A26	Ephedrine	**Public**	-	0.0075
		Private	-	0.002
		Total	-	0.0095
C01C E	**Phosphodiesterase inhibitors**			
C01C E01	Amrinone	**Public**	-	-
		Private	-	-
		Total	-	-
C01C E02	Milrinone	**Public**	<0.0001	<0.0001
		Private	0.0003	0.0002
		Total	0.0004	0.0002
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 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C01D A	**Organic nitrates**			
C01D A02	Glyceryl trinitrate	**Public**	0.2000	0.2033
		Private	0.0648	0.1853
		Total	0.2648	0.3886
C01D A08	Isosorbide dinitrate	**Public**	1.2257	0.9851
		Private	0.1000	0.0730
		Total	1.3257	1.0580
C01D A14	Isosorbide mononitrate	**Public**	0.2198	0.4496
		Private	0.3463	0.3226
		Total	0.5661	0.7722
C01D X	**Other vasodilators used in cardiac diseases**			
C01D X16	Nicorandil	**Public**	-	-
		Private	-	<0.0001
		Total	-	<0.0001

Table 8.6.2: Use of other cardiac preparations in Cardiac diseases by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C01E A	**Prostaglandins**			
C01E A01	Alprostadil	**Public**	0.0002	0.0001
		Private	<0.0001	<0.0001
		Total	0.0002	0.0002
C01E B	**Other cardiac preparations**			
C01E B10	Adenosine	**Public**	0.001	0.0007
		Private	0.0001	0.0001
		Total	0.0011	0.0008
C01E B15	Trimetazidine	**Public**	1.1154	1.0699
		Private	0.7182	0.5588
		Total	1.8337	1.6288
C01E B17	Ivabradine	**Public**	-	-
		Private	-	0.0002
		Total	-	0.0002

Table 8.7.1: Use of Diuretics by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C03A A	**Thiazides, plain**			
C03A A03	Hydrochlorothiazide	**Public**	0.1982	4.6351
		Private	0.8992	0.8399
		Total	1.0975	5.4750
C03A A04	Chlorothiazide	**Public**	5.7098	1.9016
		Private	0.0472	0.0234
		Total	5.757	1.9251
C03A X	**Thiazides, combinations with other drugs**			
C03A X01	Hydrochlorothiazide, combinations	**Public**	-	-
		Private	-	-
		Total	-	-
C03B A	**Sulfonamides, plain**			
C03B A04	Chlortalidone	**Public**	-	-
		Private	0.0371	0.0142
		Total	0.0371	0.0142
C03B A08	Metolazone	**Public**	<0.0001	0.0003
		Private	0.0003	-
		Total	0.0003	0.0003
C03B A11	Indapamide	**Public**	0.0551	0.0608
		Private	0.7218	0.4947
		Total	0.7769	0.5555
C03C A	**Sulfonamides, plain**			
C03C A01	Furosemide	**Public**	3.9851	3.9783
		Private	0.7609	0.6788
		Total	4.7460	4.657
C03C A02	Bumetanide	**Public**	0.0266	0.0293
		Private	0.0167	0.0121
		Total	0.0432	0.0414
C03D A	**Aldosterone antagonists**			
C03D A01	Spironolactone	**Public**	0.2721	0.2649
		Private	0.0787	0.0841
		Total	0.3508	0.349
C03D A04	Eplerenone	**Public**	-	<0.0001
		Private	-	-
		Total	-	<0.0001

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C03D B	**Other potassium-sparing agents**			
C03D B01	Amiloride	**Public**	0.0012	-
		Private	0.0033	-
		Total	0.0045	-
C03E A	**Low-ceiling diuretics and potassium-sparing agents**			
C03E A01	Hydrochlorothiazide and potassium-sparing agents	**Public**	0.8597	1.0581
		Private	0.4646	0.3205
		Total	1.3242	1.3786

Table 8.8.1: Use of Peripheral vasodilators by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C04A A01	Isoxsuprine	**Public**	<0.0001	-
		Private	-	-
		Total	<0.0001	-
C04A B01	Phentolamine	**Public**	<0.0001	<0.0001
		Private	-	-
		Total	<0.0001	<0.0001
C04A C01	Nicotinic acid	**Public**	-	-
		Private	0.0069	-
		Total	0.0069	-
C04A D03	Pentoxifylline	**Public**	0.0449	0.0466
		Private	0.0115	0.0723
		Total	0.0565	0.1190
C04A E01	Ergoloid mesylates	**Public**	<0.0001	0.0002
		Private	0.0062	0.0070
		Total	0.0062	0.0072
C04A X02	Phenoxybenzamine	**Public**	<0.0001	0.0005
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0005

Table 8.9.1: Use of Beta Blocking Agents by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C07A A	**Beta blocking agents, non-selective**			
C07A A05	Propranolol	**Public**	0.3070	0.2539
		Private	0.1753	0.1501
		Total	0.4824	0.4040
C07A A07	Sotalol	**Public**	0.0025	0.0016
		Private	0.0155	0.0080
		Total	0.0181	0.0096
C07A B	**Beta blocking agents, selective**			
C07A B02	Metoprolol	**Public**	11.4399	10.4686
		Private	0.6686	0.4227
		Total	12.1085	10.8913
C07A B03	Atenolol	**Public**	9.4742	7.6974
		Private	3.3074	2.4910
		Total	12.7816	10.1883
C07A B04	Acebutolol	**Public**	-	-
		Private	0.0012	0.0007
		Total	0.0012	0.0007
C07A B05	Betaxolol	**Public**	0.0001	0.0005
		Private	0.0788	0.0352
		Total	0.0790	0.0357

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C07A B	**Beta blocking agents, selective**			
C07A B07	Bisoprolol	**Public**	0.0714	0.1139
		Private	0.1654	0.1856
		Total	0.2368	0.2995
C07A B09	Esmolol	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C07A B12	Nebivolol	**Public**	-	-
		Private	-	<0.0001
		Total	-	<0.0001
C07A G	**Alpha and beta blocking agents**			
C07A G01	Labetalol	**Public**	0.1285	0.1034
		Private	0.0169	0.0149
		Total	0.1453	0.1183
C07A G02	Carvedilol	**Public**	0.1148	0.1138
		Private	0.2332	0.5334
		Total	0.3480	0.6471
C07B B	**Beta blocking agents, selective, and thiazides**			
C07B B03	Atenolol and thiazides	**Public**	-	-
		Private	-	-
		Total	-	-
C07B B07	Bisoprolol and thiazides	**Public**	-	0.0018
		Private	-	0.0108
		Total	-	0.0126
C07C A	**Beta blocking agents, non-selective, and other diuretics**			
C07C A03	Pindolol and other diuretics	**Public**	-	-
		Private	0.0006	0.0018
		Total	0.0006	0.0018
C07C B	**Beta blocking agents, selective, and other diuretics**			
C07C B02	Metoprolol and other diuretics	**Public**	-	-
		Private	0.0014	0.0006
		Total	0.0014	0.0006
C07C B03	Atenolol and other diuretics	**Public**	-	-
		Private	0.2303	0.0805
		Total	0.2303	0.0805

Table 8.10.1: Use of Calcium Channel Blockers Agents by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C08C A	**Dihydropyridine derivatives**			
C08C A01	Amlodipine	**Public**	6.4489	9.1411
		Private	2.5493	4.4649
		Total	8.9983	13.6059
C08C A02	Felodipine	**Public**	1.5873	1.9790
		Private	0.4668	0.4071
		Total	2.0540	2.3861
C08C A03	Isradipine	**Public**	-	-
		Private	0.0039	0.0044
		Total	0.0039	0.0044
C08C A04	Nicardipine	**Public**	<0.0001	<0.0001
		Private	0.0042	0.0088
		Total	0.0042	0.0088

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C08C A	**Dihydropyridine derivatives**			
C08C A05	Nifedipine	**Public**	10.646	8.9409
		Private	0.8402	0.6251
		Total	11.4862	9.5660
C08C A06	Nimodipine	**Public**	0.0011	0.0011
		Private	0.0016	0.0004
		Total	0.0026	0.0016
C08C A09	Lacidipine	**Public**	-	-
		Private	0.0052	0.0177
		Total	0.0052	0.0177
C08C A13	Lercanidipine	**Public**	-	<0.0001
		Private	0.1225	0.0701
		Total	0.1225	0.0701
C08D A	**Phenylalkylamine derivatives**			
C08D A01	Verapamil	**Public**	0.0279	0.0274
		Private	0.0494	0.0588
		Total	0.0773	0.0862
C08D B	**Benzothiazepine derivatives**			
C08D B01	Diltiazem	**Public**	0.2564	0.2148
		Private	0.1538	0.1125
		Total	0.4102	0.3274

Table 8.11.1: Use of ACE Inhibitors Agents by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C09A	**ACE inhibitors, plain**			
C09A A01	Captopril	**Public**	4.4033	3.8599
		Private	0.1500	0.0923
		Total	4.5533	3.9522
C09A A02	Enalapril	**Public**	4.7364	4.7625
		Private	1.428	0.9805
		Total	6.1644	5.7430
C09A A03	Lisinopril	**Public**	0.0879	0.0847
		Private	0.8164	0.5408
		Total	0.9043	0.6255
C09A A04	Perindopril	**Public**	6.9654	10.2666
		Private	1.0243	0.8315
		Total	7.9897	11.0981
C09A A05	Ramipril	**Public**	0.5287	0.3452
		Private	0.5074	0.3732
		Total	1.0361	0.7184
C09A A06	Quinapril	**Public**	-	-
		Private	0.0021	-
		Total	0.0021	-
C09A A09	Fosinopril	**Public**	0.0011	0.0006
		Private	0.0091	0.0031
		Total	0.0102	0.0037
C09A A12	Delapril	**Public**	-	-
		Private	-	0.0004
		Total	-	0.0004
C09A A16	Imidapril	**Public**	0.0036	0.0101
		Private	0.0307	0.0178
		Total	0.0343	0.0279
C09B	**ACE inhibitors, combinations**			
C09B A04	Perindopril and diuretics	**Public**	0.007	0.0111
		Private	0.0894	0.0819
		Total	0.0964	0.0931

Table 8.12.1: Use of Angiotensin II Antagonists by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C09C	**Angiotensin II antagonists, plain**			
C09C A01	Losartan	**Public**	0.6054	0.5681
		Private	0.6913	0.5217
		Total	1.2968	1.0897
C09C A03	Valsartan	**Public**	0.2626	0.2699
		Private	0.4560	0.3180
		Total	0.7185	0.5880
C09C A04	Irbesartan	**Public**	0.4753	0.6671
		Private	0.5120	0.3639
		Total	0.9873	1.0310
C09C A06	Candesartan	**Public**	0.0026	0.0017
		Private	0.2951	0.2239
		Total	0.2977	0.2256
C09C A07	Telmisartan	**Public**	0.5629	1.4467
		Private	0.4538	0.3527
		Total	1.0167	1.7994
C09C A08	Olmesartan medoxomil	**Public**	-	-
		Private	0.073	0.0956
		Total	0.073	0.0956
C09D	**Angiotensin II antagonists, combinations**			
C09D A01	Losartan and diuretics	**Public**	0.2180	0.2205
		Private	0.4822	0.3459
		Total	0.7002	0.5664
C09D A03	Valsartan and diuretics	**Public**	0.1150	0.1429
		Private	0.3700	0.2932
		Total	0.4850	0.4361
C09D A04	Irbesartan and diuretics	**Public**	0.0794	0.1137
		Private	0.2446	0.2167
		Total	0.3240	0.3303
C09D A06	Candesartan and diuretics	**Public**	0.0006	0.0008
		Private	0.0924	0.1018
		Total	0.0930	0.1026
C09D A07	Telmisartan and diuretics	**Public**	0.0314	0.0869
		Private	0.1123	0.1595
		Total	0.1437	0.2464
C09D A08	Olmesartan medoxomil and diuretics	**Public**	-	-
		Private	-	0.0017
		Total	-	0.0017
C09D B01	Valsartan and amlodipine	**Public**	-	0.0019
		Private	-	0.0284
		Total	-	0.0303

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CHAPTER 9 | USE OF ANTIHYPERTENSIVES

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In 2008, the total utilisation of antihypertensives had increased by 1.1% from 89.3 DDD/1000 population/day in 2007 to 90.4 DDD/1000 population /day in 2008. There is a decrease in utilisation of beta blocker by 14.1% which was compensated by increase in the use of other antihypertensives (calcium channel blockers (CCBs), 12.6%; angiotensin receptor blockers (ARBs), 6.6%; angiotensin converting enzyme inhibitors (ACEi), 7.0%; diuretics, 1.8%).

In 2007, the most commonly used antihypertensives were beta blockers (26.4 DDD/1000 population/day), CCBs(23.2 DDD/1000 population/day), ACEi (20.8 DDD/1000 population/day), diuretics (9.3 DDD/1000 population/day) and ARBs (6.1DDD/1000population/day). However in 2008, CCBs became the top-ranking antihypertensive used (26.0 DDD/1000 population/day) followed by beta blockers (22.7 DDD/1000 population/day), ACEi (22.3 DDD/1000 population/day), diuretics (9.7 DDD/1000 population/day) and ARBs (6.5 DDD/1000 population/day). This may have been due to the influence of the 3rd edition of the Malaysian Clinical Practice Guidelines on Management of Hypertension[1] which was published in February 2008. This CPG no longer recommended beta blockers as first choice antihypertensive agents.

It is encouraging to note that if ACEi and ARBs including combinations of these drugs with diuretics are grouped together under the category of agents acting on the Renin Angiotensin System (RAS), this category together with CCBs are the main antihypertensives used, in keeping with current CPG recommendations. Drugs acting on the RAS supercede CCBs as the most commonly used group of agents (26.9 DDD/1000 population/day and 28.8 in 2007 and 2008 respectively).

Among the ACEi, perindopril alone and in combination with diuretics is most commonly used. Its use increased markedly by 38.4% from 8.1 DDD/1000 population/day in 2007 to 11.2 DDD/1000 population/day in 2008. Enalapril is the next commonest used ACEi at 5.7 DDD/1000 population/day. There is a 13.2% reduction in the usage of captopril from 4.6 to 4.0 DDD/1000 population/day. The increased utilisation of perindopril is probably related to its once-daily dosing as opposed to captopril.

Among ARBs, the commonest used is telmisartan alone and in combination with diuretics which has increased by 76.3% from 1.2 to 2.0 DDD/1000 population/day. This increase occurred in the public sector. This was probably due to reduction in price and increased availability in the public sector.

Among the CCBs, use of nifedipine decreased by 16.7% (11.5 to 9.6 DDD/1000 population/day) with a compensatory rise by 51.2% in the use of amlodipine (9.0 to 13.6 DDD/1000 population/day). This pattern was seen in both public and private sectors. Use of the other CCBs remained relatively unchanged.

The most commonly used beta blockers were atenolol and metoprolol. However, use of metoprolol dropped from 12.1 to 10.9 DDD/1000 population /day and atenolol usage decreased from 12.8 to 10.1 DDD/1000 population/day (the combined drop was 31.4%). The total volume procured of these 2 drugs in the public sector was reduced by 40% in 2008 compared to 2007 (Pharmaceutical Division, Ministry of Health Malaysia, oral communication, 29th August 2012).

In analysing the use of diuretics as antihypertensive agents, high ceiling diuretics have been excluded. Use of diuretics prescribed alone was 8.0 DDD/1000 population/day in 2007 and 9.8 DDD/1000 population/day in 2008. Diuretics are also used in combination with other agents such as potasium sparing diuretics, beta blockers, ARB/ACEi. Therefore the total usage of diuretics was 11.3 in 2007 and 11.6 DDD/1000 population/day in 2008. The main diuretics used were hydrochlorothiazide (HCTZ) and chlorothiazide. However, there was a change in the pattern of use of these two agents. Chlorothiazide usage diminished from 5.8 to 1.9 DDD/1000 population/day while HCTZ use as single agent increased from 1.1 to 5.5 DDD/1000 population/day. This occurred in the public sector due to procurement policy.

The four most commonly prescribed antihypertensive agents in 2008 were amlodipine (13.6 DDD/1000 population/day, perindopril (11.1 DDD/1000 population/day), metoprolol (10.9 DDD/1000 population/day) followed by atenolol (10.2 DDD/1000 population/day). These drugs individually accounted for more than 10% of the utilisation of antihypertensives, and constituted a total of 50.6%.

Overall, 80.3% of all antihypertensives were utilised in the public sector. The most popular drugs used in the public sector were metoprolol (10.5 DDD /1000 population/day), perindopril (10.3 DDD /1000 population/day) and amlodipine (9.1 DDD /1000 population/day). The most popular drugs in the private sector were amlodipine (4.5 DDD/1000 population/day), atenolol (2.5 DDD/1000 population/day) and enalapril (1.0 DDD /1000 population/day).

Compared to Australia[2] and Nordic countries[3] the use of antihypertensives in Malaysia is low. In the Australian Statistics on Medicine 2008 report[2], the top antihypertensives used were ramipril (40 DDD/1000 population/day), perindopril (30.9 DDD/1000 population/day) and irbesartan (23.6 DDD/1000 population/day). In Nordic countries[3], drugs acting on the RAS were the most commonly prescribed agents ranging from 59.3 DDD/1000 population/day in Greenland to 180.4 in Finland.

Use of fixed-dose combinations is much lower in Malaysia. As an example, in the Finnish Statistics on Medicine report 2008[4] use of fixed-dose combination of ARB/diuretic was 25.8 DDD/1000 population/day as compared with only 3.1 DDD/1000 population in Malaysia. This may be due to cost considerations.

The overall difference in total antihypertensive and fixed-dose combination usage between Malaysia and more developed countries reinforces previous findings from the National Health and Morbidity survey 2006[5] that we are underdetecting and undertreating hypertension in Malaysia. This data should raise concern, and call for more concerted efforts to detect and optimally treat hypertension in order to reduce the devastating impact of this disease.

Table 9.1: Use of Anti-Hypertensives by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
C02	Antihypertensives	3.3671	3.0121
C02A	Antiadrenergic Agents, Centrally Acting	0.5780	0.6398
C02C	Antiadrenergic Agents, Peripherally Acting	2.7806	2.3629
C02D	Agents acting On Arteriolar Smooth Muscle	0.0079	0.0088
C02K	Other Antihypertensive	0.0006	0.0005
C03	Diuretics	9.3483	9.6978
C03A	Low-ceiling diuretics, Thiazides	6.8545	7.4001
C03B	Low-ceiling diuretics, Exclude Thiazides	0.8143	0.5700
C03D	Potassium-Sparing Agents	0.3553	0.3491
C03E	Diuretics abd Potassium Sparing Agents in Combination	1.3242	1.3786
C04	Peripheral Vasodilators	0.0698	0.1267
C07	Beta Blocking Agents	26.4322	2.6902
C08	Calcium Channel Blockers	3.1644	6.0743
C09	Agents Acting on The Renin-Angiotensin System	6.9267	8.8053
C09A	ACE Inhibitos, Plain	20.6945	2.1691
C09B	ACE Inhibitors, Combinations	0.0964	0.0931
C09C	Angiotensin II Antagonists, Plain	4.3899	4.8293
C09D	Angiotensin II Antagonists, Combinations	1.7457	1.7138

Table 9.2: Use of Anti-Hypertensives by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C02A	**Antiadrenergic Agents, Centrally Acting**			
C02A B01	Methyldopa (levorotatory)	**Public**	0.5149	0.5704
		Private	0.0213	0.0245
		Total	0.5362	0.5949
C02A C01	Clonidine	**Public**	<0.0001	<0.0001
		Private	-	-
		Total	<0.0001	<0.0001
C02A C05	Moxonidine	**Public**	0.0024	0.0037
		Private	0.0393	0.0412
		Total	0.0418	0.0449
C02C A	**Alpha-adrenoreceptor antagonists**			
C02C A01	Prazosin	**Public**	2.2975	1.8660
		Private	0.0701	0.0896
		Total	2.3676	1.9556
C02C A04	Doxazosin	**Public**	0.3525	0.3297
		Private	0.0606	0.0776
		Total	0.4130	0.4073
C02D	**Agents acting On Arteriolar Smooth Muscle**			
C02D A01	Diazoxide	**Public**	-	<0.0001
		Private	-	-
		Total	-	<0.0001
C02D B01	Dihydralazine	**Public**	0.0001	0.0002
		Private	<0.0001	-
		Total	0.0002	0.0002
C02D B02	Hydralazine	**Public**	0.0003	0.0003
		Private	<0.0001	<0.0001
		Total	0.0003	0.0003
C02D C01	Minoxidil	**Public**	0.0054	0.0070
		Private	0.0013	0.0006
		Total	0.0068	0.0076
C02D D01	Nitroprusside	**Public**	<0.0001	0.0002
		Private	0.0006	0.0005
		Total	0.0007	0.0006
C02K	**Other Antihypertensive**			
C02K X01	Bosentan	**Public**	-	<0.0001
		Private	0.0006	0.0005
		Total	0.0006	0.0005
C03A	**Low-ceiling diuretics, Thiazides**			
C03A A03	Hydrochlorothiazide	**Public**	0.1982	4.6351
		Private	0.8992	0.8399
		Total	1.0975	5.475
C03A A04	Chlorothiazide	**Public**	5.7098	1.9016
		Private	0.0472	0.0234
		Total	5.7570	1.9251

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C03B	**Low-ceiling diuretics, Exclude Thiazides**			
C03B A04	Chlortalidone	**Public**	-	-
		Private	0.0371	0.0142
		Total	0.0371	0.0142
C03B A08	Metolazone	**Public**	<0.0001	0.0003
		Private	0.0003	-
		Total	0.0003	0.0003
C03B A11	Indapamide	**Public**	0.0551	0.0608
		Private	0.7218	0.4947
		Total	0.7769	0.5555
C03D	**Potassium-Sparing Agents**			
C03D A01	Spironolactone	**Public**	0.2721	0.2649
		Private	0.0787	0.0841
		Total	0.3508	0.3490
C03D A04	Eplerenone	**Public**	-	<0.0001
		Private	-	-
		Total	-	<0.0001
C03D B01	Amiloride	**Public**	0.0012	-
		Private	0.0033	-
		Total	0.0045	-
C03E	**Diuretics abd Potassium Sparing Agents in Combination**			
C03E A01	Hydrochlorothiazide and potassium-sparing agents	**Public**	0.8597	1.0581
		Private	0.4646	0.3205
		Total	1.3242	1.3786
C07A	**Peripheral Vasodilators**			
C07A A05	Propranolol	**Public**	0.3070	0.2539
		Private	0.1753	0.1501
		Total	0.4824	0.4040
C07A A07	Sotalol	**Public**	0.0025	0.0016
		Private	0.0155	0.0080
		Total	0.0181	0.0096
C07A B02	Metoprolol	**Public**	11.4399	10.4686
		Private	0.6686	0.4227
		Total	12.1085	10.8913
C07A B03	Atenolol	**Public**	9.4742	7.6974
		Private	3.3074	2.4910
		Total	12.7816	10.1883
C07A B04	Acebutolol	**Public**	-	-
		Private	0.0012	0.0007
		Total	0.0012	0.0007
C07A B05	Betaxolol	**Public**	0.0001	0.0005
		Private	0.0788	0.0352
		Total	0.0790	0.0357

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C07A	**Peripheral Vasodilators**			
C07A B07	Bisoprolol	**Public**	0.0714	0.1139
		Private	0.1654	0.1856
		Total	0.2368	0.2995
C07A B09	Esmolol	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C07A B12	Nebivolol	**Public**	-	-
		Private	-	<0.0001
		Total	-	<0.0001
C07A G01	Labetalol	**Public**	0.1285	0.1034
		Private	0.0169	0.0149
		Total	0.1453	0.1183
C07A G02	Carvedilol	**Public**	0.1142	0.1138
		Private	0.2332	0.5334
		Total	0.3474	0.6471
C07B B07	Bisoprolol and Thiazides	**Public**	-	0.0018
		Private	-	0.0108
		Total	-	0.0126
C07C	**Beta Blocking Agents and Other Diuretics**			
C07C A03	Pindolol and other diuretics	**Public**	-	-
		Private	0.0006	0.0018
		Total	0.0006	0.0018
C07C B02	Metoprolol and other diuretics	**Public**	-	-
		Private	0.0014	0.0006
		Total	0.0014	0.0006
C07C B03	Atenolol and other diuretics	**Public**	-	
		Private	0.2303	0.0823
		Total	0.2303	0.0823
C08C	**Selective Calcium Channel Blockers With Mainly Vascular Effects**			
C08C A01	Amlodipine	**Public**	6.4459	9.2035
		Private	2.5493	4.5588
		Total	8.9952	13.7623
C08C A02	Felodipine	**Public**	1.5873	1.9790
		Private	0.4668	0.4071
		Total	2.0540	2.3861
C08C A03	Isradipine	**Public**	-	-
		Private	0.0039	0.0044
		Total	0.0039	0.0044
C08C A04	Nicardipine	**Public**	<0.0001	<0.0001
		Private	0.0042	0.0088
		Total	0.0042	0.0088
C08C A05	Nifedipine	**Public**	10.646	8.9409
		Private	0.8402	0.6251
		Total	11.4862	9.5660

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C08C	**Selective Calcium Channel Blockers With Mainly Vascular Effects**			
C08C A06	Nimodipine	**Public**	0.0011	0.0011
		Private	0.0016	0.0004
		Total	0.0026	0.0016
C08C A09	Lacidipine	**Public**	-	-
		Private	0.0052	0.0177
		Total	0.0052	0.0177
C08C A13	Lercanidipine	**Public**	-	<0.0001
		Private	0.1225	0.0701
		Total	0.1225	0.0701
C08D	**Selective Calcium Channel Blockers with Direct Cardiac Effects**			
C08D A01	Verapamil	**Public**	0.0279	0.0274
		Private	0.0494	0.0588
		Total	0.0773	0.0862
C08D B01	Diltiazem	**Public**	0.2564	0.2148
		Private	0.1538	0.1125
		Total	0.4102	0.3274
C09A	**ACE Inhibitos, Plain**			
C09A A01	Captopril	**Public**	4.4033	3.8599
		Private	0.1500	0.0923
		Total	4.5533	3.9522
C09A A02	Enalapril	**Public**	4.7364	4.7625
		Private	1.42800	0.9805
		Total	6.1644	5.7430
C09A A03	Lisinopril	**Public**	0.0879	0.0847
		Private	0.8164	0.5408
		Total	0.9043	0.6255
C09A A04	Perindopril	**Public**	6.9654	10.2666
		Private	1.0243	0.8315
		Total	7.9897	11.0981
C09A A05	Ramipril	**Public**	0.5287	0.3452
		Private	0.5074	0.3732
		Total	1.0361	0.7184
C09A A06	Quinapril	**Public**	-	-
		Private	0.0021	-
		Total	0.0021	-
C09A A09	Fosinopril	**Public**	0.0011	0.0006
		Private	0.0091	0.0031
		Total	0.0102	0.0037
C09A A12	Delapril	**Public**	-	-
		Private	-	0.0004
		Total	-	0.0004
C09A A16	Imidapril	**Public**	0.0036	0.0101
		Private	0.0307	0.0178
		Total	0.0343	0.0279

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C09B	**ACE Inhibitors, Combinations**			
C09B A04	Perindopril and diuretics	**Public**	0.007	0.0111
		Private	0.0894	0.0819
		Total	0.0964	0.0931
C09C	**Angiotensin II Antagonists, Plain**			
C09C A01	Losartan	**Public**	0.6054	0.5681
		Private	0.6913	0.5217
		Total	1.2968	1.0897
C09C A03	Valsartan	**Public**	0.2626	0.2699
		Private	0.456	0.3180
		Total	0.7185	0.5880
C09C A04	Irbesartan	**Public**	0.4753	0.6671
		Private	0.5120	0.3639
		Total	0.9873	1.0310
C09C A06	Candesartan	**Public**	0.0026	0.0017
		Private	0.2951	0.2239
		Total	0.2977	0.2256
C09C A07	Telmisartan	**Public**	0.5629	1.4467
		Private	0.4538	0.3527
		Total	1.0167	1.7994
C09C A08	Olmesartan medoxomil	**Public**	-	-
		Private	0.0730	0.0956
		Total	0.0730	0.0956
C09D	**Angiotensin II Antagonists, Combinations**			
C09D A01	Losartan and diuretics	**Public**	0.2180	0.2205
		Private	0.4822	0.3459
		Total	0.7002	0.5664
C09D A03	Valsartan and diuretics	**Public**	0.1150	0.1429
		Private	0.3700	0.2932
		Total	0.4850	0.4361
C09D A04	Irbesartan and diuretics	**Public**	0.0794	0.1137
		Private	0.2446	0.2167
		Total	0.3240	0.3303
C09D A06	Candesartan and diuretics	**Public**	0.0006	0.0008
		Private	0.0924	0.1018
		Total	0.0930	0.1026
C09D A07	Telmisartan and diuretics	**Public**	0.0314	0.0869
		Private	0.1123	0.1595
		Total	0.1437	0.2464
C09D A08	Olmesartan medoxomil and diuretics	**Public**	-	-
		Private	-	0.0017
		Total	-	0.0017
C09D B01	Valsartan and amlodipine	**Public**	-	0.0019
		Private	-	0.0284
		Total	-	0.0303

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CHAPTER 10 | USE OF LIPID MODIFYING DRUGS

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In Malaysia, cardiovascular disease (CVD) is the leading cause of death in both men and women.[1] Our National Cardiovascular Database (NCVD) - Acute Coronary Syndrome (ACS) registry, revealed that Malaysians develop ACS at a younger age (58 years) compared to population in Thailand (65 years), mainland China (63 years) and western countries (GRACE Registry - 66years, Canada - 68years). Majority of patients were managed medically, with low rates of cardiac interventions, the latter depends largely by availability of cathlab resources.

Most patients (96.0%) had at least one established cardiovascular risk factors. The prevalent risk factors are hypertension (72.6%), dyslipidaemia (55.9%) and/or diabetes (55.0%).[2] Based on the Malaysian National Health and Morbidity Survey 2006, the prevalence of dyslipidaemia was 28% in those above the age of 40 years.[3] The high prevalence of cardiovascular risk factors indicate the need of primary prevention programme.

In the prevention of CVD, efforts should be aimed at reducing global risks. Systematic reviews and large randomised clinical trials have found that lowering cholesterol in people at high risk of cardiovascular events substantially reduced 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 inhibitors, or widely known as statins, are the most commonly prescribed lipid modifying agents. Primary and secondary prevention trials have confirmed that statins constitute the single most effective type of treatment for reducing cholesterol and reducing cardiovascular risk.[4-14] The treatment target and practice guideline regarding the use of statins in various cardiovascular presentations have been well documented.[15,16,17] The lower the low-density lipoprotein (LDL), the better the outcome.[18,19]

We have noted a good standard of practice with regards to ACS pharmacotherapy among Malaysian patients. About 91.0% of our ACS patients were given statin upon discharge.[2, 20] The percentage of overall statins utilised has increased by 18.7% from year 2007 to 2008.

The most prescribed statin in Malaysia was lovastatin (51.0%), mainly in the public sector and the reason is its availability in both primary and tertiary settings. The second most commonly used statin in the public sector was simvastatin (23.0%). In the private sector, simvastatin (47.1%) was the most widely used statin. However, the usage has decreased by 17.1% in 2008 compared to 2007. There was an increase in usage of atorvastatin in the public sector (9.0%) and reduction in the private sector (11.5%). The newer available statin in Malaysia is rosuvastatin, with a trend of increased usage in both public (63.9%) and private sector (7.9%). As for pravastatin, the consumption has reduced by about 24.0% in both public and private sector. Fluvastatin was rarely prescribed in both sectors.

The fibrate group is the second most commonly used lipid modifying agent. In 2008, there was a slight increase in usage (4.1%). The most prescribed fibrate was gemfibrozil as it is the only fibrate available in public hospitals. The overall usage of fenofibrate in both sectors has decreased by about 19.7%.

The other lipid modifying agent that acts by decreasing absorption in intestine (cholesterol absorption inhibitor) is ezetimibe. The overall usage of ezetimibe has decrease by 7.0% in 2008 particularly in the private sector (22.1%).

The most striking observation in 2008 is the use of statin in fixed combination with other drugs. In particular, the use of atorvastatin with amlodipine has increased by 7-fold which was driven by usage in the private sector. The use of combination simvastatin-ezetimibe has increased by 82.7% in the public sector and reduced by 32.0% in the private sector.

Comparing the practice of lipid modifying agents with other countries, ie. in Nordic countries, the use of lipid modifying agents has increased sharply particularly in the period of 2004 – 2008. Simvastatin is the dominant statin in these countries because the generic formulation is available, making it cheaper than atorvastatin. Other lipid reducing agents (fibrates, bile-acid sequestrants and, nicotinic acid and derivatives) represent a negligible part of the consumption in all the Nordic countries.[21] In Australia, statin is the most prescribed lipid modifying agent (86%) followed by combination (8.3%), and ezetimibe alone (4.0%). There is very low usage of fibrates (1.6%). Among the statins, atorvastatin (60.4%) is most commonly used followed by simvastatin (23.0%) and rosuvastatin (10.5%).[22]

Despite the younger age of ACS in Malaysia, 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 124.69 DDD/1000 population/day in 2008 compared to 14.6 DDD/1000 population/day in Malaysia (increasing trend 17.7% compared to 2007).[22] This implies we still have more room for improvements in the treatment of dyslipidaemia in both primary and secondary prevention. There is a need to intensify lipid modifying treatment to reduce our cardiovascular health burden and healthcare cost in the future.

Table 10.1: Use of Lipid Modifying Medicines by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
C10A A	HMG CoA reductase inhibitors	12.3679	14.5539
C10A B	Fibrates	1.2886	1.3418
C10A C	Bile acid sequestrants	0.0028	0.0010
C10A D	Nicotinic acid and derivatives	<0.0001	<0.0001
C10A X	Other lipid modifying agents	0.1365	0.1269
C10B A	HMG CoA reductase inhibitors in combination with other lipid modifying agents	0.32130	0.2330
C10B X	HMG CoA reductase inhibitors, other combinations	0.0734	0.0703

Table 10.2: Use of Lipid Modifying Medicines by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C10A A	**HMG CoA reductase inhibitors**			
C10A A01	Simvastatin	**Public**	2.4880	2.6120
		Private	2.0597	1.7068
		Total	4.5477	4.3188
C10A A02	Lovastatin	**Public**	4.5976	7.2106
		Private	0.3055	0.2105
		Total	4.9031	7.4211
C10A A03	Pravastatin	**Public**	0.1607	0.1268
		Private	0.1156	0.0812
		Total	0.2763	0.2080
C10A A04	Fluvastatin	**Public**	0.0010	0.0008
		Private	0.0491	0.0321
		Total	0.0501	0.0329
C10A A05	Atorvastatin	**Public**	0.8415	0.9169
		Private	1.3053	1.1551
		Total	2.1467	2.0721
C10A A07	Rosuvastatin	**Public**	0.0393	0.0644
		Private	0.4046	0.4367
		Total	0.4439	0.5011
C10A B	**Fibrates**			
C10A B02	Bezafibrate	**Public**	-	-
		Private	0.0012	<0.0001
		Total	0.0012	<0.0001
C10A B04	Gemfibrozil	**Public**	0.5650	0.7946
		Private	0.0461	0.0191
		Total	0.6111	0.8137
C10A B05	Fenofibrate	**Public**	0.1615	0.1001
		Private	0.4840	0.4180
		Total	0.6455	0.5181
C10A B08	Ciprofibrate	**Public**	0.0141	0.0003
		Private	0.0166	0.0097
		Total	0.0308	0.0100

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C10A C	**Bile acid sequestrants**			
C10A C01	Colestyramine	**Public**	0.0008	0.0008
		Private	0.0017	0.0002
		Total	0.0025	0.0010
C10A C02	Colestipol	**Public**	-	-
		Private	0.0003	-
		Total	0.0003	-
C10A D	**Nicotinic acid and derivatives**			
C10A D02	Nicotinic acid	**Public**	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C10A X	**Other lipid modifying agents**			
C10A X09	Ezetimibe	**Public**	0.0409	0.0524
		Private	0.0956	0.0745
		Total	0.1365	0.1269
C10B A	**HMG CoA reductase inhibitors in combination with other lipid modifying agents**			
C10B A02	Simvastatin and ezetimibe	**Public**	0.0127	0.0232
		Private	0.3087	0.2098
		Total	0.3213	0.233
C10B X	**HMG CoA reductase inhibitors, other combinations**			
C10B X03	Atorvastatin and amlodipine	**Public**	-	0.0031
		Private	0.0734	0.0672
		Total	0.0734	0.0703

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CHAPTER 11 | USE OF DERMATOLOGICALS

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Topical medications remain the mainstay treatment for many dermatological conditions.[1-3] Data collected were analysed to determine the trend of utilisation in both the public and private sectors. Dermatological medications included in this study were antifungals, anti-psoriatics, antibiotics, antivirals, corticosteroids, anti-acne agents, hair growth stimulants, depigmenting agents and calcineurin inhibitors. Utilisation of topical medication is measured in g/ml/1000 population/day, whereas the utilisation of systemic agent is measured in DDD/1000 population/day.

Topical azoles remained the most commonly used antifungal in 2008. Single agent azole, such as miconazole and clotrimazole were preferred by the public sector, while the combination topical azoles were mainly used by the private sector.[4] The usage of topical nystatin was mainly in public sector, and has dropped by half, because of the availability of cheaper azoles.[5] Among the systemic antifungal, ketoconazole was the most commonly used, followed by griseofulvin, fluconazole, itraconazole and terbinafine. Usage of terbinafine by both the private and public sectors have dropped by half, probably due to the availability of cheap, generic itraconazole.

There was no data available on the usage of tar-based preparation and topical corticosteroid in psoriasis. The usage of dithranol, which has the potential to irritate and stain the skin, has gone out of favour in both private and public sectors. Despite its high cost, there has been a sevenfold increase in the use of topical calcipotriol in 2008. The cost effectiveness of calcipotriol over the conventional anti-psoriatic agents, such as tar and dithranol need to be reviewed.[6-8] It is not possible to determine the utilisation pattern of systemic antipsoriatic agents, as this survey does not document the indications for treatment. Methotrexate and cyclosporin, two conventional systemic anti-psoriatic agents, were also used in other non-dermatological conditions. Despite a 19.0% decrease in the total usage of acitretin in 2008, the availability of cheaper, generic acitretin may be the reason for a fivefold increase in its use in the private sector alone.

The use of topical fusidic acid has increase one fold in 2008, with a corresponding decrease in the use of neomycin. This may be attributed to the availability of cheaper generic fusidic acid and also the awareness on the sensitising potential of neomycin.[9] Although topical antiviral has low efficacy,[10,11] surprisingly, there was an increase in its use from 2007 to 2008. The usage of imiquimod, an effective treatment for genital wart,[12] remained low, probably due to its high cost.

In general the use of single agent topical corticosteroid and combination has dropped by about 30% in 2008 as compared to 2007 probably due to increase in awareness and fear of side effect. The total usage of topical corticosteroid is 1.6 times more in the private sector, compared to public sector. The two topical corticosteroid commonly prescribed are hydrocortisone (weak) and betamethasone (potent). However hydrocortisone usage has dropped by 28%. This may be partly explained by the increase in the use of the newer topical corticosteroid, namely, mometasone and fluticasone, which has similar safety profile, with better efficacy.

The usage of mild topical corticosteroid did not differ in both the private and public sector. However, the usage of potent corticosteroid is much higher in the private sector (67.7%), compared to 32.3% in the public sector. The use of topical steroid and antibiotic combination is high in the private sector, compared to public sector.

Medicated dressing with fusidic acid seemed to be the preferred choice of dressing by both the private and public sector in 2008.

Topical treatment for acne vulgaris includes benzoyl peroxide, retinoid, topical antibiotic and azelaic acid.[13,14] Generally, combination treatments are more preferred by clinicians.[15] In the absence of data on benzoyl peroxide, the most commonly used topical anti-acne preparations in 2008 were topical antibiotic, followed by retinoid and azelaic acid. The use of topical anti-acne medications in the private sector was nine times higher as compared to the public sector. The preference of topical anti-acne medications differed between the public and private sectors. In the public sector, the most preferred topical anti-acne medications were tretinoin, followed by adapalene and clindamycin. In the private sector, despite an increasing evidence of antibiotic- resistant acne,[16,17] the commonest prescribed topical anti-acne medications were clindamycin, followed by adapalene and tretinoin. Although there was an overall reduction in the use of oral isotretinoin, a restricted drug with stringent indication,[13] its increased utilisation in the private sector is of concern. This may be explained by the availability of cheap, generic isotretinoin, and prescription by non-dermatologists.

The increase in the usage of topical calcineurin inhibitor in 2008 may explain the reduction in the use of topical corticosteroid.[18]

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 probably perceived as aesthetic therapy.

Our report has some limitations, in that we were only able to compare the results of medications used in 2007 and 2008, therefore unable to determine the trend of usage. Certain drugs, for example systemic antifungal and systemic treatment for psoriasis were also used by other speciality and reported in other chapters, therefore the usage in dermatology cannot be determined.

In summary, the ten commonest topical dermatological preparations used in 2008 are shown in Figure 11.1.

Figure 11.1: Ten commonest topical dermatological preparations used in 2008

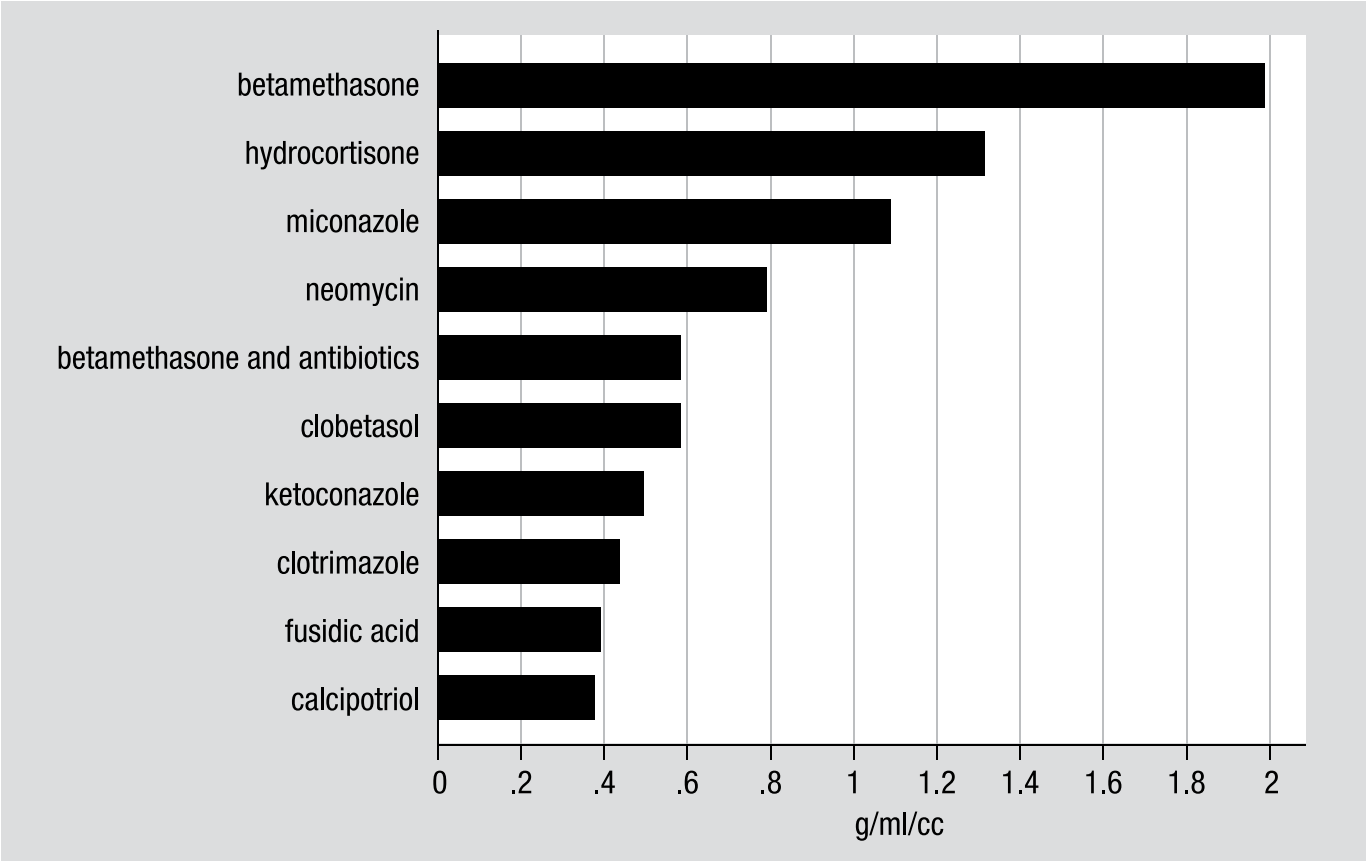

Table 11.1: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D01A A	**Antibiotics**				
D01A A01	Nystatin	g/ml/cc	**Public**	0.1030	0.0735
			Private	0.0126	-
			Total	0.1156	0.0735
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	-

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D01A C	**Imidazole and triazole derivatives**				
D01A C01	Clotrimazole	g/ml/cc	**Public**	0.1835	0.1074
			Private	1.2877	0.3349
			Total	1.4712	0.4423
D01A C02	Miconazole	g/ml/cc	**Public**	0.8189	0.7575
			Private	0.4397	0.3306
			Total	1.2586	1.0882
D01A C03	Econazole	g/ml/cc	**Public**	-	-
			Private	0.0293	0.0269
			Total	0.0293	0.0269
D01A C05	Isoconazole	g/ml/cc	**Public**	0.0001	-
			Private	0.0099	0.0019
			Total	0.0100	0.0019
D01A C07	Tioconazole	g/ml/cc	**Public**	0.0005	0.0011
			Private	0.0092	0.0059
			Total	0.0097	0.0070
D01A C08	Ketoconazole	g/ml/cc	**Public**	0.0760	0.0689
			Private	0.5644	0.4285
			Total	0.6404	0.4974
D01A C14	Sertaconazole	g/ml/cc	**Public**	-	-
			Private	0.0047	-
			Total	0.0047	-
D01A C15	Fluconazole	g/ml/cc	**Public**	-	-
			Private	0.0010	-
			Total	0.0010	-
D01A C20	Combinations	g/ml/cc	**Public**	0.0054	0.0051
			Private	1.9843	1.0727
			Total	1.9897	1.0779
D01A C52	Miconazole, combinations	g/ml/cc	**Public**	-	-
			Private	0.0046	0.0066
			Total	0.0046	0.0066
D01A E	**Other antifungals for topical use**				
D01A E13	Selenium sulfide	g/ml/cc	**Public**	0.0363	0.0562
			Private	0.0885	0.0011
			Total	0.1248	0.0573
D01A E15	Terbinafine	g/ml/cc	**Public**	-	<0.0001
			Private	0.0308	0.0273
			Total	0.0308	0.0274
D01A E16	Amorolfine	g/ml/cc	**Public**	0.0003	0.0002
			Private	<0.0001	<0.0001
			Total	0.0003	0.0003
D01A E22	Naftifine	g/ml/cc	**Public**	-	-
			Private	0.0001	0.0037
			Total	0.0001	0.0037

Table 11.2: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
D01B A	**Antifungals for systemic use**			
D01B A01	Griseofulvin	**Public**	0.1350	0.0823
		Private	0.3235	0.1612
		Total	0.4585	0.2434
D01B A02	Terbinafine	**Public**	0.0083	0.0054
		Private	0.0107	0.0120
		Total	0.0190	0.0174

Table 11.3: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
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	<0.0001
			Private	0.0001	0.0104
			Total	0.0004	0.0104
D05A X	**Other antipsoriatics for topical use**				
D05A X02	Calcipotriol	g/ml/cc	**Public**	0.0431	0.3591
			Private	0.0073	0.0101
			Total	0.0504	0.3693
D05A X03	Calcitriol	g/ml/cc	**Public**	0.0002	-
			Private	-	-
			Total	0.0002	-
D05A X52	Calcipotriol, combinations	g/ml/cc	**Public**	0.0003	0.0028
			Private	0.0107	0.0104
			Total	0.0110	0.0132

Table 11.4: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
D05B A	**Psoralens for systemic use**			
D05B A02	Methoxsalen	**Public**	0.0008	0.0011
		Private	0.0004	0.0004
		Total	0.0011	0.0016
D05B B	**Retinoids for treatment of psoriasis**			
D05B B02	Acitretin	**Public**	0.0139	0.0095
		Private	0.0004	0.0019
		Total	0.0143	0.0115

Table 11.5: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
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	0.0053	0.0017
			Total	0.0053	0.0017
D06A X	**Other antibiotics for topical use**				
D06A X01	Fusidic acid	g/ml/cc	**Public**	0.0465	0.0586
			Private	0.2803	0.3278
			Total	0.3268	0.3864
D06A X04	Neomycin	g/ml/cc	**Public**	0.7810	0.5741
			Private	0.3192	0.2160
			Total	1.1002	0.7901
D06A X05	Bacitracin	g/ml/cc	**Public**	-	-
			Private	0.0003	-
			Total	0.0003	-
D06A X07	Gentamicin	g/ml/cc	**Public**	0.0168	0.0130
			Private	0.3217	0.2712
			Total	0.3385	0.2842
D06A X09	Mupirocin	g/ml/cc	**Public**	0.0166	0.0293
			Private	0.1048	0.0812
			Total	0.1214	0.1105

Table 11.6: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D06B A	**Sulfonamides**				
D06B A01	Silver sulfadiazine	g/ml/cc	**Public**	0.1717	0.2785
			Private	0.0829	0.0766
			Total	0.2545	0.3551
D06B B	**Antivirals**				
D06B B02	Tromantadine	g/ml/cc	**Public**	-	-
			Private	0.0054	0.0014
			Total	0.0054	0.0014
D06B B03	Aciclovir	g/ml/cc	**Public**	0.0020	0.0109
			Private	0.0537	0.0612
			Total	0.0557	0.0721
D06B B04	Podophyllotoxin	g/ml/cc	**Public**	0.0001	0.001
			Private	<0.0001	<0.0001
			Total	0.0001	0.0010
D06B B10	Imiquimod	g/ml/cc	**Public**	-	<0.0001
			Private	0.0015	-
			Total	0.0015	<0.0001
D06B X	**Other chemotherapeutics**				
D06B X01	Metronidazole	g/ml/cc	**Public**	<0.0001	-
			Private	0.0168	0.0117
			Total	0.0168	0.0117

Table 11.7: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D07A A	**Corticosteroids, weak (group I)**				
D07A A02	Hydrocortisone	g/ml/cc	**Public**	1.0019	0.7173
			Private	1.0484	0.6029
			Total	2.0503	1.3201
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**	0.0843	0.0882
			Private	0.1275	0.0333
			Total	0.2118	0.1215
D07A B09	Triamcinolone	g/ml/cc	**Public**	-	-
			Private	0.0174	0.0028
			Total	0.0174	0.0028
D07A B19	Dexamethasone	g/ml/cc	**Public**	-	-
			Private	0.0007	0.0014
			Total	0.0007	0.0014
D07A C	**Corticosteroids, potent (group III)**				
D07A C01	Betamethasone	g/ml/cc	**Public**	0.7833	0.8985
			Private	1.9550	1.0898
			Total	2.7382	1.9882
D07A C04	Fluocinolone acetonide	g/ml/cc	**Public**	-	-
			Private	0.0159	0.0089
			Total	0.0159	0.0089
D07A C08	Fluocinonide	g/ml/cc	**Public**	-	-
			Private	-	0.0001
			Total	-	0.0001
D07A C13	Mometasone	g/ml/cc	**Public**	0.0349	0.0378
			Private	0.1509	0.1829
			Total	0.1858	0.2207
D07A C15	Beclometasone	g/ml/cc	**Public**	-	-
			Private	-	0.0040
			Total	-	0.0040
D07A C16	Hydrocortisone aceponate	g/ml/cc	**Public**	0.0002	0.0005
			Private	0.0185	0.0130
			Total	0.0186	0.0136
D07A C17	Fluticasone	g/ml/cc	**Public**	-	0.0002
			Private	0.0068	0.0176
			Total	0.0068	0.0178
D07A D	**Corticosteroids, very potent (group IV)**				
D07A D01	Clobetasol	g/ml/cc	**Public**	0.1091	0.0720
			Private	0.6340	0.5046
			Total	0.7431	0.5767

Table 11.8: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D07C A	**Corticosteroids, weak, combinations with antibiotics**				
D07C A01	Hydrocortisone and antibiotics	g/ml/cc	**Public**	0.0407	0.0554
			Private	0.0558	0.0338
			Total	0.0965	0.0892
D07C B	**Corticosteroids, moderately potent, combinations with antibiotics**				
D07C B01	Triamcinolone and antibiotics	g/ml/cc	**Public**	0.0007	-
			Private	0.0032	0.0009
			Total	0.0039	0.0009
D07C B04	Dexamethasone and antibiotics	g/ml/cc	**Public**	<0.0001	-
			Private	-	-
			Total	<0.0001	-
D07C C	**Corticosteroids, potent, combinations with antibiotics**				
D07C C01	Betamethasone and antibiotics	g/ml/cc	**Public**	0.0351	0.0297
			Private	0.7802	0.5483
			Total	0.8153	0.5780
D07C C02	Fluocinolone acetonide and antibiotics	g/ml/cc	**Public**	-	-
			Private	0.0159	0.0044
			Total	0.0159	0.0044
D07C D	**Corticosteroids, very potent, combinations with antibiotics**				
D07C D01	Clobetasol and antibiotics	g/ml/cc	**Public**	-	-
			Private	0.0041	0.0112
			Total	0.0041	0.0112

Table 11.9: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D07X A	**Corticosteroids, weak, other combinations**				
D07X A01	Hydrocortisone	g/ml/cc	**Public**	-	-
			Private	0.0472	0.0122
			Total	0.0472	0.0122
D07X C	**Corticosteroids, potent, other combinations**				
D07X C01	Betamethasone	g/ml/cc	**Public**	0.0119	0.0109
			Private	0.2346	0.1619
			Total	0.2465	0.1728

Table 11.10: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D09A A	**Medicated dressings with antiinfectives**				
D09A A01	Framycetin	g/ml/cc	**Public**	-	-
			Private	-	0.0001
			Total	-	0.0001
D09A A02	Fusidic acid	g/ml/cc	**Public**	0.0011	0.0029
			Private	0.0424	0.0501
			Total	0.0435	0.0530
D09A A13	Iodoform	g/ml/cc	**Public**	0.0007	0.0001
			Private	0.0002	-
			Total	0.0009	0.0001

Table 11.11: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D10A A	**Corticosteroids, combinations for treatment of acne**				
D10A A02	Methylprednisolone	g/ml/cc	**Public**	-	-
			Private	0.0049	0.0011
			Total	0.0049	0.0011
D10A D	**Retinoids for topical use in acne**				
D10A D01	Tretinoin	g/ml/cc	**Public**	0.0224	0.0269
			Private	0.0491	0.0405
			Total	0.0715	0.0674
D10A D03	Adapalene	g/ml/cc	**Public**	0.0010	0.0026
			Private	0.0363	0.0572
			Total	0.0372	0.0598
D10A D04	Isotretinoin	g/ml/cc	**Public**	-	-
			Private	0.0015	0.0003
			Total	0.0015	0.0003
D10A D51	Tretinoin, combinations	g/ml/cc	**Public**	-	-
			Private	-	0.0006
			Total	-	0.0006
D10A F	**Antiinfectives for treatment of acne**				
D10A F01	Clindamycin	g/ml/cc	**Public**	0.0005	0.0005
			Private	0.2099	0.1424
			Total	0.2103	0.1429
D10A F02	Erythromycin	g/ml/cc	**Public**	-	0.0001
			Private	0.0341	0.0295
			Total	0.0341	0.0296
D10A F52	Erythromycin, combinations	g/ml/cc	**Public**	-	-
			Private	-	0.0002
			Total	-	0.0002
D10A X	**Other anti-acne preparations for topical use**				
D10A X03	Azelaic acid	g/ml/cc	**Public**	0.0006	0.0008
			Private	0.0037	0.0044
			Total	0.0043	0.0052

Table 11.12: Use of Dermatological by Drug Class and Agents, in DDD/1000 opulation/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
D10B A	**Retinoids for treatment of acne**			
D10B A01	Isotretinoin	**Public**	0.0156	0.0070
		Private	0.0063	0.0092
		Total	0.0219	0.0162

Table 11.13: Use of Dermatological by Drug Class and Agents, in DDD/1000 opulation/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
D11A C	**Medicated shampoos**				
D11A C03	Selenium compounds	g/ml/cc	**Public**	0.0767	0.0917
			Private	0.1590	0.1230
			Total	0.2358	0.2147
D11A F	**Wart and anti-corn preparations**				
D11A F00	Wart and anti-corn preparations	g/ml/cc	**Public**	<0.0001	-
			Private	0.0052	0.0009
			Total	0.0052	0.0009
D11A H	**Agents for atopic dermatitis, excluding corticosteroids**				
D11A H01	Tacrolimus	g/ml/cc	**Public**	0.0001	0.0002
			Private	0.0078	0.0096
			Total	0.0079	0.0098
D11A H02	Pimecrolimus	g/ml/cc	**Public**	<0.0001	<0.0001
			Private	0.0009	0.0019
			Total	0.001	0.0019
D11A X	**Other dermatologicals**				
D11A X01	Minoxidil	g/ml/cc	**Public**	<0.0001	0.0002
			Private	0.0367	0.0280
			Total	0.0368	0.0282
D11A X10	Finasteride	mg	**Public**	-	<0.0001
			Private	0.0695	0.0083
			Total	0.0695	0.0084
D11A X11	Hydroquinone	g/ml/cc	**Public**	<0.0001	0.0001
			Private	0.0103	0.0056
			Total	0.0104	0.0057

Table 11.14: Use of Antifungal in Dermatology by Drug Class and Agents, in DDD/1000 opulation / day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
J02A B	**Imidazole derivatives**				
J02A B02	Ketoconazole	g	**Public**	0.0143	0.0156
			Private	0.3212	0.2251
			Total	0.3355	0.2407
J02A C	**Triazole derivatives**				
J02A C01	Fluconazole	g	**Public**	0.0195	0.0183
			Private	0.0309	0.0312
			Total	0.0504	0.0495
J02A C02	Itraconazole	g	**Public**	0.0192	0.0197
			Private	0.0361	0.0260
			Total	0.0553	0.0456
J02A C03	Voriconazole	g	**Public**	0.0003	0.0005
			Private	0.0002	<0.0001
			Total	0.0005	0.0006

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CHAPTER 12 | USE OF GYNAECOLOGICALS, SEX HORMONES AND HORMONAL CONTRACEPTIVES

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The initial comprehensive reviews on the use of gynaecological, sex hormone and hormonal contraceptive drugs in the Malaysian literature appeared in the Malaysian Statistics on Medicines in 2006 and 2007.[1,2] This chapter reviews the trends in drug usage in Obstetrics and Gynaecology (O&G) for the year 2008.

The use of gynaecological anti-infectives and antiseptics was 0.213 DDD/1000 population/ day in 2008; other gynaecologicals was 0.099 DDD/1000 population/day, both of which showed marginal increases whereas sex hormones and modulators of the genital system showed a marked increase to 9.029 DDD/1000 population/day compared to 8.417 in the year 2007.

The overall increase in anti-infectives and antiseptics can be correlated to the rising caesarean section rate and almost universal use of prophylactic antibiotics in all obstetric and gynaecological surgery. It was noted that some of the imidazole derivatives such as miconazole, econazole and metronidazole were not captured under the gynaecological category but were classified under the dermatological and anti-infective groups. The use of imidazole derivatives in gynaecological practice is quite prevalent especially as treatment and prophylaxis for anaerobic infections as well as fungal infections in the reproductive tract.

The use of nystatin continued to show marked reduction almost half in the public sector whereas its use in the private sector increased from 0.0039 DDD/1000 population/day to 0.0042. This may be due to the easier availability due to down grading of prescriber category for the alternative drug, clotrimazole, in the public sector as well as better compliance patterns with once/day dosages as compared to nystatin. The usage of clotrimazole continued to double from 2007 to 2008 in the public sector. Nystatin use in the private sector increased due to cheaper cost.

The use of methylergometrine and ergometrine doubled in the year 2008. There is a need to review the protocols use in Alternative Birth Centers (ABC) and hospitals without specialist as both ergot alkaloids are to be used with caution due to its effect on cardiovascular system. Future drug utilisation reviews should capture the use of oxytocin and syntometrine as these oxytocics are more relevant to current evidence based protocols.[3,4] The usage of ergometrine in obstetric practice in public hospitals has ceased since 2011.

Misoprostol is a drug that is licensed for peptic ulcer disease but it has been used "off-label" in O&G practice for cervical priming, termination of pregnancy, induction of labour and postpartum haemorrhage.[5] The Director-General of Health sanctioned the off-label use of misoprostol for medical management of stable first trimester miscarriages < 13 weeks.[5] There has been very little use of this drug in the public sector other than for the approved indication. Its use in the private sector has increased. The data is not sufficient to clarify for which indication it has been used in the private sector. Some data has emerged that there have been adverse events related to the use of misoprostol for labour induction prompting a warning by the Pharmaceutical Division against its use for the induction of labour in patients with a previous scar.[6]

Although carboprost is an expensive uterotonic drug, its usage showed a slight increase from <0.0001 to 0.0001 DDD/1000 population/day. This is due to increasing awareness among care providers, its place in the protocol for the management of postpartum haemorrhage (PPH) and its effectiveness.

Preterm labour complicates up to 15% of pregnancies.[7] The majority of drugs used in labour suppression are used "off-label" and has currently been sanctioned by Director General of Health.[5] The tocolytic agents used such as nifedipine, salbutamol and terbutaline were not captured in this survey for its obstetric off-label indications. The use of the only registered drug for labour suppression, atosiban[7], still remained low because of the costing.

Bromocriptine has still been the prevalent prolactin inhibitor used compared to cabergoline. However, there has been a reduction in the use of bromocriptine in both sectors compared to 2007. A reversal in favour of cabergoline should be advocated due to worries of cardiovascular complications and the worries of the risk of concurrent use of antihypertensives with bromocriptine, especially in pre-eclamptic mothers.[8]

Hormonal contraceptives for systemic use have shown marked increase in utilisation from 6.0376 to 7.0053 DDD/1000 population/day. This is in line with the Millennium Development Goal (MDG) 5 targets and the rise was contributed significantly by an increase in the usage of progestogens such as norethisterone and desogestrel as well as fixed combination oestrogen and progestogen such as desogestrel and oestrogen.

Emergency contraceptive use of levonorgestrel quadrupled in the public sector in 2008. There was a slight decline in the private sector. In line with MDG5 goals there is a need to ensure that every woman who requires contraception is provided with it without any difficulty.

In general, the use of progestogens for menstrual dysfunction decreased slightly from 0.9066 to 0.8408 DDD/1000 population/day.

The usage of oestrogens in 2008 showed a drop in the usage as compared to previous year from 0.5863 to 0.4364 DDD/1000 population/day respectively. There may be concern for its association with breast malignancy among users.[9]

The usage of gonadotropins and other ovulation stimulants showed a slight increase from the previous year. The private sector was the main user due to the increased availability of assisted reproductive centers as compared to the public sector. The usage of clomiphene citrate which is cheaper was more commonly used in the public sector with increasing trend from 0.1146 to 0.1753 DDD/1000 population/day.

In conclusion, there is an increased trend in the usage of O&G drugs in 2008. The increase could be even greater when drugs such as tranexamic acid for menorrhagia, dexamethasone for fetal lung maturity, gonadotrophin releasing hormone analogues for endometriosis and uterine fibroids, drugs used for thromboprophylaxis and anemia are included in the gynaecological section. At present, the usage of these drugs is captured under other chapters. Changes in prescribing patterns may be due to increasing disease burden, cost, availability and the direction provided by Clinical Practice Guidelines. Better quality data from the private sector is still required to enable meaningful analysis for national patterns and trends.

Table 12.1: Use of Gynecological, Sex Hormones and Hormonal Contraceptives, in DD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
G01	Gynecological antiinfectives and antiseptics	0.2058	0.2129
G02	Other gynecologicals	0.0959	0.0987
G03	Sex hormones and modulators of the genital system	8.4172	9.0297

Table 12.2.1: Use of Gynecological, Sex Hormones and Hormonal Contraceptives by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
G01A	Antiinfectives and antiseptics, excl. Combinations with orticosteroids	0.2058	0.2129
G01A A	Antibiotics	0.0090	0.0066
G01A F	Imidazole derivatives	0.1966	0.2063
G01A X	Other antiinfectives and antiseptics	0.0001	<0.0001
G02A	Oxytocics	0.0417	0.0589
G02A B	Ergot alkaloids	0.0023	0.0069
G02A D	Prostaglandins	0.0394	0.0520
G02C	Other gynecologicals	0.0542	0.0398
G02C A	Sympathomimetics, labour repressants	<0.0001	-
G02C B	Prolactine inhibitors	0.0542	0.0398
G02C X	Other gynecologicals	<0.0001	<0.0001
G03A	Hormonal contraceptives for systemic use	6.0376	7.0053
G03A A	Progestogens and estrogens, fixed combinations	4.6491	4.1717
G03A B	Progestogens and estrogens, sequential preparations	0.0678	0.0217
G03A C	Progestogens	1.3061	2.7994
G03A D	Emergency contraceptives	0.0146	0.0125
G03B	Androgens	0.0270	0.0355
G03B A	3-oxoandrosten (4) derivatives	0.0265	0.0353
G03B B	5-androstanon (3) derivatives	0.0005	0.0002
G03C	Estrogens	0.5863	0.4364
G03C A	Natural and semisynthetic estrogens, plain	0.4788	0.3519
G03C X	Other estrogens	0.1076	0.0845
G03D	Progestogens	0.9066	0.8408
G03D A	Pregnen (4) derivatives	0.3715	0.3114
G03D B	Pregnadien derivatives	0.2035	0.1792
G03D C	Estren derivatives	0.3317	0.3502
G03F	Progestogens and estrogens in combination	0.2345	0.1580
G03F A	Progestogens and estrogens, fixed combinations	0.0571	0.0571
G03F B	Progestogens and estrogens, sequential preparations	0.1774	0.1008
G03G	Gonadotropins and other ovulation stimulants	0.3263	0.3469
G03G A	Gonadotropins	0.0210	0.0351
G03G B	Ovulation stimulants, synthetic	0.3053	0.3118
G03H	Antiandrogens	0.1502	0.0601
G03H A	Antiandrogens, plain	0.0080	0.0091
G03H B	Antiandrogens and estrogens	0.1422	0.0510
G03X	Other sex hormones and modulators of the genital system	0.1487	0.1469
G03X A	Antigonadotropins and similar agents	0.0184	0.0179
G03X C	Selective estrogen receptor modulators	0.1303	0.1289

Table 12.2.2: Use of Gynecological, Sex Hormones and Hormonal Contraceptives by Drug Class and Agents, in DDD/1000 population/ day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G01A A	**Antibiotics**			
G01A A01	Nystatin	**Public**	0.0051	0.0022
		Private	0.0039	0.0042
		Total	0.0089	0.0064
G01A A03	Amphotericin B	**Public**	-	-
		Private	<0.0001	0.0002
		Total	<0.0001	0.0002
G01A F	**Imidazole derivatives**			
G01A F01	Metronidazole	**Public**	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G01A F02	Clotrimazole	**Public**	0.0716	0.1620
		Private	0.1106	0.0381
		Total	0.1822	0.2001
G01A F04	Miconazole	**Public**	-	-
		Private	0.0062	0.0018
		Total	0.0062	0.0018
G01A F05	Econazole	**Public**	-	-
		Private	0.0066	0.0031
		Total	0.0066	0.0031
G01A F08	Tioconazole	**Public**	<0.0001	<0.0001
		Private	0.0015	0.0010
		Total	0.0015	0.0010
G01A F15	Butoconazole	**Public**	-	-
		Private	<0.0001	0.0003
		Total	<0.0001	0.0003
G01A X	**Other antiinfectives and antiseptics**			
G01A X03	Policresulen	**Public**	<0.0001	-
		Private	<0.0001	<0.0001
		Total	0.0001	<0.0001
G02A B	**Ergot alkaloids**			
G02A B01	Methylergometrine	**Public**	-	0.0044
		Private	0.0016	0.0013
		Total	0.0016	0.0057
G02A B03	Ergometrine	**Public**	0.0007	0.0011
		Private	<0.0001	<0.0001
		Total	0.0008	0.0012

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G02A D	**Prostaglandins**			
G02A D02	Dinoprostone	**Public**	0.0344	0.0471
		Private	0.0035	0.0035
		Total	0.0379	0.0506
G02A D03	Gemeprost	**Public**	0.0012	0.0012
		Private	<0.0001	<0.0001
		Total	0.0013	0.0013
G02A D04	Carboprost	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0001
G02C A	**Sympathomimetics, labour repressants**			
G02C A01	Ritodrine	**Public**	<0.0001	-
		Private	-	-
		Total	<0.0001	-
G02C B	**Prolactine inhibitors**			
G02C B01	Bromocriptine	**Public**	0.0447	0.0319
		Private	0.0060	0.0039
		Total	0.0507	0.0358
G02C B03	Cabergoline	**Public**	0.0020	0.0028
		Private	0.0015	0.0012
		Total	0.0035	0.0040
G02C X	**Other gynecologicals**			
G02C X01	Atosiban	**Public**	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G03A A	**Progestogens and estrogens, fixed combinations**			
G03A A07	Levonorgestrel and estrogen	**Public**	1.3678	1.2237
		Private	1.3727	0.6064
		Total	2.7405	1.8301
G03A A09	Desogestrel and estrogen	**Public**	0.4085	1.3492
		Private	0.8334	0.6568
		Total	1.2418	2.0061
G03A A10	Gestodene and estrogen	**Public**	0.0002	0.0001
		Private	0.3828	0.1584
		Total	0.3831	0.1585
G03A A12	Drospirenone and estrogen	**Public**	0.0035	0.0049
		Private	0.2802	0.1721
		Total	0.2837	0.1770

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G03A B	**Progestogens and estrogens, sequential preparations**			
G03A B03	Levonorgestrel and estrogen	**Public**	-	-
		Private	0.0678	0.0217
		Total	0.0678	0.0217
G03A C	**Progestogens**			
G03A C01	Norethisterone	**Public**	0.0807	0.6402
		Private	0.2970	0.2398
		Total	0.3777	0.8800
G03A C03	Levonorgestrel	**Public**	-	-
		Private	-	0.0002
		Total	-	0.0002
G03A C06	Medroxyprogesterone	**Public**	0.1270	0.4950
		Private	0.7257	1.2406
		Total	0.8527	1.7356
G03A C08	Etonogestrel	**Public**	0.0126	0.0141
		Private	0.0631	0.1507
		Total	0.0757	0.1648
G03A C09	Desogestrel	**Public**	-	0.0189
		Private	-	-
		Total	-	0.0189
G03A D	**Emergency contraceptives**			
G03A D01	Levonorgestrel	**Public**	<0.0001	0.0004
		Private	0.0146	0.0121
		Total	0.0146	0.0125
G03B A	**3-oxoandrosten (4) derivatives**			
G03B A03	Testosterone	**Public**	0.0112	0.0196
		Private	0.0153	0.0157
		Total	0.0265	0.0353
G03B B	**5-androstanon (3) derivatives**			
G03B B01	Mesterolone	**Public**	-	-
		Private	0.0005	0.0002
		Total	0.0005	0.0002
G03C A	**Natural and semisynthetic estrogens, plain**			
G03C A01	Ethinylestradiol	**Public**	<0.0001	0.0113
		Private	-	-
		Total	<0.0001	0.0113
G03C A03	Estradiol	**Public**	0.0453	0.0395
		Private	0.0738	0.0396
		Total	0.1191	0.0792
G03C A57	Conjugated estrogens	**Public**	0.2174	0.1978
		Private	0.1422	0.0636
		Total	0.3596	0.2614

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G03C X	**Other estrogens**			
G03C X01	Tibolone	**Public**	0.0482	0.0425
		Private	0.0594	0.0420
		Total	0.1076	0.0845
G03D A	**Pregnen (4) derivatives**			
G03D A02	Medroxyprogesterone	**Public**	0.3102	0.2317
		Private	0.0238	0.0347
		Total	0.3340	0.2664
G03D A03	Hydroxyprogesterone	**Public**	0.0004	0.0005
		Private	0.0335	0.0189
		Total	0.0339	0.0194
G03D A04	Progesterone	**Public**	0.0001	0.0005
		Private	0.0035	0.0251
		Total	0.0036	0.0256
G03D B	**Pregnadien derivatives**			
G03D B01	Dydrogesterone	**Public**	0.1077	0.1098
		Private	0.0813	0.0693
		Total	0.1890	0.1792
G03D B02	Megestrol	**Public**	-	-
		Private	0.0145	-
		Total	0.0145	-
G03D C	**Estren derivatives**			
G03D C01	Allylestrenol	**Public**	-	-
		Private	0.0118	0.0037
		Total	0.0118	0.0037
G03D C02	Norethisterone	**Public**	0.0186	0.0120
		Private	0.3013	0.3345
		Total	0.3199	0.3465
G03F A	**Progestogens and estrogens, fixed combinations**			
G03F A01	Norethisterone and estrogen	**Public**	0.0066	0.0069
		Private	0.0080	0.0033
		Total	0.0146	0.0103
G03F A12	Medroxyprogesterone and estrogen	**Public**	0.0351	0.0240
		Private	0.0029	0.0044
		Total	0.0380	0.0284
G03F A14	Dydrogesterone and estrogen	**Public**	0.0025	0.0064
		Private	0.0019	0.0078
		Total	0.0044	0.0142
G03F A17	Drospirenone and estrogen	**Public**	-	0.0005
		Private	-	0.0037
		Total	-	0.0042

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G03F B	**Progestogens and estrogens, sequential preparations**			
G03F B01	Norgestrel and estrogen	**Public**	0.0798	0.0430
		Private	0.0431	0.0246
		Total	0.1229	0.0676
G03F B05	Norethisterone and estrogen	**Public**	-	-
		Private	0.0074	0.0012
		Total	0.0074	0.0012
G03F B06	Medroxyprogesterone and estrogen	**Public**	0.0016	0.0005
		Private	0.0038	-
		Total	0.0054	0.0005
G03F B08	Dydrogesterone and estrogen	**Public**	0.0207	0.0193
		Private	0.0210	0.0092
		Total	0.0417	0.0284
G03F B09	Levonorgestrel and estrogen	**Public**	-	-
		Private	-	0.0031
		Total	-	0.0031
G03G A	**Gonadotropins**			
G03G A01	Chorionic gonadotrophin	**Public**	0.0131	0.0143
		Private	0.0048	0.0157
		Total	0.0179	0.0300
G03G A02	Human menopausal gonadotrophin	**Public**	-	-
		Private	0.0001	<0.0001
		Total	0.0001	<0.0001
G03G A04	Urofollitropin	**Public**	-	0.0002
		Private	0.0001	0.0002
		Total	0.0001	0.0004
G03G A05	Follitropin alfa	**Public**	0.0010	0.0010
		Private	0.0004	0.0014
		Total	0.0014	0.0024
G03G A06	Follitropin beta	**Public**	0.0011	0.0006
		Private	0.0004	0.0014
		Total	0.0015	0.0021
G03G A07	Lutropin alfa	**Public**	-	-
		Private	<0.0001	-
		Total	<0.0001	-
G03G A08	Choriogonadotropin alfa	**Public**	<0.0001	<0.0001
		Private	<0.0001	0.0002
		Total	<0.0001	0.0002

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G03G B	**Ovulation stimulants, synthetic**			
G03G B02	Clomifene	**Public**	0.1146	0.1753
		Private	0.1907	0.1365
		Total	0.3053	0.3118
G03H A	**Antiandrogens, plain**			
G03H A01	Cyproterone	**Public**	0.0061	0.0076
		Private	0.0019	0.0015
		Total	0.0080	0.0091
G03H B	**Antiandrogens and estrogens**			
G03H B01	Cyproterone and estrogen	**Public**	0.0268	0.0311
		Private	0.1154	0.0199
		Total	0.1422	0.0510
G03X A	**Antigonadotropins and similar agents**			
G03X A01	Danazol	**Public**	0.0112	0.0074
		Private	0.0047	0.0083
		Total	0.0159	0.0157
G03X A02	Gestrinone	**Public**	0.0005	0.0003
		Private	0.0020	0.0019
		Total	0.0025	0.0022
G03X C	**Selective estrogen receptor modulators**			
G03X C01	Raloxifene	**Public**	0.0638	0.0640
		Private	0.0666	0.0649
		Total	0.1303	0.1289

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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 and propiverine are recommended for use in overactive bladder[1-3] There is an increasing trend of antispasmodic use in 2008 with tolterodine being the highest utilized agent. There is marked increase usage of oxybutynin in public sector this year (0.0026 DDD/1000 population/day) compared to usage in 2007 (0.0008 DDD/1000 population/day). This may be due to increasing indication for its use (diagnosis of overactive bladder) and its wider availability and cheaper price in the public sector. However despite the vast price difference between tolterodine and oxybutynin, the usage of tolterodine exceeds oxybutynin due to its better side effect profile. Tolteradine use in Malaysia is higher (0.0673 DDD/1000 population/day) compared to Australia (0.0430 DDD/1000 population/day) because it is subsidized by the government

Flavoxate, the oldest drug in the group, is used mainly in the private sector and is prescribed with decreasing trend. This could be due to its questionable efficacy and has only level 2 evidence for its use in the treatment of overactive bladder.[1]

Drug used in erectile dysfunction

Sildenafil, tadalafil and vardenafil are the three selective phosphodiesterase type-5 (PDE5) inhibitors used in the treatment of erectile dysfunction. PDE5 inhibitors are more commonly prescribed in the private sector because the drugs are not available in the public sector. 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 hours) compared to vardenafil (duration 5 hours).

There has been a huge 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 (0.0188 vs 0.4350 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 and expensive . It requires patient to do his own self injection and therefore 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 α_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 diagnosed with Benign Prostate Hyperplasia (BPH). The extended release, Alfuzosin XL and Doxazosin XL are becoming more popular since dose titration is not required. Doxazosin is the highest among the group because it has higher tolerability compared to terazosin and cheaper compared to alfuzosin. Furthermore alfuzosin was just introduced to the MOH Formulary in 2008. The usage of terazosin is still high (0.3936 DDD/1000 population/day) and is much higher than in Australia (0.018 DDD/1000 population/day). This could be due to its wider availability even in non urological centers and its cheaper price, tamsulosin is the drug of choice in Australia, due to its increased prostate selectivity.

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). There is increasing trend of usage for both drugs especially in public sector. Between these two, finasteride usage is the highest (0.2903 DDD/1000 population/day) and higher than Australia (0.238 DDD/1000 population/day).This could be due to prescribing practice and wider availability of the drug compared to dutasteride. Dutasteride was relatively new in the MOH formulary at the time. Side effect profile is similar between the two drugs. In Australia, surgery is the more preferred option of treatment for larger prostates and therefore the usage of 5ARIs is low.

Gonadotropin releasing hormone analogues

There is an increasing trend in the usage of long-acting Luteinizing Hormone-Releasing Hormone (LHRH) agonists (buserelin, goserelin, leuprorelin and triptorelin). These agents are used in the treatment of metastatic prostate cancer and are currently the main forms of androgen deprivation treatment (ADT).[7, 8]

Leuprorelin (0.0232 DDD/1000 population/day) and goserelin (0.0279DDD/1000 population/day) are the most popular. Its usage has increased due to increasing number of metastatic prostate cancer patients being diagnosed. Leuprorelin has better patient acceptance due to the availability of 3 monthly depot and finer needle size. It is also cheaper making it more preferable compared to goserelin. Usage is also more in public sector as this is an expensive treatment and more cancer patients are seen in the public sector. Our usage is much lower than that in Australia for leuprorelin (0.8150 DDD/1000 population/day) and goserelin (0.6010 DDD/1000 population/day) due to the higher incidence of prostate cancer in Australia.

Antiandrogens

The antiandrogens are indicated for metastatic prostate cancer. It is used during the initiation of LHRH to prevent the 'flare phenomenon' or can be used in combination with LHRH for complete androgen blockade. Cyproterone (steroidal) is the oldest drug.[1] Its usage has increased especially in the public sector however it is still lower compared to Australia (0.0090 DDD/1000 population/day vs 0.415 DDD/1000 population/day). Non-steroidal antiandrogen especially bicalutamide (0.0117 DDD/1000 population/day) is more preferred than cyproterone and its usage is expected to increase as non steroidal antiandrogens are the more preferred option due to its better safety profile.

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. There is a slight increase of usage in 2008 (0.0353 DDD/1000 population/day) especially in public sector, the most popular being injectable testosterone. Men's health is now increasingly being emphasized. 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 (0.8110 DDD/1000 population/day). However we expect this trend to increase. The cost of testosterone treatment is high and this may be the limiting factor to its usage especially in the public sector.

BCG Vaccine

BCG vaccine is administered intravesically for high risk urothelial bladder cancer. The usage. BCG vaccine is comparable in 2007 and 2008 with no marked changes noted.

Table 13.1: Use of Drugs for Urological Disorders in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	2007	2008
G04	Urologicals	1.0915	1.1212
C02C	Antiadrenergic agents, peripherally acting	0.4130	0.4073
G03	Sex hormones and modulators of the genital system	0.0346	0.0444
L02	Endocrine therapy	0.0668	0.0670
L03	Immunostimulants	0.0015	0.0013

Table 13.2.1: Use of Urologicals by Drug Class in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	2007	2008
G04B	Other urologicals, incl. Antispasmodics	0.1501	0.1160
G04C	Drugs used in benign prostatic hypertrophy	0.9413	1.0052

Table 13.2.2: Use of Urologicals by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G04B D	**Urinary antispasmodics**			
G04B D02	Flavoxate	**Public**	0.0006	0.0014
		Private	0.0155	0.0136
		Total	0.0161	0.015
G04B D04	Oxybutynin	**Public**	0.0007	0.0023
		Private	0.0001	0.0003
		Total	0.0008	0.0026
G04B D06	Propiverine	**Public**	-	0.0002
		Private	0.0009	0.0029
		Total	0.0009	0.0031
G04B D07	Tolterodine	**Public**	0.0362	0.0467
		Private	0.0274	0.0206
		Total	0.0636	0.0673
G04B E	**Drugs used in erectile dysfunction**			
G04B E01	Alprostadil	**Public**	<0.0001	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G04B E03	Sildenafil	**Public**	0.0007	0.0012
		Private	0.0554	0.0176
		Total	0.056	0.0188
G04B E08	Tadalafil	**Public**	0.0003	0.0003
		Private	0.0075	0.006
		Total	0.0077	0.0063
G04B E09	Vardenafil	**Public**	0.0001	0.0001
		Private	0.0048	0.0027
		Total	0.0049	0.0028
G04C A	**Alpha-adrenoreceptor antagonists**			
G04C A01	Alfuzosin	**Public**	0.1535	0.1539
		Private	0.0854	0.0937
		Total	0.2388	0.2476
G04C A03	Terazosin	**Public**	0.3104	0.3129
		Private	0.0621	0.0807
		Total	0.3726	0.3936
G04C B	**Testosterone-5-alpha reductase inhibitors**			
G04C B01	Finasteride	**Public**	0.2464	0.2728
		Private	0.0223	0.0176
		Total	0.2688	0.2903
G04C B02	Dutasteride	**Public**	0.0348	0.0551
		Private	0.0263	0.0185
		Total	0.0612	0.0736

Table 13.3.1: Use of Other Dugs for Urologica Disorders by Drug Class and Agents in DD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
C02C	**Antiadrenergic agents, peripherally acting**			
C02C A04	Doxazosin	**Public**	0.3525	0.3297
		Private	0.0606	0.0776
		Total	0.4130	0.4073
G03	**Sex hormones and modulators of the genital system**			
G03B A	**3-oxoandrosten (4) derivatives**			
G03B A03	Testosterone	**Public**	0.0112	0.0196
		Private	0.0153	0.0157
		Total	0.0265	0.0353
G03H A	**Antiandrogens, plain**			
G03H A01	Cyproterone	**Public**	0.0061	0.0076
		Private	0.0019	0.0015
		Total	0.0080	0.0091
L02	**Endocrine therapy**			
L02A E	**Gonadotropin releasing hormone analogues**			
L02A E01	Buserelin	**Public**	-	-
		Private	0.0002	0.0004
		Total	0.0002	0.0004
L02A E02	Leuprorelin	**Public**	0.0114	0.0111
		Private	0.0076	0.0122
		Total	0.0190	0.0232
L02A E03	Goserelin	**Public**	0.0174	0.0179
		Private	0.0129	0.0101
		Total	0.0303	0.0279
L02A E04	Triptorelin	**Public**	0.0010	0.0016
		Private	0.0003	0.0002
		Total	0.0014	0.0017
L02B B	**Anti-androgens**			
L02B B01	Flutamide	**Public**	0.0023	0.0015
		Private	0.0008	0.0004
		Total	0.0031	0.0019
L02B B03	Bicalutamide	**Public**	0.0094	0.0093
		Private	0.0037	0.0024
		Total	0.0130	0.0117
L03A X	**Other immunostimulants**			
L03A X03	BCG vaccine	**Public**	0.0007	0.0006
		Private	0.0008	0.0007
		Total	0.0015	0.0013

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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 2008 decreased by 6.3% when compared to 2007 (2.1529 to 2.0175 DDD/1000 populations/day).[1] Thyroid-related drugs was still the most utilised endocrine drugs (93.0%), followed by pituitary-hypothalamic hormones and analogues (6.0%), and drugs for calcium homeostasis (0.8%). Similar to 2007, there was much higher utilisation of endocrine-related drugs in Malaysia as compare to Australia for 2008.[2]

Drugs for thyroid disorders consist of thyroid replacement hormone and anti-thyroid therapy. Levothyroxine (T4) was the mainstay for the treatment of hypothyroidism (99.99%) at 0.8959 DDD/1000 population/day. However, the use of levothyroxine reduced by 16.0% as compared to 2007. The use of levothyroxine was 20-fold higher in Australia (16.7100 DDD/1000 population/day) in the same year.[2] The difference suggested a higher prevalence of hypothyroidism in Australia, possibly related to better screening, diagnosis and treatment among the elderly population in comparison to Malaysia where there is lack of screening.[2] Similar to 2006 and 2007, liothyronine (T3) sodium was hardly used in Malaysia.

In 2008, there was a reduction of 6.8% in anti-thyroid drug utilization (0.9844 DDD/1000 population/day) compared to 2007 and this was higher than Australia (0.8400 DDD/1000 population/day).[1,2] Among the anti-thyroid drugs in Malaysia, carbimazole (84.52%) was the most utilised, followed by propylthiouracil (15.18%) that may reflected the preference for once daily dosing of carbimazole. Also, carbimazole is the drug of choice in paediatric and adolescent patients.

Drug utilisation of pituitary-hypothalamic hormones and analogues were generally low in Malaysia at 0.1209 DDD/1000 population/day even though there was 12.9% increment compared to 2007. Pituitary-hypothalamic endocrine disorders were generally uncommon.

Regards to drugs for calcium homeostasis, the use of calcitonin (salmon synthetic), 0.0100 DDD/1000 population/day was 10-fold higher as compared to Australia, 0.001 DDD/1000 population/day.[2] At the same time, the usage was 20.48% higher than previous year. This increase occurred predominantly in the public hospitals in Malaysia. The use of teriparatide was still the same and exclusively use in the private health sector.

In conclusion, the overall consumption of endocrine related drugs had decreased; these figures may still not accurately reflect the actual usage of drugs as these data rely heavily on public and private sectors purchasing reports.

Table 14.1: Use of Drug for Endocrine Disorders, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	2007	2008
H01	Pituitary and hypothalamic hormones and analogues	0.1071	0.1209
H03	Thyroid therapy	2.0319	1.8803
H04	Pancreatic hormones	0.0001	0.0002
H05	Calcium homeostasis	0.0138	0.0161

Table 14.2: Use of Pituitary and Hypothalamic Hormones and Analogues by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	2007	2008
H01A	Anterior pituitary lobe hormones and analogues	0.0018	0.0024
H01A A	ACTH	0.0001	0.0002
H01A B	Thyrotropin	-	<0.0001
H01A C	Somatropin and somatropin agonists	0.0017	0.0022
H01B	Posterior pituitary lobe hormones	0.1042	0.1167
H01B A	Vasopressin and analogues	0.0234	0.0321
H01B B	Oxytocin and analogues	0.0808	0.0846
H01C	Hypothalamic hormones	0.0011	0.0018
H01C B	Antigrowth hormones	0.001	0.0018
H01C C	Anti-gonadotropin-releasing hormones	<0.0001	<0.0001
H03A	Thyroid preparations	0.9756	0.8959
H03A A	Thyroid hormones	0.9756	0.8959
H03B	Antithyroid preparations	1.0561	0.9844
H03B A	Thiouracils	0.1818	0.1494
H03B B	Sulfur-containing imidazole derivatives	0.8743	0.8350
H03C	Iodine therapy	0.0002	-
H03C A	Iodine therapy	0.0002	-
H04A	Glycogenolytic hormones	0.0001	0.0002
H04A A	Glycogenolytic hormones	0.0001	0.0002
H05A	Parathyroid hormones and analogues	0.0028	0.0024
H05A A	Parathyroid hormones and analogues	0.0028	0.0024
H05B	Anti-parathyroid agents	0.0110	0.0138
H05B A	Calcitonin preparations	0.0083	0.0100
H05B X	Other anti-parathyroid agents	0.0027	0.0038

Table 14.3.1: Use of Thyroid Therapy by Drug Class, in DDD/1000 population/day 2007- 2008

ATC	DRUG CLASS AND AGENTS	2007	2008
H03A	Thyroid preparations	0.9756	0.8959
H03A A	Thyroid hormones	0.9756	0.8959
H03B	Antithyroid preparations	1.0561	0.9844
H03B A	Thiouracils	0.1818	0.1494
H03B B	Sulfur-containing imidazole derivatives	0.8743	0.8350
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 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
H03A A	**Thyroid hormones**			
H03A A01	Levothyroxine sodium	**Public**	0.7689	0.7101
		Private	0.2067	0.1859
		Total	0.9756	0.8959
H03A A02	Liothyronine sodium	**Public**	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
H03B A	**Thiouracils**			
H03B A02	Propylthiouracil	**Public**	0.1147	0.1031
		Private	0.0671	0.0464
		Total	0.1818	0.1494
H03B B	**Sulfur-containing imidazole derivatives**			
H03B B01	Carbimazole	**Public**	0.6023	0.5812
		Private	0.2719	0.2507
		Total	0.8743	0.8320
H03B B02	Thiamazole	**Public**	-	-
		Private	<0.0001	0.0030
		Total	<0.0001	0.0030
H03C A	**Iodine therapy**			
H03C AXX	Fake INN for H03CA	**Public**	-	-
		Private	0.0002	-
		Total	0.0002	-

Table 14.4.1: Use of Pancreatic Hormones by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	2007	2008
H04A	Glycogenolytic hormones	0.0001	0.0002
H04A A	Glycogenolytic hormones	0.0001	0.0002

Table 14.4.2: Use of Pancreatic Hormones by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
H04A A	**Glycogenolytic hormones**			
H04A A01	Glucagon	**Public**	<0.0001	0.0002
		Private	<0.0001	<0.0001
		Total	0.0001	0.0002

Table 14.5.1: Use of Pancreatic Hormones by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	2007	2008
H05A	Parathyroid hormones and analogues	0.0028	0.0024
H05A A	Parathyroid hormones and analogues	0.0028	0.0024
H05B	Anti-parathyroid agents	0.0110	0.0138
H05B A	Calcitonin preparations	0.0083	0.0100
H05B X	Other anti-parathyroid agents	0.0027	0.0038

Table 14.5.2: Use of Pancreatic Hormones by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
H05A A	**Parathyroid hormones and analogues**			
H05A A02	Teriparatide	**Public**	-	<0.0001
		Private	0.0028	0.0023
		Total	0.0028	0.0024
H05B A	**Calcitonin preparations**			
H05B A01	Calcitonin (salmon synthetic)	**Public**	0.0056	0.0077
		Private	0.0027	0.0023
		Total	0.0083	0.0100
H05B X	**Other anti-parathyroid agents**			
H05B X02	Paricalcitol	**Public**	0.0012	0.0017
		Private	0.0015	0.0021
		Total	0.0027	0.0038

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CHAPTER 15 | USE OF ANTI-INFECTIVES

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Anti-infectives are among the largest group of drugs being used in Malaysia apart from antidiabetics, antihypertensives, lipid lowering agents and others. In 2008, the consumption of anti-infectives has shown a slight reduction (0.7%) compared to 2007. The reduction has been contributed by the reduction in use of certain therapeutic groups of drug in this class namely antimycotics for systemic use (23%) and antimycobacterials (4.6%). Conversely, antiviral for systemic use (31.8%) and antimalarias (8.6%) have shown a slight increase in their usage in 2008 compared to 2007. Antibacterial for systematic use is the ninth most used therapeutic group in 2008 with 70% total usage contributed by the private sector.

The largest class of antibacterials used in 2008 was penicillins followed by macrolides, tetracyclines, other beta lactam antibacterials, fluoroquinolones and others. Among the penicillins, amoxicillin was the most widely used drugs (55.2%) and the usage of private sector contributed to the 77.3% of the total usage. Mild or suspected community acquired pneumonia (CAP) maybe one of the indication that contributed to the high usage of amoxicillin. In Australia, amoxycillin, cephalexin and amoxicillin/clavulanate were among the top 10 drugs by prescription count.[1] The usage of amoxicillin in Australia was 61% higher than Malaysia while amoxycillin/clavulanate was 86% higher than Malaysia.[1]

Cephalosporins constituted 11.6% of total antibacterial use. Cephalexin was the most used first- generation cephalosporins (83%) while among the second generation, cefuroxime was the most used drug (79%) and was 74% higher than Australia.[1] For third and fourth generation cephalosporins, ceftriaxone (44.6%) and ceftibuten (14%) were the most used with ceftibuten predominantly prescribed by the private sector. This differed from Australia where the third and fourth generation cephalosporin use was negligible. This continues a worrying trend from the previous years where ceftriaxone usage continues to increase, which often leads to increase in extended spectrum beta lactamase inhibitors (ESBLs) among gut flora.

Macrolides constituted 13.7% of total bacterial use in 2008 comparable to cephalosporins. The most used macrolides was erythromycin (63.7%) followed by clarithromycin (16.3%). Azithromycin has shown 32.7% increase in usage compared to 2007 and the private sector use was two times more than the public sector. The increase in the usage could be contributed by Malaysian Antibiotic Guideline 2008 that recommends azithromycin as first line for severe CAP in combination with ceftriaxone or amoxicillin/clavulanate. When compared to Australian Statistics on Medicines 2008, Malaysian usage of azithromycin was 39.4% higher than Australia while their usage of erythromycin was 24.8% higher than Malaysia. With this increased usage, it would be important to monitor for rates of azithromycin resistance in *Strepcococcus pneumoniae* over the next few years.

Fluoroquinolones constitute 8.7% of total bacterial use in 2008. Among fluoroquinolones group, ciprofloxacin and norfloxacin have shown significant increase in use in 2008 compared to 2007 with the percentage of 25.6% and 259% respectively. When compared to Australia, the use of ciprofloxacin is comparable to Malaysia whereas norfloxacin is higher in our country (66%). The usage of ciprofloxacin in private sector was 7 times more than public sector as well as for norfloxacin in which private sector contributed around 99% of the usage in 2008. Restricted policy on prescribing of quinolones in MOH hospitals could have resulted in this pattern since quinolone use has been linked to infection with MRSA and with increasing quinolone resistance in gram-negative bacilli such as *Pseudomonas aeruginosa*.[2] It would be advisable for the public sector to have a clear policy on how to limit the usage of this antibiotic. Certain hospitals and even countries abroad have now introduced formulary restrictions for access to fluoroquinolones to prevent collateral damage.

Another antibiotic observed to show an increase in its usage for 2008 is clindamycin recording 18.6% from 2007 with public sector usage nearly two times higher than private sector. Clindamycin is used by the public sector for treating HIV opportunistic infections such as *Pneumocystic carinii* pneumonia (PCP), *Toxoplasma gondii* encephalitis and sometimes for diabetic foot ulcer. It is also indicated as an alternative for metronidazole in certain infections as well as an alternative for penicllin allergic patient. When compared to Australia, their usage of clindamycin was comparable to Malaysia in 2008. Since the most common adverse effect of clindamycin is *Clostridium difficile*-associated diarrhoea (CDAD), this drug needs to be used appropriately to prevent pseudomembranous colitis caused by CDAD.

Moving past the antibacterials, Tuberculosis has remained a big challenge in Malaysia with a purported rise in tuberculosis from 15,057 cases in 2000 to 17,506 cases in Tuberculosis Information System (TBIS) Ministry of Health 2008. Despite the increase in cases, the overall usage of antimycobacterials for the treatment of tuberculosis did not seem to correspond to incidence rate of tuberculosis (63.1 per 100,000 population in 2007 compared to 62.3 per 100,000 in 2008).

Malaria however, has seen a significant drop in the number of cases from 12,705 in 2000 to 7,390 in 2008 (Report from Vector Borne Diseases Control Programme, Ministry of Health). In this medicines use survey, a small increase was observed i.e. 0.1562/1000 population/day in 2008 as compared to 0.1438/1000 population/day in 2007. Artemisinin-derivatives is not commonly used in both public and private hospitals.

With regard to antivirals, 2008 saw an increase in the usage of fixed dose combination of antiretrovirals by 22% in keeping with MOH's policy of providing 1st line HAART free of charge to all eligible patients, which came into effect in 2006. Fixed dose combinations were deemed more efficacious for patient compliance which is of paramount importance in this group.

In the nucleoside reverse transcriptase group there was a trend towards avoidance of stavudine and didanosine due to their inferior safety profiles when compared to zidovudine and lamivudine.

Of the protease inhibitors, lopinavir saw an increase in usage by 103%. Indinavir which has a higher incidence of significant adverse events saw a slight drop in usage. More nevirapine were prescribed compared to efavirenz most likely due to its lower cost. Tenofovir and emtricitabine in a fixed dose combination began to see an increase in usage in accordance with the revised 2006 WHO guidelines. The fixed dose formulation of stavudine, lamivudine and nevirapine saw a decrease in usage (96%).

In the public sector, voriconazole saw an increase in usage most likely due to expansion of haematological services i.e. bone marrow transplants, chemotherapy for malignancies etc.

Adefovir and entecavir saw an increase in usage in the both the public and private sectors due to more awareness about hepatitis B treatment amongst clinicians and patients.

In terms of safety, antiinfectives constitute nearly 25% of total ADR from National Centre for ADR Monitoring, National Pharmaceutical Control Bureau, MOH reports. Antibacterials were the main contributors with 863 (72%) reports which is not surprising considering their high usage followed by antiTB 149 (12.5%), antivirals 126 (3.5%) and antifungals 42 (3.5%). In the antibacterial group, penicillins contributed one third of ADRs with nearly half (44%) due to amoxicillin use. Cephalosporin and macrolide usage was similar (13%) however, ADRs due to cephalosporins was three times higher (22%) as compared to macrolides (7%). Thus it can be seen that macrolide use was associated with less adverse events. More than half of cephalosporin ADRs was due to the 3rd generation ceftriaxone (27%) and cefoperazone (25%).

Data from National Centre for ADR Monitoring, National Pharmaceutical Control Bureau, MOH found that generally 50-60% of ADRs observed from the use of antibacterials of penicillin, cephalosporin and sulphonamide groups are related to skin and appendages disorder including the serious Steven-Johnson Syndrome. Meanwhile, ADRs reported from carbapenem use was generally that of the central and peripheral nervous system disorder (23.1%) and liver and biliary system disorder (22.3%). Thus close monitoring of patients prescribed antibacterials is critical for early detection of possible adverse events to avoid complications and prolonged hospital stay.

As suggested in last years report, a concerted effort is required to merge existing antimicrobial resistance data with the antibiotic consumption, to enable a more meaningful approach in promoting judicious use of antimicrobials. Available data on antimicrobial resistance is available in the public sector, 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 antibiotic resistance.

Table 15.1: Use of Anti-Infectives, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
J01	Antibacterials for systemic use	9.874	9.7204	3.604	3.5577
J02	Antimycotics for systematic use	0.4448	0.3395	0.1623	0.1242
J04	Antimycobacterials	0.9881	0.9423	0.3607	0.3449
J05	Antivirals for systemic use	0.6401	0.8437	0.2336	0.3088
J06	Immune sera and immunoglobulins	-	0.0006	-	0.0002
J07	Vaccines	-	1.4032	-	0.5136
P01B	Antimalarials	0.1438	0.1562	0.0525	0.0572

Table 15.2.1: Use of Anti-Bacterials by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
J01A	Tetracyclines	1.1004	1.1551	0.4017	0.4228
J01B	Amphenicols	0.0034	0.003	0.0013	0.0011
J01C	Beta-lactam antibacterials, penicillins	5.0966	4.7526	1.8603	1.7394
J01D	Other beta-lactam antibacterial	1.0929	1.1426	0.3989	0.4182
J01E	Sulfonamides and trimethoprim	0.5228	0.3846	0.1908	0.1408
J01F	Macrolides, lincosamides and streptogramins	1.387	1.3341	0.5063	0.4883
J01G	Aminoglycosides antibacterials	0.0431	0.0463	0.0157	0.0169
J01M	Quinolone antibacterials	0.5377	0.8467	0.1963	0.3099
J01X	Other antibacterials	0.0900	0.0554	0.0329	0.0203

Table 15.2.2: Use of Anti-Bacterials by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01A A	**Tetracyclines**					
J01A A01	Demeclocycline	**Public**	-	-	-	-
		Private	0.0008	-	0.0003	-
		Total	0.0008	-	0.0003	-
J01A A02	Doxycycline	**Public**	0.2484	0.1994	0.0907	0.0608
		Private	0.7138	0.8345	0.2605	0.3054
		Total	0.9622	1.0338	0.3512	0.3662
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**	0.0493	0.0349	0.0180	0.0088
		Private	0.0819	0.0803	0.0299	0.0294
		Total	0.1312	0.1152	0.0479	0.0382
J01A A08	Minocycline	**Public**	0.0014	0.0007	0.0005	0.0003
		Private	0.0047	0.0052	0.0017	0.0019
		Total	0.0061	0.0059	0.0022	0.0022
J01A A12	Tigecycline	**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
J01B A	**Amphenicols**					
J01B A01	Chloramphenicol	**Public**	0.0014	0.001	0.0005	0.0004
		Private	0.0021	0.002	0.0008	0.0007
		Total	0.0034	0.003	0.0013	0.0011

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01C A	**Penicillins with extended spectrum**					
J01C A01	Ampicillin	**Public**	0.0659	0.0653	0.024	0.0191
		Private	0.0848	0.0613	0.0309	0.0224
		Total	0.1507	0.1265	0.0550	0.0415
J01C A04	Amoxicillin	**Public**	0.7419	0.5955	0.2708	0.1893
		Private	1.8492	2.0297	0.6750	0.7429
		Total	2.5912	2.6252	0.9458	0.9322
J01C A06	Bacampicillin	**Public**	0.1991	0.1524	0.0727	0.0394
		Private	0.0900	0.1985	0.0329	0.0726
		Total	0.2891	0.3509	0.1055	0.112
J01C A07	Epicillin	**Public**	-	-	-	-
		Private	<0.0001	-	<0.0001	-
		Total	<0.0001	-	<0.0001	-
J01C A12	Piperacillin	**Public**	0.0001	<0.0001	<0.0001	<0.0001
		Private	-	-	-	-
		Total	0.0001	<0.0001	<0.0001	<0.0001
J01C A13	Ticarcillin	**Public**	-	-	-	-
		Private	<0.0001	-	<0.0001	-
		Total	<0.0001	-	<0.0001	-
J01C A51	Ampicillin, combinations	**Public**	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01C E	**Beta-lactamase sensitive penicillins**					
J01C E01	Benzylpenicillin	**Public**	0.0153	0.0165	0.0056	0.006
		Private	0.0010	0.0009	0.0004	0.0003
		Total	0.0163	0.0174	0.0059	0.0064
J01C E02	Phenoxymethylpenicillin	**Public**	0.1564	0.161	0.0571	0.0430
		Private	0.0199	0.0142	0.0073	0.0052
		Total	0.1764	0.1752	0.0644	0.0482
J01C E08	Benzathine benzylpenicillin	**Public**	0.0008	0.0011	0.0003	0.0004
		Private	0.0008	0.0004	0.0003	0.0002
		Total	0.0016	0.0015	0.0006	0.0005
J01C E09	Procaine benzylpenicillin	**Public**	0.0030	0.0029	0.0011	0.0009
		Private	<0.0001	-	<0.0001	-
		Total	0.003	0.0029	0.0011	0.0009

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01C F	**Beta-lactamase resistant penicillins**					
J01C F02	Cloxacillin	**Public**	0.6545	0.5341	0.2389	0.1670
		Private	0.2043	0.1587	0.0746	0.0581
		Total	0.8587	0.6928	0.3134	0.2251
J01C F04	Oxacillin	**Public**	-	-	-	-
		Private	0.0010	<0.0001	0.0004	<0.0001
		Total	0.0010	<0.0001	0.0004	<0.0001
J01C F05	Flucloxacillin	**Public**	0.0017	0.0014	0.0006	0.0005
		Private	0.0143	0.0105	0.0052	0.0038
		Total	0.0159	0.0119	0.0058	0.0043
J01C R	**Combinations of penicillins, incl. beta-lactamase inhibitors**					
J01C R01	Ampicillin and enzyme inhibitor	**Public**	0.0260	0.0250	0.0095	0.0092
		Private	0.0066	0.0083	0.0024	0.003
		Total	0.0326	0.0333	0.0119	0.0122
J01C R02	Amoxicillin and enzyme inhibitor	**Public**	0.1560	0.1709	0.0569	0.0614
		Private	0.7285	0.4301	0.2659	0.1574
		Total	0.8845	0.6009	0.3228	0.2188
J01C R04	Sultamicillin	**Public**	0.0352	0.0342	0.0129	0.0125
		Private	0.0340	0.0721	0.0124	0.0264
		Total	0.0692	0.1062	0.0253	0.0389
J01C R05	Piperacillin and enzyme inhibitor	**Public**	0.0048	0.0057	0.0018	0.0021
		Private	0.0014	0.0013	0.0005	0.0005
		Total	0.0062	0.007	0.0023	0.0026
J01C R50	Combinations of penicillins	**Public**	-	-	-	-
		Private	-	0.0007	-	0.0003
		Total	-	0.0007	-	0.0003
J01D B	**First-generation cephalosporins**					
J01D B01	Cefalexin	**Public**	0.0597	0.0612	0.0218	0.0187
		Private	0.3998	0.3306	0.1459	0.1210
		Total	0.4595	0.3919	0.1677	0.1397
J01D B04	Cefazolin	**Public**	<0.0001	0.0003	<0.0001	0.0001
		Private	0.0026	0.0018	0.0009	0.0007
		Total	0.0026	0.0022	0.001	0.0008
J01D B05	Cefadroxil	**Public**	-	-	-	-
		Private	0.0804	0.0742	0.0293	0.0272
		Total	0.0804	0.0742	0.0293	0.0272
J01D B09	Cefradine	**Public**	-	-	-	-
		Private	0.0010	0.0015	0.0004	0.0005
		Total	0.0010	0.0015	0.0004	0.0005

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01D C	**Second-generation cephalosporins**					
J01D C02	Cefuroxime	**Public**	0.2043	0.2067	0.0746	0.0743
		Private	0.1743	0.2305	0.0636	0.0844
		Total	0.3786	0.4371	0.1382	0.1586
J01D C04	Cefaclor	**Public**	0.0013	0.0017	0.0005	0.0006
		Private	0.0407	0.1048	0.0148	0.0384
		Total	0.0420	0.1065	0.0153	0.0390
J01D C10	Cefprozil	**Public**	0.0003	0.0002	<0.0001	<0.0001
		Private	0.0086	0.0044	0.0031	0.0016
		Total	0.0089	0.0046	0.0032	0.0017
J01D D	**Third-generation cephalosporins**					
J01D D01	Cefotaxime	**Public**	0.0038	0.0037	0.0014	0.0014
		Private	0.0006	0.0005	0.0002	0.0002
		Total	0.0044	0.0042	0.0016	0.0015
J01D D02	Ceftazidime	**Public**	0.0079	0.0078	0.0029	0.0029
		Private	0.0021	0.0016	0.0008	0.0006
		Total	0.0100	0.0094	0.0036	0.0035
J01D D04	Ceftriaxone	**Public**	0.0238	0.0268	0.0087	0.0098
		Private	0.018	0.0175	0.0066	0.0064
		Total	0.0418	0.0443	0.0153	0.0162
J01D D08	Cefixime	**Public**	-	-	-	-
		Private	0.0027	0.0119	0.001	0.0044
		Total	0.0027	0.0119	0.001	0.0044
J01D D12	Cefoperazone	**Public**	0.0087	0.0091	0.0032	0.0033
		Private	0.0003	0.0003	0.0001	0.0001
		Total	0.009	0.0094	0.0033	0.0034
J01D D14	Ceftibuten	**Public**	-	-	-	-
		Private	0.0123	0.0139	0.0045	0.0051
		Total	0.0123	0.0139	0.0045	0.0051
J01D D62	Cefoperazone, combinations	**Public**	0.0023	0.0023	0.0008	0.0008
		Private	0.0030	0.0039	0.0011	0.0014
		Total	0.0052	0.0061	0.0019	0.0022
J01D E	**Fourth-generation cephalosporins**					
J01D E01	Cefepime	**Public**	0.0111	0.0056	0.0041	0.0020
		Private	0.0022	0.0018	0.0008	0.0007
		Total	0.0133	0.0074	0.0049	0.0027

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01D F	**Monobactams**					
J01D F01	Aztreonam	**Public**	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
J01D H	**Carbapenems**					
J01D H02	Meropenem	**Public**	0.0094	0.0067	0.0034	0.0025
		Private	0.0028	0.0028	0.0010	0.0010
		Total	0.0122	0.0095	0.0044	0.0035
J01D H03	Ertapenem	**Public**	<0.0001	0.0002	<0.0001	<0.0001
		Private	0.0014	0.0013	0.0005	0.0005
		Total	0.0015	0.0015	0.0005	0.0006
J01D H51	Imipenem and enzyme inhibitor	**Public**	0.0058	0.0049	0.0021	0.0018
		Private	0.0018	0.002	0.0007	0.0007
		Total	0.0075	0.007	0.0028	0.0025
J01E A	**Trimethoprim and derivatives**					
J01E A01	Trimethoprim	**Public**	0.0036	0.0094	0.0013	0.0034
		Private	0.0084	0.0008	0.0031	0.0003
		Total	0.0120	0.0102	0.0044	0.0037
J01E C	**Intermediate-acting sulfonamides**					
J01E C02	Sulfadiazine	**Public**	0.0044	-	0.0016	-
		Private	-	-	-	-
		Total	0.0044	-	0.0016	-
J01E E	**Combinations of sulfonamides and trimethoprim, incl. derivatives**					
J01E E01	Sulfamethoxazole and trimethoprim	**Public**	0.2167	0.1939	0.0791	0.0619
		Private	0.2724	0.1716	0.0994	0.0628
		Total	0.4892	0.3654	0.1785	0.1247
J01E E02	Sulfadiazine and trimethoprim	**Public**	-	<0.0001	-	<0.0001
		Private	0.0173	0.009	0.0063	0.0033
		Total	0.0173	0.009	0.0063	0.0033
J01F A	**Macrolides**					
J01F A01	Erythromycin	**Public**	0.5376	0.5815	0.1962	0.1864
		Private	0.3124	0.2476	0.1140	0.0906
		Total	0.8499	0.8290	0.3102	0.277
J01F A02	Spiramycin	**Public**	-	-	-	-
		Private	0.0008	0.0006	0.0003	0.0002
		Total	0.0008	0.0006	0.0003	0.0002
J01F A06	Roxithromycin	**Public**	-	-	-	-
		Private	0.1243	0.1118	0.0454	0.0409
		Total	0.1243	0.1118	0.0454	0.0409

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01F A	**Macrolides**					
J01F A09	Clarithromycin	**Public**	0.0337	0.0206	0.0123	0.0075
		Private	0.2400	0.1919	0.0876	0.0702
		Total	0.2737	0.2124	0.0999	0.0778
J01F A10	Azithromycin	**Public**	0.0195	0.0561	0.0071	0.0205
		Private	0.0913	0.091	0.0333	0.0333
		Total	0.1108	0.1471	0.0404	0.0538
J01F A15	Telithromycin	**Public**	-	-	-	0
		Private	-	0.0003	-	0.0001
		Total	-	0.0003	-	0.0001
J01F F	**Lincosamides**					
J01F F01	Clindamycin	**Public**	0.0066	0.0183	0.0024	0.0067
		Private	0.0170	0.0097	0.0062	0.0036
		Total	0.0236	0.028	0.0086	0.0102
J01F F02	Lincomycin	**Public**	-	-	-	-
		Private	0.0039	0.0047	0.0014	0.0017
		Total	0.0039	0.0047	0.0014	0.0017
J01G A	**Streptomycins**					
J01G A01	Streptomycin	**Public**	0.0218	0.0211	0.0079	0.0059
		Private	0.0002	0.0008	<0.0001	0.0003
		Total	0.022	0.0219	0.008	0.0062
J01G B	**Other aminoglycosides**					
J01G B03	Gentamicin	**Public**	0.0100	0.0113	0.0037	0.0041
		Private	0.0041	0.0072	0.0015	0.0026
		Total	0.0141	0.0185	0.0052	0.0068
J01G B04	Kanamycin	**Public**	0.0008	0.0004	0.0003	0.0001
		Private	0.0009	0.0007	0.0003	0.0003
		Total	0.0016	0.0011	0.0006	0.0004
J01G B05	Neomycin	**Public**	-	-	-	-
		Private	0.0003	-	<0.0001	-
		Total	0.0003	-	<0.0001	-
J01G B06	Amikacin	**Public**	0.0024	0.0024	0.0009	0.0009
		Private	0.0009	0.0007	0.0003	0.0003
		Total	0.0033	0.0032	0.0012	0.0012
J01G B07	Netilmicin	**Public**	0.0008	0.0008	0.0003	0.0003
		Private	0.0010	0.0007	0.0004	0.0003
		Total	0.0018	0.0016	0.0006	0.0006

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01M A	**Fluoroquinolones**					
J01M A01	Ofloxacin	**Public**	0.0132	0.0091	0.0048	0.0033
		Private	0.0933	0.1043	0.034	0.0382
		Total	0.1065	0.1135	0.0389	0.0415
J01M A02	Ciprofloxacin	**Public**	0.0393	0.0294	0.0143	0.0107
		Private	0.1539	0.2134	0.0562	0.0781
		Total	0.1932	0.2428	0.0705	0.0889
J01M A03	Pefloxacin	**Public**	0.0016	0.0023	0.0006	0.0008
		Private	0.0033	0.0007	0.0012	0.0003
		Total	0.0049	0.0030	0.0018	0.0011
J01M A04	Enoxacin	**Public**	-	-	-	-
		Private	<0.0001	-	<0.0001	-
		Total	<0.0001	-	<0.0001	-
J01M A06	Norfloxacin	**Public**	0.0003	0.0005	<0.0001	0.0002
		Private	0.1138	0.4093	0.0415	0.1498
		Total	0.1141	0.4098	0.0416	0.15
J01M A07	Lomefloxacin	**Public**	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M A10	Rufloxacin	**Public**	-	-	-	-
		Private	0.0036	-	0.0013	-
		Total	0.0036	-	0.0013	-
J01M A12	Levofloxacin	**Public**	0.0017	0.0016	0.0006	0.0006
		Private	0.0478	0.0414	0.0175	0.0152
		Total	0.0495	0.0430	0.0181	0.0157
J01M A14	Moxifloxacin	**Public**	0.0003	0.0003	0.0001	0.0001
		Private	0.0287	0.0176	0.0105	0.0065
		Total	0.029	0.0179	0.0106	0.0066
J01M A15	Gemifloxacin	**Public**	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J01M A17	Prulifloxacin	**Public**	-	-	-	-
		Private	-	0.0029	-	0.0011
		Total	-	0.0029	-	0.0011

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01M B	**Other quinolones**					
J01M B04	Pipemidic acid	**Public**	-	-	-	-
		Private	0.008	0.0138	0.0029	0.005
		Total	0.008	0.0138	0.0029	0.005
J01M B07	Flumequine	**Public**	-	-	-	-
		Private	0.0288	-	0.0105	-
		Total	0.0288	-	0.0105	-
J01X A	**Glycopeptide antibacterials**					
J01X A01	Vancomycin	**Public**	0.0039	0.0039	0.0014	0.0014
		Private	0.0011	0.0009	0.0004	0.0003
		Total	0.0050	0.0048	0.0018	0.0018
J01X A02	Teicoplanin	**Public**	0.0002	0.0001	<0.0001	<0.0001
		Private	0.0001	0.0002	<0.0001	<0.0001
		Total	0.0003	0.0003	0.0001	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
J01X C	**Steroid antibacterials**					
J01X C01	Fusidic acid	**Public**	0.0136	0.0111	0.005	0.0041
		Private	0.0032	0.0013	0.0012	0.0005
		Total	0.0167	0.0124	0.0061	0.0045
J01X D	**Imidazole derivatives**					
J01X D01	Metronidazole	**Public**	0.0428	0.0131	0.0156	0.0048
		Private	0.0083	0.0121	0.0030	0.0044
		Total	0.0511	0.0252	0.0186	0.0092
J01X D02	Tinidazole	**Public**	-	-	-	-
		Private	-	0.0003	-	0.0001
		Total	-	0.0003	-	0.0001
J01X E	**Nitrofuran derivatives**					
J01X E01	Nitrofurantoin	**Public**	0.0086	0.0061	0.0031	0.0022
		Private	0.0054	0.0041	0.0020	0.0015
		Total	0.0139	0.0102	0.0051	0.0037

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J01X X	**Other antibacterials**					
J01X X01	Fosfomycin	**Public**	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0017	0.0014	0.0006	0.0005
		Total	0.0017	0.0014	0.0006	0.0005
J01X X05	Methenamine	**Public**	-	-	-	-
		Private	0.0005	-	0.0002	-
		Total	0.0005	-	0.0002	-
J01X X08	Linezolid	**Public**	0.0003	0.0002	0.0001	<0.0001
		Private	0.0004	0.0003	0.0001	0.0001
		Total	0.0007	0.0005	0.0003	0.0002
J01X X09	Daptomycin	**Public**	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001

Table 15.3.1: Use of Anti-Mycotics by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
J02A A	Antibiotics	0.0029	0.0028	0.0011	0.0010
J02A B	Imidazole derivatives	0.3355	0.2407	0.1225	0.0881
J02A C	Triazole derivatives	0.1062	0.0957	0.0388	0.0350
J02A X	Other antimycotics for systemic use	0.0002	0.0002	<0.0001	<0.0001

Table 15.3.2: Use of Anti-Mycotics by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J02A A	**Antibiotics**					
J02A A01	Amphotericin B	**Public**	0.0025	0.0027	0.0009	0.0010
		Private	0.0004	0.0002	0.0002	<0.0001
		Total	0.0029	0.0028	0.0011	0.0010
J02A B	**Imidazole derivatives**					
J02A B02	Ketoconazole	**Public**	0.0143	0.0156	0.0052	0.0057
		Private	0.3212	0.2251	0.1172	0.0824
		Total	0.3355	0.2407	0.1225	0.0881

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J02A C	**Triazole derivatives**					
J02A C01	Fluconazole	**Public**	0.0195	0.0183	0.0071	0.0065
		Private	0.0309	0.0312	0.0113	0.0114
		Total	0.0504	0.0495	0.0184	0.018
J02A C02	Itraconazole	**Public**	0.0192	0.0197	0.0070	0.0072
		Private	0.0361	0.0260	0.0132	0.0095
		Total	0.0553	0.0456	0.0202	0.0167
J02A C03	Voriconazole	**Public**	0.0003	0.0005	0.0001	0.0002
		Private	0.0002	<0.0001	<0.0001	<0.0001
		Total	0.0005	0.0006	0.0002	0.0002
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	0.0002	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0002	0.0002	<0.0001	<0.0001
J02A X06	Anidulafungin	**Public**	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001

Table 15.4.1: Use of Anti-Mycobacterials by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J04A B	**Antibiotics**					
J04A B01	Cycloserine	**Public**	0.0004	0.0004	0.0001	0.0001
		Private	-	-	-	-
		Total	0.0004	0.0004	0.0001	0.0001
J04A B02	Rifampicin	**Public**	0.21	0.2252	0.0766	0.0613
		Private	0.0177	0.0182	0.0065	0.0067
		Total	0.2277	0.2435	0.0831	0.068
J04A B04	Rifabutin	**Public**	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
J04A C	**Hydrazides**					
J04A C01	Isoniazid	**Public**	0.3570	0.2775	0.1303	0.0751
		Private	0.0594	0.0304	0.0217	0.0111
		Total	0.4164	0.3079	0.1520	0.0862
J04A D	**Thiocarbamide derivatives**					
J04A D03	Ethionamide	**Public**	0.0005	0.0003	0.0002	0.0001
		Private	-	<0.0001	-	<0.0001
		Total	0.0005	0.0004	0.0002	0.0001

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J04A K	**Other drugs for treatment of tuberculosis**					
J04A K01	Pyrazinamide	**Public**	0.1308	0.1257	0.0477	0.0336
		Private	0.0099	0.0115	0.0036	0.0042
		Total	0.1407	0.1372	0.0514	0.0378
J04A K02	Ethambutol	**Public**	0.0722	0.1023	0.0263	0.0374
		Private	0.0119	0.015	0.0043	0.0055
		Total	0.0840	0.1172	0.0307	0.0429
J04A M	**Combinations of drugs for treatment of tuberculosis**					
J04A M02	Rifampicin and isoniazid	**Public**	<0.0001	-	<0.0001	-
		Private	0.0130	0.0110	0.0048	0.0040
		Total	0.0131	0.0110	0.0048	0.0040
J04A M05	Rifampicin, pyrazinamide and isoniazid	**Public**	<0.0001	-	<0.0001	-
		Private	0.0043	0.0074	0.0016	0.0027
		Total	0.0043	0.0074	0.0016	0.0027
J04A M06	Rifampicin, pyrazinamide, ethambutol and isoniazid	**Public**	-	0.006	-	0.0022
		Private	0.0007	0.0030	0.0002	0.0011
		Total	0.0007	0.009	0.0002	0.0033
J04B A	**Drugs for treatment of lepra**					
J04B A01	Clofazimine	**Public**	0.0035	0.0026	0.0013	0.0009
		Private	-	-	-	-
		Total	0.0035	0.0026	0.0013	0.0009
J04B A02	Dapsone	**Public**	0.0872	0.0959	0.0318	0.0291
		Private	0.0095	0.0099	0.0035	0.0036
		Total	0.0967	0.1058	0.0353	0.0327

Table 15.5.1: Use of Anti-Malarials by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
P01A	Agents against ameobiasis and other protozoal diseases	0.2091	0.1906	0.0763	0.0698
P01B A	Aminoquinolines	0.1257	0.139	0.0459	0.0509
P01B B	Biguanides	0.0004	0.0003	-	0.0001
P01B C	Methanolquinolines	0.0047	0.0044	0.0017	0.0016
P01B D	Diaminopyrimidines	0.0129	0.0125	0.0047	0.0046
P01B E	Artemisinin and derivatives, plain	-	<0.0001	-	<0.0001

Table 15.5.2: Use of Anti-Malarials by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
P01A	**Agents against amoebiasis and other protozoal diseases**					
P01A B01	Metronidazole	**Public**	0.1135	0.0933	0.0414	0.0290
		Private	0.0886	0.0931	0.0323	0.0341
		Total	0.2021	0.1864	0.0738	0.0631
P01A B02	Tinidazole	**Public**	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0069	0.0042	0.0025	0.0015
		Total	0.007	0.0042	0.0025	0.0015
P01B A	**Aminoquinolines**					
P01B A01	Chloroquine	**Public**	0.0132	0.0119	0.0048	0.0044
		Private	0.0056	0.0006	0.002	0.0002
		Total	0.0187	0.0126	0.0068	0.0046
P01B A02	Hydroxychloroquine	**Public**	0.0598	0.0640	0.0218	0.0234
		Private	0.0109	0.0277	0.0040	0.0101
		Total	0.0707	0.0916	0.0258	0.0335
P01B A03	Primaquine	**Public**	0.0335	0.0345	0.0122	0.0097
		Private	0.0028	0.0003	0.0010	<0.0001
		Total	0.0363	0.0348	0.0133	0.0098
P01B B	**Biguanides**					
P01B B51	Proguanil, combinations	**Public**	-	-	-	-
		Private	0.0004	0.0003	0.0002	0.0001
		Total	0.0004	0.0003	0.0002	0.0001
P01B C	**Methanolquinolines**					
P01B C01	Quinine	**Public**	0.0043	0.0034	0.0016	0.0012
		Private	0.0003	0.001	<0.0001	0.0004
		Total	0.0046	0.0044	0.0017	0.0016
P01B C02	Mefloquine	**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
P01B D	**Diaminopyrimidines**					
P01B D01	Pyrimethamine	**Public**	0.0009	0.0009	0.0003	0.0003
		Private	-	-	-	-
		Total	0.0009	0.0009	0.0003	0.0003
P01B D51	Pyrimethamine, combinations	**Public**	0.0106	0.0109	0.0039	0.0027
		Private	0.0014	0.0007	0.0005	0.0002
		Total	0.0120	0.01160	0.0044	0.0030
P01B E	**Artemisinin and derivatives, plain**					
P01B E01	Artemisinin	**Public**	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
P01B E03	Artesunate	**Public**	-	<0.0001	-	<0.0001
		Private	-	0	-	-
		Total	-	<0.0001	-	<0.0001

Table 15.6.1: Use of Anti-Virals by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
J05A B	Nucleosides and nucleotides excl. reverse transcriptase inhibitors	0.0515	0.0418	0.0188	0.0153
J05A D	Phosphonic acid derivatives	<0.0001	<0.0001	<0.0001	<0.0001
J05A E	Protease inhibitors	0.0128	0.0147	0.0047	0.0054
J05A F	Nucleoside and nucleotide reverse transcriptase inhibitors	0.1828	0.1989	0.0667	0.0728
J05A G	Non-nucleoside reverse transcriptase inhibitors	0.1772	0.1474	0.0647	0.0540
J05A H	Neuraminidase inhibitors	0.0893	0.3228	0.0326	0.1181
J05A R	Antivirals for treatment of HIV infections, combinations	0.1265	0.1181	0.0462	0.0432
J05A X	Other antivirals	-	-	-	-

Table 15.6.2: Use of Anti-Virals by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J05A B	**Nucleosides and nucleotides excl. reverse transcriptase inhibitors**					
J05A B01	Aciclovir	**Public**	0.0056	0.0075	0.0020	0.0026
		Private	0.0429	0.0315	0.0156	0.0115
		Total	0.0484	0.0390	0.0177	0.0142
J05A B04	Ribavirin	**Public**	0.0008	0.0005	0.0003	0.0002
		Private	0.0004	0.0007	0.0001	0.0003
		Total	0.0011	0.0012	0.0004	0.0004
J05A B06	Ganciclovir	**Public**	0.0002	0.0004	<0.0001	0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0003	0.0004	<0.0001	0.0001
J05A B11	Valaciclovir	**Public**	0.0001	0.0002	<0.0001	<0.0001
		Private	0.0013	0.0008	0.0005	0.0003
		Total	0.0014	0.001	0.0005	0.0004
J05A B14	Valganciclovir	**Public**	0.0001	0.0002	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0002	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

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J05A E	**Protease inhibitors**					
J05A E02	Indinavir	**Public**	0.0062	0.0057	0.0023	0.0021
		Private	0.0002	0.0001	<0.0001	<0.0001
		Total	0.0064	0.0059	0.0023	0.0022
J05A E03	Ritonavir	**Public**	0.0031	0.0021	0.0011	0.0008
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0031	0.0021	0.0011	0.0008
J05A E06	Lopinavir	**Public**	0.0033	0.0064	0.0012	0.0023
		Private	-	0.0003	-	0.0001
		Total	0.0033	0.0067	0.0012	0.0025
J05A F	**Nucleoside and nucleotide reverse transcriptase inhibitors**					
J05A F01	Zidovudine	**Public**	0.0126	0.0134	0.0046	0.0049
		Private	<0.0001	0.0002	<0.0001	<0.0001
		Total	0.0127	0.0136	0.0046	0.005
J05A F02	Didanosine	**Public**	0.0146	0.0137	0.0053	0.005
		Private	0.0005	0.0008	0.0002	0.0003
		Total	0.0152	0.0145	0.0055	0.0053
J05A F03	Zalcitabine	**Public**	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-
J05A F04	Stavudine	**Public**	0.0572	0.0428	0.0209	0.0157
		Private	0.0005	0.0008	0.0002	0.0003
		Total	0.0577	0.0436	0.0211	0.016
J05A F05	Lamivudine	**Public**	0.067	0.0812	0.0245	0.0297
		Private	0.0034	0.0031	0.0012	0.0011
		Total	0.0704	0.0842	0.0257	0.0308
J05A F06	Abacavir	**Public**	-	0.0008	-	0.0003
		Private	-	-	-	-
		Total	-	0.0008	-	0.0003
J05A F07	Tenofovir disoproxil	**Public**	0.0008	0.0069	0.0003	0.0025
		Private	-	-	-	-
		Total	0.0008	0.0069	0.0003	0.0025
J05A F08	Adefovir dipivoxil	**Public**	0.0075	0.014	0.0027	0.0051
		Private	0.0077	0.0051	0.0028	0.0019
		Total	0.0152	0.0191	0.0056	0.0070
J05A F10	Entecavir	**Public**	0.0005	0.0025	0.0002	0.0009
		Private	0.0083	0.0122	0.0030	0.0045
		Total	0.0089	0.0147	0.0032	0.0054
J05A F11	Telbivudine	**Public**	-	<0.0001	-	<0.0001
		Private	0.0019	0.0015	0.0007	0.0005
		Total	0.0019	0.0015	0.0007	0.0006

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
J05A G	**Non-nucleoside reverse transcriptase inhibitors**					
J05A G01	Nevirapine	**Public**	0.0293	0.0342	0.0107	0.0125
		Private	0.0002	0.0002	<0.0001	<0.0001
		Total	0.0295	0.0344	0.0108	0.0126
J05A G03	Efavirenz	**Public**	0.1456	0.1109	0.0531	0.0406
		Private	0.0022	0.0021	0.0008	0.0008
		Total	0.1477	0.1130	0.0539	0.0414
J05A H	**Neuraminidase inhibitors**					
J05A H01	Zanamivir	**Public**	-	0.0727	-	0.0266
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	0.0727	<0.0001	0.0266
J05A H02	Oseltamivir	**Public**	0.0893	0.2501	0.0326	0.0915
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0893	0.2501	0.0326	0.0915
J05A R	**Antivirals for treatment of HIV infections, combinations**					
J05A R01	Zidovudine and lamivudine	**Public**	0.0969	0.1112	0.0354	0.0407
		Private	0.0035	0.0023	0.0013	0.0008
		Total	0.1003	0.1135	0.0366	0.0416
J05A R03	Tenofovir disoproxil and emtricitabine	**Public**	<0.0001	0.0036	<0.0001	0.0013
		Private	-	-	-	-
		Total	<0.0001	0.0036	<0.0001	0.0013
J05A R07	Stavudine, lamivudine and nevirapine	**Public**	0.0261	0.0010	0.0095	0.0004
		Private	-	-	-	-
		Total	0.0261	0.001	0.0095	0.0004
J05A X	**Other antivirals**					
J05A X02	Lysozyme	**Public**	-	-	-	-
		Private	-	-	-	-
		Total	-	-	-	-

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

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Cancer is a leading cause of death worldwide, accounting for 7.6 million deaths (around 13% of all deaths) in 2008. Deaths from cancer worldwide are projected to continue to rise, with an estimated 13.1 million deaths in 2030.[1] Malignant neoplasm was among the top five principle cause of death in the Ministry of Health (MOH) hospitals in 2011.[2] According to the National Cancer Registry 2007, 18,219 new cancer cases were reported in Malaysia. The estimated Age- Standardised Incidence Rate (ASR) was 85.1 per 100,000 in males and 94.4 per 100,000 in females.[3]

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.[4] 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 report, the total utilisation of antineoplastics is described similarly to the previous report in 2007. 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,[5,6] standardised Body Surface Area (BSA) of 1.72m^2 and standardised weight of 60 kg.[7] 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 carboplatin, cyclophosphamide, 5-flurouracil, methotrexate, doxorubicin, cisplatin, hydroxycarbamide, mercaptopurine, epirubicin and dactinomycin.

Comparing the public and private, the top 10 antineoplastics used in the public sector were carboplatin, cyclophosphamide, fluorouracil, methotrexate, doxorubicin, cisplatin, hydroxycarbamide, mercaptopurine, epirubicin and dactinomycin. In the private sector, cyclophosphamide, fluorouracil, gemcitabine, carboplatin, doxorubicin,hydroxycarbamide, oxaliplatin, capecitabine, cisplatin and paclitaxel were the 10 most used agents.

According to the different drug classes, the most used alkylating agent was cyclophosphamide followed by ifosfamide and mephalan. Carmustine, melphalan and busulphan are part of conditioning regimens for transplant and the usage has increased due to increase in number of transplants.

For antimetabolites, fluorouracil was the most used agent followed by methotrexate and mercaptopurine. There was a marked increment of methotrexate due to an increase in incidence of CNS lymphoma and acute lymphoblastic leukemia (ALL). It is also used in salvage therapies for lymphoma, paediatric malignancies and ALL.

There was a decrease in usage of pemetrexed likely due to availability of targeted therapy for EGFR mutated lung cancer.

For vinca alkaloids, vincristine was most frequently used. Etoposide was the most common agent in the podophyllotoxin class but the usage has reduced. Paclitaxel was the most common agent in the taxane group but the usage has also reduced. In the anthracycline group, doxorubicin is the most used followed by epirubicin and dactinomycin.

In the platinum group, there is a drastic increase in usage for carboplatin surpassing cisplatin. This is surprising and may indicate a changing trend from cisplatin usage to carboplatin in the future. It will be compared with the future report.

The usage of tretinoin has increased due to the increase in incidence of acute promyelocytic leukemia (APML). However, the usage of arsenic trioxide which is the second line for relapse APML remained the same for both years.

For targeted therapy, rituximab is still the most commonly prescribed monoclonal antibody followed by bevacizumab and trastuzumab. It was noted that the use of trastuzumab has increased in the public sector as it was made available in the MOH formulary in 2008. In terms of small molecules, gefitinib is ranked highest in usage, followed by imatinib and lapatinib. The increase in imatinib reflects its availablity through patient assistance program for chronic myeloid leukaemia and gastrointestinal stromal tumor. Dasatinib and nilotinib were introduced in 2008 as 2nd generation tyrosine kinase inhibitors. The use of Erlotinib has decreased significantly.

By using the above formula proposed in the 2007 report, we are able to compare and conclude these data and observe the changes in the trends of prescribing antineoplastic drugs. However, we propose to incorporate the cost and number of patients in future reports for international comparisons.

ENDOCRINE THERAPY

Hormonal therapy is commonly used for breast and prostate cancer. The use in prostate cancer is discussed in the urology section (Chapter 13).

In terms of the different agents, tamoxifen remains the most used antioestrogens in 2008. This was followed by letrozole and anastrazole. Letrozole is the most used aromatase inhibitor for year 2008. The total usage of tamoxifen had reduced in 2008 compared to 2007. We also noted that the use of anastrazole has reduced by half.

IMMUNOSTIMULANTS

Colony stimulating factors are used as prophylaxis or treatment of neutropenia. Filgrastim was the most used colony stimulating factor. Pegfilgrastim is still mainly used in the private sector.

Interferons may be used in the treatment of renal cancer, Kaposi's sarcoma, haematological malignancies and non-malignant conditions. The most frequently used interferon isinterferon alfa 2b followed by interferon alfa 2a. The use of interferon alfa 2a had reduced drastically possibly due to the availability of newer agents.

Table 16.1: Use of Anti-Neoplastic Agents by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	Drug Class & Agents	Dose & Duration	Average Dose per treatment cycle	Unit	Sector	2007		2008	
						Total Dosage /1000 population	Total no. of treatment cycle	Total Dosage /1000 population	Total no. of treatment cycle
L01A A	**Nitrogen mustard analogues**								
L01A A01	Cyclophosphamide	750mg/m2	1300	mg	Public	2.1746	16591	2.4588	16976
					Private	0.6602	5037	0.5840	5154
					Total	2.8348	21628	3.0428	22130
L01A A02	Chlorambucil	10mg d1-14	140	mg	Public	0.0040	283	0.0040	289
					Private	0.0009	61	0.0002	62
					Total	0.0048	344	0.0043	352
L01A A03	Melphalan	30mg/m2	50	mg	Public	0.0012	234	0.0039	239
					Private	0.0010	192	0.0005	196
					Total	0.0021	426	0.0044	436
L01A A06	Ifosfamide	1500mg/m2 x 5/7	12900	mg	Public	0.0016	1	0.0011	1
					Private	0.0002	<1	0.0001	<1
					Total	0.0018	1	0.0012	1
L01A B	**Alkyl sulfonates**								
L01A B01	Busulfan	0.8mg/kg QID x 4/7	800	mg	Public	0.0051	64	0.0157	65
					Private	0.0020	24	0.0001	25
					Total	0.0071	88	0.0158	90

ATC	Drug Class & Agents	Dose & Duration	Average Dose per treatment cycle	Unit	Sector	2007		2008	
						Total Dosage /1000 population	Total no. of treatment cycle	Total Dosage /1000 population	Total no. of treatment cycle
L01A C	**Ethylene imines**								
L01A C01	Thiotepa	45mg/m2 weekly	80	mg	Public	0.0001	8	<0.0001	8
					Private	-	-	-	-
					Total	0.0001	8	<0.0001	8
L01A D	**Nitrosoureas**								
L01A D01	Carmustine	300mg/m2 x1/7	500	mg	Public	0.0006	11	0.0022	11
					Private	0.0013	25	0.0015	26
					Total	0.0018	36	0.0036	37
L01A D02	Lomustine	110mg/m2 d1	190	mg	Public	0.0006	31	0.0007	32
					Private	0.0002	12	0.0001	13
					Total	0.0008	43	0.0008	44
L01A X	**Other alkylating agents**								
L01A X03	Temozolomide	75mg/m2 d1-5 x 6 weeks	3900	mg	Public	0.0046	12	0.0125	12
					Private	0.0096	24	0.0103	25
					Total	0.0142	36	0.0228	37
L01A X04	Dacarbazine	375mg/m2 D1+15	1300	mg	Public	0.1002	765	0.0895	782
					Private	0.0330	251	0.0131	257
					Total	0.1332	1016	0.1026	1040
L01B A	**Folic acid analogues**								
L01B A01	Methotrexate	2000mg/m2	3500	mg	Public	0.7348	2082	4.0560	2131
					Private	0.1913	542	0.1738	555
					Total	0.9261	2624	4.2298	2685
L01B A04	Pemetrexed	500mg/m2	860	mg	Public	0	0	0.0004	0
					Private	0.0092	106	0.0066	108
					Total	0.0092	106	0.0070	108
L01B B	**Purine analogues**								
L01B B02	Mercaptopurine	100mg/m2 d1-5	860	mg	Public	0.8572	9886	0.6260	10115
					Private	0.1464	1688	0.0181	1728
					Total	1.0036	11574	0.644	11843
L01B B03	Tioguanine	100mg/m2 d1-5	860	mg	Public	0.0822	948	0.0695	970
					Private	0.0048	55	0.0002	56
					Total	0.0870	1003	0.0697	1026
L01B B04	Cladribine	0.2mg/kg d1-5	60	mg	Public	<0.0001	3	<0.0001	3
					Private	<0.0001	3	<0.0001	3
					Total	<0.0001	5	<0.0001	5
L01B B05	Fludarabine	25mg/m2 d1-5	215	mg	Public	0.0073	337	0.0032	345
					Private	0.0013	61	0.0002	62
					Total	0.0086	397	0.0034	407

ATC	Drug Class & Agents	Dose & Duration	Average Dose per treatment cycle	Unit	Sector	2007		2008	
						Total Dosage /1000 population	Total no. of treatment cycle	Total Dosage /1000 population	Total no. of treatment cycle
L01B C	**Pyrimidine analogues**								
L01B C01	Cytarabine	1500mg/m2 b BD x 4/7	20640	mg	Public	1.4036	674	1.8288	690
					Private	0.2533	122	0.8669	125
					Total	1.6569	796	2.6957	815
L01B C02	Fluorouracil	1000mg/m2	2000	mg	Public	4.1618	20639	4.1341	21118
					Private	1.3773	6830	0.8548	6989
					Total	5.5391	27469	4.9889	28107
L01B C03	Tegafur	300mg/m2 x 21days rest 7days	10836	mg	Public	0	0	0	0
					Private	0	0	0.0116	0
					Total	0	0	0.0116	0
L01B C05	Gemcitabine	1000mg/m2 d1+ 8	3440	mg	Public	0.9037	2606	0.5806	2666
					Private	0.4505	1299	1.0374	1329
					Total	1.3542	3904	1.6179	3995
L01B C06	Capecitabine	2500mg/d d1- 14	35000	mg	Public	11.2026	3175	7.1037	3248
					Private	10.8932	3087	7.3898	3159
					Total	22.0958	6262	14.4935	6407
L01B C08	Decitabine	20mg/m2/d x 5days	172	mg	Public	0	0	0	0
					Private	0	0	0.0001	0
					Total	0	0	0.0001	0
L01B C53	Tegafur, combinations	100mg tds x 28 days	8400	mg	Public	0.0121	14	0.0002	15
					Private	0.1773	209	0.1490	214
					Total	0.1894	224	0.1492	229
L01C A	**Vinca alkaloids and analogues**								
L01C A01	Vinblastine	10mg d1+15	20	mg	Public	0.0014	671	0.0031	686
					Private	0.0018	870	0.0004	891
					Total	0.0031	1541	0.0035	1577
L01C A02	Vincristine	2mg d1+8	4	mg	Public	0.0019	4706	0.0018	4816
					Private	0.0004	1007	0.0002	1030
					Total	0.0023	5714	0.0019	5846
L01C A04	Vinorelbine	30mg/m2 d1+8	100	mg	Public	0.0027	264	0.0064	270
					Private	0.0057	561	0.0070	574
					Total	0.0083	825	0.0134	844
L01C B	**Podophyllotoxin derivatives**								
L01C B01	Etoposide	100mg/m2 d1-5	860	mg	Public	0.1796	2072	0.1175	2120
					Private	0.0425	490	0.0318	502
					Total	0.2221	2562	0.1493	2621
L01C B02	Teniposide	100mg/m2	860	mg	Public	0.0006	7	0.0011	7
					Private	0.0014	17	0.0002	17
					Total	0.0020	23	0.0014	24

ATC	Drug Class & Agents	Dose & Duration	Average Dose per treatment cycle	Unit	Sector	2007		2008	
						Total Dosage /1000 population	Total no. of treatment cycle	Total Dosage /1000 population	Total no. of treatment cycle
L01C D	**Taxanes**								
L01C D01	Paclitaxel	175mg/m2	300	mg	Public	0.1014	3351	0.0613	3429
					Private	0.0464	1534	0.0462	1570
					Total	0.1478	4885	0.1075	4998
L01C D02	Docetaxel	75mg/m2	130	mg	Public	0.0279	2126	0.0254	2175
					Private	0.0212	1621	0.0185	1658
					Total	0.0491	3746	0.0439	3833
L01D A	**Actinomycines**								
L01D A01	Dactinomycin	15mcg/kg	1	mcg	Public	0.0003	2661	0.0006	2722
					Private	<0.0001	70	<0.0001	71
					Total	0.0003	2730	0.0006	2794
L01D B	**Anthracyclines and related substances**								
L01D B01	Doxorubicin	50mg/m2	90	mg	Public	0.0775	8536	0.0827	8734
					Private	0.0253	2786	0.0202	2851
					Total	0.1027	11322	0.1029	11585
L01D B02	Daunorubicin	45mg/m2 d1-3	230	mg	Public	0.0134	578	0.0076	592
					Private	0.0016	70	0.0010	71
					Total	0.0150	648	0.0086	663
L01D B03	Epirubicin	75mg/m2	130	mg	Public	0.0857	6539	0.0811	6691
					Private	0.0165	1256	0.0142	1286
					Total	0.1022	7796	0.0953	7977
L01D B06	Idarubicin	12mg/m2 d1-3	105	mg	Public	0.0009	81	0.0013	83
					Private	0.0003	27	0.0003	28
					Total	0.0011	108	0.0017	111
L01D B07	Mitoxantrone	12mg/m2 d1-3	60	mg	Public	0.0009	146	0.0025	150
					Private	0.0004	67	0.0014	69
					Total	0.0013	213	0.0039	218
L01D C	**Other cytotoxic antibiotics**								
L01D C01	Bleomycin	30mg/m2 d1, 8, 15	90	mg	Public	0.0062	685	0.0062	701
					Private	0.0020	218	0.0016	223
					Total	0.0082	903	0.0078	924
L01D C03	Mitomycin		12	mg	Public	0.0021	1754	0.0023	1795
					Private	0.0011	875	0.0012	896
					Total	0.0032	2629	0.0036	2690
L01X A	**Platinum compounds**								
L01X A01	Cisplatin	75mg/m2	130	mg	Public	0.0969	7396	0.1042	7567
					Private	0.0397	3029	0.0240	3100
					Total	0.1366	10425	0.1283	10667
L01X A02	Carboplatin		500	mg	Public	0.2276	4515	0.2457	4620
					Private	0.1277	2534	0.1277	2593
					Total	0.3554	7049	0.3734	7213
L01X A03	Oxaliplatin	85mg/m2	150	mg	Public	0.0370	2447	0.0257	2504
					Private	0.0394	2603	0.0293	2663
					Total	0.0764	5050	0.0551	5167

ATC	Drug Class & Agents	Dose & Duration	Average Dose per treatment cycle	Unit	Sector	2007		2008	
						Total Dosage /1000 population	Total no. of treatment cycle	Total Dosage /1000 population	Total no. of treatment cycle
L01X B	**Methylhydrazines**								
L01X B01	Procarbazine	100mg/m2 d1-14 [max 150mg]	2100	mg	Public	0.0071	33	0.0253	34
					Private	0.0185	87	0.0009	89
					Total	0.0256	121	0.0263	123
L01X C	**Monoclonal antibodies**								
L01X C02	Rituximab	375mg/m2	500	mg	Public	0.0697	1383	0.0831	1415
					Private	0.0512	1015	0.0466	1039
					Total	0.1209	2399	0.1297	2454
L01X C03	Trastuzumab	6mg/kg	400	mg	Public	0.0004	11	0.0083	11
					Private	0.0139	345	0.0361	353
					Total	0.0143	356	0.0443	364
L01X C04	Alemtuzumab	30mg [3x/week]	90	mg	Public	-	-	0.0004	-
					Private	0.0004	45	<0.0001	46
					Total	0.0004	45	0.0004	46
L01X C05	Gemtuzumab	-	5	mg	Public	<0.0001	20	<0.0001	21
					Private	<0.0001	40	<0.0001	41
					Total	<0.0001	60	<0.0001	62
L01X C06	Cetuximab	250mg/m2 d1+15	800	mg	Public	-	-	0.0035	0
					Private	0.0229	284	0.0279	291
					Total	0.0229	284	0.0314	291
L01X C07	Bevacizumab	5mg/kg	300	mg	Public	-	-	<0.0001	-
					Private	0.0281	928	0.0328	950
					Total	0.0281	928	0.0329	950
L01X E	**Protein kinase inhibitors**								
L01X E01	Imatinib	400mg od x 28 days	11200	mg	Public	0.1757	156	0.5571	159
					Private	0.1389	123	0.1898	126
					Total	0.3145	279	0.7469	285
L01X E02	Gefitinib	250mg od x 28 days	7000	mg	Public	-	-	0.0450	-
					Private	0.1896	269	0.4131	275
					Total	0.1896	269	0.4581	275
L01X E03	Erlotinib	100mg od x 28 days	2800	mg	Public	0.0046	16	0.0063	17
					Private	0.0892	316	0.0165	323
					Total	0.0938	332	0.0228	340
L01X E04	Sunitinib	37.5mg x 4/52 rest 2/52	1050	mg	Public	0.0003	3	0.0036	3
					Private	0.0048	45	0.0004	46
					Total	0.0051	48	0.0040	49
L01X E05	Sorafenib	400mg bd x 28 days	22400	mg	Public	0.0054	2	0.0001	2
					Private	0.0859	38	0.0365	39
					Total	0.0913	40	0.0366	41
L01X E06	Dasatinib	70mg bd x 28 days	3920	mg	Public	-	-	0.0083	-
					Private	0.0007	2	0.0035	2
					Total	0.0007	2	0.0118	2

ATC	Drug Class & Agents	Dose & Duration	Average Dose per treatment cycle	Unit	Sector	2007		2008	
						Total Dosage /1000 population	Total no. of treatment cycle	Total Dosage /1000 population	Total no. of treatment cycle
L01X E	**Protein kinase inhibitors**								
L01X E07	Lapatinib	1250mg od x 28 days	35000	mg	Public	-	-	-	-
					Private	0.0418	12	0.2374	12
					Total	0.0418	12	0.2374	12
L01X E08	Nilotinib	400mg bd x 28 days	38528	mg	Public	-	-	0.0192	-
					Private	-	-	0	-
					Total	-	-	0.0192	-
L01X E09	Temsirolimus	25 mg per week x 4	100	mg	Public	-	-	-	-
					Private	-	-	0.0002	-
					Total	-	-	0.0002	-
L01X X	**Other antineoplastic agents**								
L01X X02	Asparaginase	10000iu/m2	20000	iu	Public	4.7908	2376	4.0042	2431
					Private	0.8304	412	0.4671	421
					Total	5.6212	2788	4.4713	2852
L01X X05	Hydroxycarbamide	500mg tds x 28 days	42000	mg	Public	28.3178	6687	32.2063	6843
					Private	8.3229	1965	9.0130	2011
					Total	36.6407	8653	41.2193	8854
L01X X11	Estramustine	280mg tds d1-5	4200	mg	Public	-	-	-	-
					Private	0.1211	286	0.0106	293
					Total	0.1211	286	0.0106	293
L01X X14	Tretinoin	45mg/m2 d1- 15 q12 weeks	1160	mg	Public	0.0181	155	0.0262	159
					Private	0.0122	104	0.0003	106
					Total	0.0303	259	0.0265	265
L01X X17	Topotecan	1.25mg/m2 d2-6	10	mg	Public	-	-	<0.0001	-
					Private	<0.0001	5	<0.0001	5
					Total	<0.0001	5	<0.0001	5
L01X X19	Irinotecan	180mg/m2	310	mg	Public	0.0354	1133	0.0227	1159
					Private	0.0118	376	0.0115	385
					Total	0.0472	1509	0.0342	1544
L01X X23	Mitotane	10 g per day x 28	280000	mg	Public	-	-	0.0029	-
					Private	-	-	-	-
					Total	-	-	0.0029	-
L01X X27	Arsenic trioxide	10mg od x 42 days	420	mg	Public	0.0003	7	0.0004	7
					Private	-	-	0.0001	-
					Total	0.0003	7	0.0005	7
L01X X32	Bortezomib	1.3mg/m2 d1, 4, 8, 11 q21 days	9	mg	Public	<0.0001	33	0.0001	34
					Private	0.0001	73	<0.0001	74
					Total	0.0001	106	0.0001	109
L01X X35	Anagrelide	0.5mg bd x 28 days	28	mg	Public	0.0042	1490	0.0045	1525
					Private	0.0026	930	0.0002	951
					Total	0.0068	2420	0.0047	2476

Table 16.2: Use of Anti-Neoplastic Agents by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
L02A B	**Progestogens**				
L02A B01	Megestrol	g	Public	-	<0.0001
			Private	0.0057	0.0032
			Total	0.0057	0.0032
L02A B02	Medroxyprogesterone	g	Public	0.0001	0.0004
			Private	<0.0001	<0.0001
			Total	0.0002	0.0004
L02A E	**Gonadotropin releasing hormone analogues**				
L02A E01	Buserelin	mg	Public	-	-
			Private	0.0002	0.0004
			Total	0.0002	0.0004
L02A E02	Leuprorelin	mg	Public	0.0114	0.0111
			Private	0.0076	0.0122
			Total	0.0190	0.0232
L02A E03	Goserelin	mg	Public	0.0174	0.0179
			Private	0.0129	0.0101
			Total	0.0303	0.0279
L02A E04	Triptorelin	mg	Public	0.0010	0.0016
			Private	0.0003	0.0002
			Total	0.0014	0.0017
L02B A	**Anti-estrogens**				
L02B A01	Tamoxifen	mg	Public	0.1483	0.1444
			Private	0.0565	0.0360
			Total	0.2048	0.1804
L02B A03	Fulvestrant	mg	Public	-	-
			Private	<0.0001	<0.0001
			Total	<0.0001	<0.0001
L02B B	**Anti-androgens**				
L02B B01	Flutamide	g	Public	0.0023	0.0015
			Private	0.0008	0.0004
			Total	0.0031	0.0019
L02B B03	Bicalutamide	mg	Public	0.0094	0.0093
			Private	0.0037	0.0024
			Total	0.013	0.0117
L02B G	**Enzyme inhibitors**				
L02B G03	Anastrozole	mg	Public	0.0092	0.0043
			Private	0.0044	0.0028
			Total	0.0136	0.0071
L02B G04	Letrozole	mg	Public	0.0112	0.0103
			Private	0.0054	0.0041
			Total	0.0167	0.0144
L02B G06	Exemestane	mg	Public	<0.0001	0.0001
			Private	0.0005	0.0005
			Total	0.0006	0.0006

Table 16.3: Use of Anti-Neoplastic Agents by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
L03A A	**Colony stimulating factors**				
L03A A02	Filgrastim	mg	Public	0.0028	0.0031
			Private	0.0012	0.0010
			Total	0.0040	0.0041
L03A A10	Lenograstim	mg	Public	0.0001	0.0002
			Private	<0.0001	0.0002
			Total	0.0002	0.0003
L03A A13	Pegfilgrastim	mg	Public	-	<0.0001
			Private	0.0001	0.0005
			Total	0.0001	0.0005
L03A B	**Interferons**				
L03A B04	Interferon alfa-2a	MU	Public	0.0004	0.0001
			Private	0.0001	-
			Total	0.0005	0.0001
L03A B05	Interferon alfa-2b	MU	Public	0.0018	0.0015
			Private	0.0002	0.0001
			Total	0.0020	0.0016
L03A C	**Interleukins**				
L03A C01	Aldesleukin	mg	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001

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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, glucocorticoidsand immunosuppressants such as selective immunosupressants, tumor necrosis factor-a inhibitors, interleukin inhibitors, calcineurin inhibitors, antimetabolites and other immunosuppressants.

The main corticosteroid used in 2008 was glucocorticoids where it was used in 0.4% of the general population. This was a decrease of 32.4% compared to 2007 (Table 17.1). This is estimated that an equivalent of 110,000 people (0.4% of the population) were on daily glucocorticoids based on the population of Malaysia of 27.5 million in 2008. The usage was two times lower in comparison to Australia where 0.86% of the population was on systemic glucocorticoids in 2008.[1] Prednisolone was the most commonly used glucocorticoids accounting for 66% of all glucocorticoids used. The overall change in the usage of glucocorticoids in 2008 was mainly contributed by the 41.5% drop in the utilization of prednisolone especially in the private sector (56.4%). While most of the other types of glucocorticoids usage remained relatively unchanged, the prescription of betamethasone had increased remarkably by 55.57% and this was mainly due to a change in the prescription habit in the private sector.

The usage of mineralocorticoids has increased by 21.15% in 2008 and this was contributed by the usage in both public and private sectors.

Based on the National Medicine Use Survey (NMUS) and taking into account that the population of Malaysia was 27.5 million in 2008, there should be about 976 people on cyclosporine A, 201 on tacrolimus and 443 on mycophenolic acid. However, data from the 19th Malaysian Dialysis and Transplant Registry in December 2008 showed that there were 1,429 patients with functioning kidney transplants with 985 people on cyclosporine A, 201 on tacrolimus and 446 on mycophenolic acid.[2] Even without taking into account other solid organ and bone marrow recipients, the actual numbers of renal transplant recipients on various immunosuppressants were larger than those calculated based on NMUS.[2] This was probably due to a lower dose of immunosuppressants used in Malaysia compared to the WHO proposed Defined Daily Dose (DDD) of these immunosuppressants used in this survey, as the population in Malaysia generally has a smaller body habitus. This may further be contributed by increased awareness of calcineurin inhibitor (CNI) nephrotoxicity, which has led to CNI minimisation regime in Malaysian transplant recipients.

The reduction in the usage of transplant immunosuppressants (calcineurin inhibitors and mycophenolic acid) in 2008 corresponded with the reduction (14%) in the number of functioning renal transplant recipients from 2007 to 2008. However, the use of azathioprine had remained relatively unchanged, as it is also used for the treatment of other diseases. The usage of interleukin-2 inhibitors remained low due to the small number of transplants performed in this country.

With regard to tumour necrosis factor-α inhibitors (TNF-α inhibitors), the overall usage had remained relatively unchanged. There was an increased usage of all TNF-α inhibitors in the public sector with a corresponding reduction in the private sector.

The use of thalidomide and leflunomide in the public sector has remained relatively unchanged but there was a marked reduction in its usage in the private sector.

Table 17.1: Use of Systemic Corticosteroids and Immunosuppressive Agents by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
H02A A	Mineralocorticoids	0.0279	0.0338
H02A B	Glucocorticoids	6.0004	4.0407

Table 17.2: Use of Systemic Corticosteroids and Immunosuppressive Agents by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
H02A A	**Mineralocorticoids**			
H02A A02	Fludrocortisone	Public	0.0218	0.0244
		Private	0.0061	0.0094
		Total	0.0279	0.0338
H02A B	**Glucocorticoids**			
H02A B01	Betamethasone	Public	0.0002	<0.0001
		Private	0.0689	0.1074
		Total	0.0691	0.1075
H02A B02	Dexamethasone	Public	0.3890	0.3262
		Private	0.2865	0.2370
		Total	0.6756	0.5632
H02A B04	Methylprednisolone	Public	0.0576	0.0630
		Private	0.0581	0.0362
		Total	0.1157	0.0992
H02A B06	Prednisolone	Public	1.1432	1.1914
		Private	3.4858	1.5177
		Total	4.629	2.7091
H02A B08	Triamcinolone	Public	0.0093	0.0120
		Private	0.1138	0.1276
		Total	0.1231	0.1395
H02A B09	Hydrocortisone	Public	0.3265	0.3457
		Private	0.0613	0.0765
		Total	0.3878	0.4222

Table 17.3: Use of Immunosuppressive Agents by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
L04	Immunosuppressants	0.3392	0.2389

Table 17.4: Use of Immunosuppressive Agents by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
L04A A	**Selective immunosuppressants**			
L04A A04	Antithymocyte immunoglobulin (rabbit)	Public	-	<0.0001
		Private	-	<0.0001
		Total	-	<0.0001
L04A A06	Mycophenolic acid	Public	0.0227	0.0110
		Private	0.0073	0.0052
		Total	0.03	0.0162
L04A A10	Sirolimus	Public	0.0003	0.0001
		Private	-	<0.0001
		Total	0.0003	0.0002
L04A A13	Leflunomide	Public	0.0133	0.0614
		Private	0.0054	0.0022
		Total	0.0187	0.0636
L04A A21	Efalizumab	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
L04A B	**Tumor necrosis factor alpha (TNF-) inhibitors**			
L04A B01	Etanercept	Public	0.0006	0.0008
		Private	0.0009	0.0004
		Total	0.0015	0.0012
L04A B02	Infliximab	Public	0.0002	0.0009
		Private	0.0035	0.0026
		Total	0.0037	0.0035
L04A B04	Adalimumab	Public	-	0.0003
		Private	0.0002	0.0002
		Total	0.0002	0.0004
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	<0.0001
		Total	<0.0001	<0.0001
L04A D	**Calcineurin inhibitors**			
L04A D01	Ciclosporin	Public	0.0389	0.0333
		Private	0.0029	0.0023
		Total	0.0419	0.0355
L04A D02	Tacrolimus	Public	0.0088	0.0069
		Private	0.0026	0.0003
		Total	0.0114	0.0073

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
L04A X	**Other immunosuppressants**			
L04A X01	Azathioprine	Public	0.0686	0.0655
		Private	0.0086	0.0059
		Total	0.0772	0.0714
L04A X02	Thalidomide	Public	0.0092	0.0097
		Private	0.0044	0.0009
		Total	0.0136	0.0107
L04A X03	Methotrexate	Public	0.0819	0.0263
		Private	0.0588	0.0026
		Total	0.1407	0.0289

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1. Australian Government Department of Health and Ageing. Australian Statistics onMedicines 2008. Commonwealth of Australia 2009.

2. Lim YN, Ong LM, Goh BL (eds). 19th Report of the Malaysian Dialysis and Transplant Registry 2011. Chapter 13. Renal Transplantation. *Access from*: http://www.msn.org.my

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CHAPTER 18 | USE OF DRUGS FOR RHEUMATOLOGICAL AND BONE DISORDERS

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Drugs that are used for rheumatological and bone disorders are selective estrogen receptor modulators (SERMS), calcitonin preparations, anti-inflammatory and anti-rheumatic products, muscle-relaxants, antigout preparations, and drugs for treatment for bone diseases. Anti-inflammatory and antirheumatic products' usage had ranked as 7th most used drugs by therapeutic group in Malaysia in 2008 (11.2247 DDD/1000 population/day) with estimated 1.12% population utilising them.[1]

Overall, the use of drugs for rheumatological and bone disorders in 2008 remained the same as in 2007.[2] Anti-inflammatory and antirheumatic products ranked first (11.2247 DDD/1000 population/day), followed by antigout preparations (1.5957 DDD/1000 population/day), muscle relaxant (DDD 0.7743), then drugs for treatment of bone diseases (0.6604 DDD/1000 population/day). This is especially significant in the reduced usage of antigout prepartions (11.56%) in 2008. This pattern was similar to the trend of usage in Finland.[3]

For the use of non-steroidal anti-inflammatory drugs (NSAIDs), the top three drugs were fenamates (3.4781 DDD/1000 population/day), followed by acetic acid derivatives and related substances (3.4558 DDD/1000 population/day) and coxibs (1.99 DDD/1000 population/day). Both the usage of acetic acid derivatives and related substances (25%) and Fenamates (2.57%) were reduced but the usage of the coxib group (3.24%) was increased in 2008, and the same trend was observed in Australia.[3] However, the commonest used NSAID in Finland in 2008 was propionic acid derivatives.[4]

Since rofecoxib had been withdrawn from the market since 2004, there was no usage of the drug. Therefore, it should be excluded from the list.

In 2008, there was a significant reduction in the usage of anti-gout preparations. The three most used antigout preparations were allopurinol, colchicine, and probenecid. There was a reduction in the usage of allopurinol and probenecid in 2008 (16.98%, 18.18%). On the other hand, the usage of colchicine was increased by 18.92%. Benzbromarone was the new anti-gout drug used, albeit it is only used in the private setting with a 0.003 DDD/1000 population/day.

The trend of usage of muscle relaxants in 2008 was similar to 2007, whereby it was primarily used by the private sectors.

The three commonly used drugs for treatment for bone diseases were alendronic acid and cholecalciferol (0.2448 DDD/1000 population/day), Alendronic acid (0.2382 DDD/1000 population/day) and risedronic acid (0.1226 DDD/1000 population/day). There was an increasing trend of usage of alendronic acid and cholecalciferol (58.22%) and risedronic acid (252.29%) but the usage of alendronic acid reduced by 32.18%. However, the usage of alendronic acid in Finland was the highest in 2008.[4] As for strontium ranelate, there was an increased usage in 2008 by 15.04%, mainly contributed by the private sectors (0.0254 DDD/1000 population/day). The public sectors only started using strontium ranelate in 2008 (0.0006 DDD/1000 population/day).

As for calcium homeostasis agent, both calcitonin (salmon synthethic) and paricalcitol had a remarkable increase in usage (20.48% and 40.74% respectively).

Table 18.1: Use of Drugs for Rheumatological and Bone disorders, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
G03X C	Selective estrogen receptor modulators	0.1303	0.1289
H05B A	Calcitonin preparations	0.0083	0.0100
M01	Antiinflammatory and antirheumatic products	12.6558	11.2247
M03	Muscle relaxants	0.7697	0.7743
M04	Antigout preparations	1.8042	1.5957
M05	Drugs for treatment of bone diseases	0.6295	0.6604

Table 18.2.1: Use of Non-Steroidal Anti-Inflammatory drugs by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
M01A A	Butylpyrazolidines	-	0.0068
M01A B	Acetic acid derivatives and related substances	4.6126	3.4558
M01A C	Oxicams	1.3299	1.4350
M01A E	Propionic acid derivatives	1.1276	0.9139
M01A G	Fenamates	3.5697	3.4781
M01A H	Coxibs	1.8619	1.9222
M01A X	Other antiinflammatory and antirheumatic agents, non-steroids	0.1486	0.0064
M01C C	Penicillamine and similar agents	0.0053	0.0063

Table 18.2.2: Use of Non-Steroidal Anti-Inflammatory drugs by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
M01A A	**Butylpyrazolidines**			
M01A A01	Phenylbutazone	Public	-	-
		Private	-	0.0068
		Total	-	0.0068
M01A B	**Acetic acid derivatives and related substances**			
M01A B01	Indometacin	Public	0.3491	0.2044
		Private	0.1055	0.0715
		Total	0.4546	0.2760
M01A B02	Sulindac	Public	-	-
		Private	-	0.0002
		Total	-	0.0002
M01A B05	Diclofenac	Public	1.1058	1.0936
		Private	3.0511	2.0781
		Total	4.1569	3.1717
M01A B06	Alclofenac	Public	-	-
		Private	-	0.0002
		Total	-	0.0002
M01A B15	Ketorolac	Public	0.0007	0.0005
		Private	0.0003	0.0073
		Total	0.0010	0.0078
M01A C	**Oxicams**			
M01A C01	Piroxicam	Public	0.0391	0.0136
		Private	0.5645	0.3712
		Total	0.6036	0.3848
M01A C02	Tenoxicam	Public	-	-
		Private	0.0558	0.0582
		Total	0.0558	0.0582
M01A C06	Meloxicam	Public	0.2422	0.2008
		Private	0.4283	0.7912
		Total	0.6705	0.9920

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
M01A E	**Propionic acid derivatives**			
M01A E01	Ibuprofen	Public	0.1111	0.1515
		Private	0.3660	0.2979
		Total	0.4771	0.4494
M01A E02	Naproxen	Public	0.0939	0.0366
		Private	0.5367	0.4197
		Total	0.6306	0.4563
M01A E03	Ketoprofen	Public	0.0047	0.0003
		Private	0.0151	0.0079
		Total	0.0198	0.0082
M01A G	**Fenamates**			
M01A G01	Mefenamic acid	Public	1.4249	0.9575
		Private	2.1448	2.5206
		Total	3.5697	3.4781
M01A H	**Coxibs**			
M01A H01	Celecoxib	Public	0.5803	0.5532
		Private	0.3406	0.3776
		Total	0.9208	0.9308
M01A H02	Rofecoxib	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
M01A H03	Valdecoxib	Public	-	-
		Private	0.0007	0.0065
		Total	0.0007	0.0065
M01A H04	Parecoxib	Public	0.0014	0.0031
		Private	0.0048	0.0107
		Total	0.0063	0.0137
M01A H05	Etoricoxib	Public	0.2043	0.2711
		Private	0.7298	0.7001
		Total	0.9341	0.9712
M01A X	**Other antiinflammatory and antirheumatic agents, non-steroids**			
M01A X01	Nabumetone	Public	-	-
		Private	-	0.0014
		Total	-	0.0014
M01A X17	Nimesulide	Public	-	-
		Private	0.1486	0.005
		Total	0.1486	0.005
M01A X21	Diacerein	Public	-	-
		Private	-	-
		Total	-	-
M01C C	**Penicillamine and similar agents**			
M01C C01	Penicillamine	Public	0.0051	0.0059
		Private	0.0002	0.0004
		Total	0.0053	0.0063

Table 18.3.1: Use of Muscle relaxants by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
M03B	**Muscle relaxants, centrally acting agents**			
M03B B03	Chlorzoxazone	Public	-	-
		Private	0.0036	-
		Total	0.0036	-
M03B B52	Chlormezanone, combinations excl. Psycholeptics	Public	-	-
		Private	0.0367	0.0344
		Total	0.0367	0.0344
M03B B53	Chlorzoxazone, combinations excl. Psycholeptics	Public	-	-
		Private	0.0252	0.0261
		Total	0.0252	0.0261
M03B C01	Orphenadrine (citrate)	Public	0.0071	0.0107
		Private	0.1361	0.0435
		Total	0.1432	0.0541
M03B C51	Orphenadrine, combinations	Public	-	-
		Private	0.3957	0.4296
		Total	0.3957	0.4296
M03B X01	Baclofen	Public	0.0574	0.0531
		Private	0.0057	0.0103
		Total	0.0631	0.0634
M03B X09	Eperisone	Public	0.0332	0.0366
		Private	0.0366	0.1051
		Total	0.0698	0.1417
M03C	**Muscle relaxants, directly acting agents**			
M03C A01	Dantrolene	Public	<0.0001	<0.0001
		Private	<0.0001	0.0249
		Total	<0.0001	0.0249

Table 18.4.1: Use of Anti-Gout preparations by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
M04A	**Antigout preparations**			
M04A A01	Allopurinol	Public	1.0867	0.9032
		Private	0.4478	0.3707
		Total	1.5345	1.2739
M04A A51	Allopurinol, combinations	Public	-	-
		Private	-	-
		Total	-	-
M04A B01	Probenecid	Public	0.0023	0.0007
		Private	0.0032	0.0038
		Total	0.0055	0.0045
M04A B03	Benzbromarone	Public	-	-
		Private	-	0.0030
		Total	-	0.0030
M04A C01	Colchicine	Public	0.0616	0.0968
		Private	0.2027	0.2174
		Total	0.2642	0.3142

Table 18.5.1: Use of Bone diseases therapy by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
M05	**Drugs for treatment of bone diseases**			
M05B A01	Etidronic acid	Public	-	-
		Private	0.0012	0.0010
		Total	0.0012	0.0010
M05B A02	Clodronic acid	Public	0.0015	0.0021
		Private	0.0022	0.0017
		Total	0.0038	0.0039
M05B A03	Pamidronic acid	Public	0.0004	0.0004
		Private	<0.0001	<0.0001
		Total	0.0004	0.0005
M05B A04	Alendronic acid	Public	0.2858	0.1858
		Private	0.0654	0.0524
		Total	0.3512	0.2382
M05B A06	Ibandronic acid	Public	-	0.0033
		Private	0.0001	0.0193
		Total	0.0001	0.0226
M05B A07	Risedronic acid	Public	0.0034	0.1095
		Private	0.0314	0.0131
		Total	0.0348	0.1226
M05B A08	Zoledronic acid	Public	<0.0001	0.0001
		Private	0.0002	0.0002
		Total	0.0003	0.0003
M05B B03	Alendronic acid and colecalciferol	Public	0.0979	0.1549
		Private	0.1172	0.0899
		Total	0.2152	0.2448
M05B B04	Risedronic acid, calcium and colecalciferol, sequential	Public	-	-
		Private	-	0.0007
		Total	-	0.0007
M05B X03	Strontium ranelate	Public	-	0.0006
		Private	0.0226	0.0254
		Total	0.0226	0.0260

Table 18.6.1: Use of Selective Estrogen Receptor Modulators by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
G03	**Sex hormones and modulators of the genital system**			
G03X C01	Raloxifene	Public	0.0638	0.0640
		Private	0.0666	0.0649
		Total	0.1303	0.1289

Table 18.7.1: Use Calcitonin preparations of by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
H05	**Calcium homeostasis**			
H05A A02	Teriparatide	Public	-	<0.0001
		Private	0.0028	0.0023
		Total	0.0028	0.0024
H05B A01	Calcitonin (salmon synthetic)	Public	0.0056	0.0077
		Private	0.0027	0.0023
		Total	0.0083	0.0100
H05B X02	Paricalcitol	Public	0.0012	0.0017
		Private	0.0015	0.0021
		Total	0.0027	0.0038

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1. Pharmaceutical Services Division & Clinical Research Centre. Malaysian Statistics on Medicines 2007. Ministry of Health Malaysia 2009
2. National Agency for Medicines, Drug Sales Register. Finland 2008
3. Australian Government Department of Health and Ageing. Australian Statistics on Medicines. 2008 14th Edition. Commonwealth of Australia 2009
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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 2008 was 0.4443 DDD/1000 population/day, an increase of 9% compared to 2007 (0.4231 DDD/1000 population/day). Although there is an increasing trend, the total consumption of opioids in Malaysia is very much lower than the opioid consumption in Australia (8.217 DDD/1000 population/day)[1], and that in the Nordic countries (Denmark, Finland, Norway, Iceland and Sweden), which ranged from 16.2 DDD/1000 population/day to 20.4 DDD/1000 population/day.[2]

Weak opioids (dihydrocodeine, tramadol and tramadol combinations) were more commonly used than strong opioids (morphine, oxycodone, pethidine and fentanyl). The total amount of weak opioids consumed was 0.3307 DDD/1000 population/day and comprised 74% of the total opioid consumption in Malaysia. 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. For example, in Australia the consumption of weak opioids (tramadol and dextropropoxyphene) accounted for only 43% of the total opioids used.[1]

Tramadol remained as the most commonly used weak opioid with slightly reduced usage compared to 2007 (0.2497 DDD/1000 population/day in 2008 compared to 0.2549 DDD/1000 population/day in 2007). Although the use of dihydrocodeine has increased about 16% as compared to the previous year, tramadol and tramadol combinations comprised more than 90% of the total weak opioids consumed in 2008. 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 in public and private hospitals, clinics and retail pharmacies.

The total consumption of strong opioids was 0.0894 DDD/1000 population/day, which is a decrease of 3.24% compared to 2008. The most commonly used strong opioid was morphine, which had much higher use than fentanyl, pethidine and oxycodone, with the consumption of morphine alone being more than that of the other 3 strong opioids combined.

There was a large increase in the use of morphine in the public sector (0.0515 DDD/1000 population/day in 2008 compared to 0.0414 DDD/1000 population/day in 2007, an increase of 50%) and this was the main contributor to the increase in the total use of opioids in 2008 compared to 2007. However, transdermal fentanyl, mainly used for the pain control in cancer patients, decreased by 43.9% compared to 2007, both in the private and public sectors. Due to the fact that the data is obtained from purchasing (and not from prescriptions), it is unclear if this decrease is due to an actual decrease in the usage of transdermal fentanyl or if it is due to excess stock in purchased in 2007. The other factor that could account for this decrease is the availability of another strong opioid (oxycodone) which could replace fentanyl in opioid rotation as an alternative to morphine; in 2008, oxycodone use increased by about 20.67% compared to 2007. This report does not include utilisation of injection fentanyl (used mainly for acute perioperative pain) due to the unavailability of the reference DDD from WHO, and so the fentanyl use included in the report is for chronic (mainly cancer) pain only.

Table 19.1: Use of Analgesics by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N02A	Opioids	0.4231	0.4443

Table 19.1.2: Use of Analgesics by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N02A A	Natural opium alkaloids	0.0788	0.1163
N02A B	Phenylpiperidine derivatives	0.0415	0.0279
N02A D	Benzomorphan derivatives	<0.0001	-
N02A E	Oripavine derivatives	0.0007	-
N02A F	Morphinan derivatives	0.0016	0.0018
N02A X	Other opioids	0.3004	0.2982

Table 19.2 : Use of Opioid Analgesics by Drug Class, agents and Administration Route, in DDD/1000population/day 2007-2008

ATC	Drug Class & Agents	Sector	2007					2008				
			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	0.0204	0.0210	-	-	0.0414	0.0251	0.0264	-	-	0.0515
		Private	0.0020	0.0045	-	-	0.0065	0.0023	0.0043	-	-	0.0065
		Total	0.0224	0.0255	-	-	0.0480	0.0274	0.0307	-	-	0.0581
N02A A05	Oxycodone	Public	0.0018	-	-	-	0.0018	0.0030	-	-	-	0.0030
		Private	0.0010	-	-	-	0.0010	0.0005	-	-	-	0.0005
		Total	0.0029	-	-	-	0.0029	0.0035	-	-	-	0.0035
N02A A08	Dihydrocodeine	Public	0.0153	-	-	-	0.0153	0.0153	-	-	-	0.0153
		Private	0.0126	-	-	-	0.0126	0.0171	-	-	-	0.0171
		Total	0.0279	-	-	-	0.0279	0.0324	-	-	-	0.0324
N02A A59	codeine, combinations excl. psycholeptics	Public	-	-	-	-	-	-	-	-	-	-
		Private	-	-	-	-	-	0.0224	-	-	-	0.0224
		Total	-	-	-	-	-	0.0224	-	-	-	0.0224
N02A B	**Phenylpiperidine derivatives**											
N02A B02	Pethidine	Public	-	0.0075	-	-	0.0075	-	0.0085	-	-	0.0085
		Private	-	0.0053	-	-	0.0053	-	0.0055	-	-	0.0055
		Total	-	0.0128	-	-	0.0128	-	0.0140	-	-	0.0140
N02A B03	Fentanyl	Public	-	-	0.0200	-	0.0200	-	-	0.0103	-	0.0103
		Private	-	-	0.0046	0.0041	0.0087	-	-	0.0035	-	0.0035
		Total	-	-	0.0246	0.0041	0.0287	-	-	0.0138	-	0.0138
N02A D	**Benzomorphan derivatives**											
N02A D01	Pentazocine	Public	-	-	-	-	-	-	-	-	-	-
		Private	-	<0.0001	-	-	<0.0001	-	-	-	-	-
		Total	-	<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 F02	Nalbuphine	Public	-	0.0012	-	-	0.0012	-	0.0013	-	-	0.0013
		Private	-	0.0003	-	-	0.0003	-	0.0005	-	-	0.0005
		Total	-	0.0016	-	-	0.0016	-	0.0018	-	-	0.0018
N02A X	**Other opioids**											
N02A X02	Tramadol	Public	0.2084	0.0121	-	-	0.2205	0.1784	0.016	-	-	0.1944
		Private	0.0321	0.0022	-	-	0.0344	0.0523	0.0030	-	-	0.0552
		Total	0.2406	0.0144	-	-	0.2549	0.2307	0.0189	-	-	0.2497
N02A X52	Tramadol, combinations	Public	0.0014	-	-	-	0.0014	0.0021	-	-	-	0.0021
		Private	0.0442	-	-	-	0.0442	0.0465	-	-	-	0.0465
		Total	0.0455	-	-	-	0.0455	0.0486	-	-	-	0.0486

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1. Australian Government Department of Health and Ageing. Australian Statistics on Medicines. 2007 13th Edition. Commonwealth of Australia 2009
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CHAPTER 20 | USE OF DRUGS FOR NEUROLOGICAL DISORDER

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Introduction:

In 2008, 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 (drugs mainly used to treat vertigo and motor neuron disease). The later drugs were grouped together as '*other nervous system drugs*'. This year we also analysed another group of drug (Interferons-β) which is used to treat multiple sclerosis.

AEDs remained the largest group of neurological drugs being dispensed with the total utilisation of 1.5757 DDD/1000 population/day. This can be explained by the used of AEDs for other indications, including neuropathic pain, bipolar affective disorder and generalised anxiety disorder.[1] The second largest drugs being dispensed was antiparkinson drugs (0.8784), 'other nervous system drugs' (0.8247), interferon-β (0.0734) and antimigraine preparations (0.068).

Generally there is a significant reduction in the utilisation of AEDs and antimigraine mainly in the private sector while usage in the public sector (MOH, Universities Hospitals and Armed-Forces Hospitals) showed an increment in all group of drugs. The changes in the trend of prescribing were probably contributed by the slow economic growth worldwide in 2008, which also affected Malaysia.

Antiepileptics Drugs:

Phenytoin was the most commonly prescribed AED with 0.507 DDD/1000 population/day, followed by valproic acid, carbamazepine, and phenobarbital (0.4076 DDD/1000 population/day, 0.323 DDD/1000 population/day, and 0.0839 DDD/1000 population/day respectively). The utilisations of these older AEDs were lower compared to 2007 due to new trend of management towards usage of new generation of AEDs.

The overall dispensing trend for the new generation of AEDs showed reduction in 2008, especiallyfor levetiracetam which showed tremendous reduction(0.0383DDD/1000population/day)ascomparedto2007(0.0752DDD/1000population/day)mainlyintheprivatesector(0.0099DDD/1000 population/day and 0.0538 DDD/1000 population/day respective years). However, gabapentin showed a slight increment in utilisation in public sector which is used mainly for neuropathic pain. The reversed trend was observed in the private sector, probably due to the introduction of pregabalin for the same indication. The utilisation of other AEDs such as vigabatrin, oxcarbazepine, ethosuximide and primidone were very low since they were used mainly by the university hospitals and private sectors.

Anti-Parkinson Drugs:

The five main classes of drugs used for PD are the levodopa (+ peripheral dopamine decarboxylase inhibitors), dopamine agonists (ergot and non-ergot), anticholinergics, adamantane derivatives and the catechol-O-methyltransferase inhibitors.[2]

Trihexyphenidyl (Artane) was the most commonly prescribed drug for tremor in PD with 0.6022. It is also widely used for the prevention and treatment of drug-induced extrapyramidal syndrome (EPS).[2] Levodopa and decarboxylase inhibitor persistently remains the gold standard treatment in PD[2] with the usage of 0.1822 DDD/1000 population/day.

In 2008, the usage of pramipexole and ropinirole were similar but a huge jump in utilisation of pramipexole was observed compared to 2007; (0.0013 DDD/1000 population/day to 0.0042 DDD/1000 population/day). There was remarkable reduction in piribedil; this may be due to the lack of neuroprotective effect compared with non-ergot dopamine agonist.[2] Comparing other enzyme inhibitor groups, selegiline was dispensed more frequently entacapone, 0.0515 DDD/1000 population/day and 0.0114 DDD/1000 population/day, respectively.

Anti-migraine preparations:

The total utilisation of antimigraine preparation in Malaysia was 0.068 DDD/1000 population/day which showed a reduction compared to utilisation in 2007. Flunarizine is the preferred drugs used for prophylaxis of migraine in Malaysia and the utilization in 2008 is 0.0635 DDD/1000 population/day while the usage of pizotifen is 0.0238 DDD/1000population/day.

For drugs used in abortive migraine attack, the utilisation of sumatriptan is 00006 DDD/1000 population/day. Ergotamine and combination ergotamine utilisation in public sector is generally low but their usage is more preferred in private sector. Ergotamine combination excluding psycholeptics showed a utilisation records of 0.038 DDD/1000 population/day in private sector compared to only 0.0004 DDD/1000 population/day in public sector. In general, similar pattern of utilisation for antimigraine preparations can be seen in Australia whereby selective serotonin ($5HT_1$) receptor agonist ranked the highest followed by ergot alkaloids.[3]

Other nervous system drugs:

Other nervous system drugs: Other nervous system drugs are categorisedas parasympathomimetics, antivertigo and riluzole. Parasympathomimetics drugs such as neostigmine and pyridostigmine contributed to 0.1 DDD/1000 population/day. This finding was comparable to Finland statistic at 0.19, suggestive of its low prevalence of Myasthenia Gravis worldwide.[4]

In Finland and Australia, the only antivertigo drug listed is betahistine at 2.37 and 24.00, respectively.[3,4] In Malaysia, total utilisation of antivertigo is 0.7245 DDD/1000 population/day with betahistine ranked the highest at 0.4006 DDD/1000 population/day. This indicates that the other two antivertigo preparation, cinnarizine and flunarizine were mainly used for other indication such as antimigraine. Finally, riluzole which is used for motor neuron disease, it usage stands at 0.0001 DDD/1000 population/day in Malaysia compared to Finland and Australia stand at 0.03 and 0.10, respectively.[3,4]

Interferon:

The immunomodulating drugs, namely Interferon-β 1-a (Rebif) and Interferon-β 1-b (Betaferon) were used in treating Remitting-Relapsing Multiple Sclerosis (RRMS). The total utilisation were 0.0734 and <0.0001DDD/1000 population/day, respectively. There was an increasein utilisation of Rebif by 0.0694 DDD/1000 population/day from 2007 which is due to the inclusion of the drug into the MOH drug formulary. The utilisation of Betaferon was very low because it has not been listed in MOH drug formulary.

Table 20.1: Use of Drugs for Neurological Disorder, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N02C	Antimigraine preparations	0.0803	0.0680
N03	Antiepileptics	1.6553	1.5757
N04	Anti-parkinson drugs	0.8105	0.8784
N07	Other nervous system drugs	0.9097	0.8247

Table 20.2: Use of Anti-Epileptics by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N03A	Antiepileptics	1.6553	1.5757
N03A A	Barbiturates and derivatives	0.1072	0.0846
N03A B	Hydantoin derivatives	0.4797	0.5070
N03A D	Succinimide derivatives	<0.0001	<0.0001
N03A E	Benzodiazepine derivatives	0.0537	0.0565
N03A F	Carboxamide derivatives	0.3409	0.3241
N03A G	Fatty acid derivatives	0.4391	0.4078
N03A X	Other antiepileptics	0.2346	0.1957

Table 20.3: Use of Anti-Epileptics by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N03A A	**Barbiturates and derivatives**			
N03A A02	Phenobarbital	Public	0.0809	0.0710
		Private	0.0225	0.0129
		Total	0.1033	0.0839
N03A A03	Primidone	Public	0.0010	0.0007
		Private	0.0029	<0.0001
		Total	0.0039	0.0007
N03A B	**Hydantoin derivatives**			
N03A B02	Phenytoin	Public	0.4354	0.4757
		Private	0.0444	0.0313
		Total	0.4797	0.5070
N03A D	**Succinimide derivatives**			
N03A D01	Ethosuximide	Public	<0.0001	<0.0001
		Private	-	-
		Total	<0.0001	<0.0001
N03A E	**Benzodiazepine derivatives**			
N03A E01	Clonazepam	Public	0.0429	0.0430
		Private	0.0108	0.0135
		Total	0.0537	0.0565
N03A F	**Carboxamide derivatives**			
N03A F01	Carbamazepine	Public	0.3139	0.2881
		Private	0.0261	0.0349
		Total	0.3400	0.3230
N03A F02	Oxcarbazepine	Public	0.0001	0.0001
		Private	0.0008	0.0010
		Total	0.0009	0.0011
N03A G	**Fatty acid derivatives**			
N03A G01	Valproic acid	Public	0.3718	0.3659
		Private	0.0671	0.0417
		Total	0.4389	0.4076
N03A G04	Vigabatrin	Public	<0.0001	<0.0001
		Private	0.0001	<0.0001
		Total	0.0002	0.0002
N03A X	**Other antiepileptics**			
N03A X09	Lamotrigine	Public	0.0525	0.0467
		Private	0.0034	0.0033
		Total	0.0559	0.0500
N03A X11	Topiramate	Public	0.0127	0.0133
		Private	0.0061	0.0019
		Total	0.0187	0.0153
N03A X12	Gabapentin	Public	0.0476	0.0585
		Private	0.0370	0.0327
		Total	0.0846	0.0912
N03A X14	Levetiracetam	Public	0.0213	0.0284
		Private	0.0538	0.0099
		Total	0.0752	0.0383
N03A X16	Pregabalin	Public	<0.0001	0.0001
		Private	0.0002	0.0008
		Total	0.0002	0.0010

Table 20.4: Use of Anti-Parkinson by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N04A	Anticholinergic agents	0.5444	0.6048
N04A A	Tertiary amines	0.5436	0.6026
N04A C	Ethers of tropine or tropine derivatives	0.0008	0.0022
N04B	Dopaminergic agents	0.2662	0.2735
N04B A	Dopa and dopa derivatives	0.1794	0.1866
N04B B	Adamantane derivatives	0.0069	0.0076
N04B C	Dopamine agonists	0.0209	0.0165
N04B D	Monoamine oxidase B inhibitors	0.0472	0.0515
N04B X	Other dopaminergic agents	0.0117	0.0114

Table 20.5: Use of Anti-Parkinson by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N04A A	**Tertiary amines**			
N04A A01	Trihexyphenidyl	Public	0.5051	0.5639
		Private	0.0378	0.0384
		Total	0.5429	0.6022
N04A A04	Procyclidine	Public	0.0007	0.0004
		Private	<0.0001	<0.0001
		Total	0.0007	0.0004
N04A C	**Ethers of tropine or tropine derivatives**			
N04A C01	Benzatropine	Public	0.0008	0.0022
		Private	-	-
		Total	0.0008	0.0022
N04B A	**Dopa and dopa derivatives**			
N04B A02	Levodopa and decarboxylase inhibitor	Public	0.1574	0.1615
		Private	0.0174	0.0207
		Total	0.1748	0.1822
N04B A03	Levodopa, decarboxylase inhibitor and COMT inhibitor	Public	0.0034	0.0031
		Private	0.0013	0.0013
		Total	0.0046	0.0044
N04B B	**Adamantane derivatives**			
N04B B01	Amantadine	Public	0.0042	0.0054
		Private	0.0027	0.0022
		Total	0.0069	0.0076
N04B C	**Dopamine agonists**			
N04B C01	Bromocriptine	Public	0.0005	-
		Private	<0.0001	0.0002
		Total	0.0005	0.0002
N04B C02	Pergolide	Public	-	-
		Private	-	-
		Total	-	-
N04B C04	Ropinirole	Public	0.0053	0.0037
		Private	0.0013	0.0004
		Total	0.0067	0.0040
N04B C05	Pramipexole	Public	0.0002	0.0033
		Private	0.0012	0.0009
		Total	0.0013	0.0042
N04B C08	Piribedil	Public	0.0107	0.0067
		Private	0.0016	0.0014
		Total	0.0123	0.0081

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N04B D	**Monoamine oxidase B inhibitors**			
N04B D01	Selegiline	Public	0.0421	0.0434
		Private	0.0051	0.0081
		Total	0.0472	0.0515
N04B X	**Other dopaminergic agents**			
N04B X02	Entacapone	Public	0.0109	0.0108
		Private	0.0008	0.0006
		Total	0.0117	0.0114

Table 20.6: Use of Antimigraine Preparations by Drugs Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N02C	Antimigraine preparations	0.0803	0.0680
N02C A	Ergot alkaloids	0.0493	0.0382
N02C C	Selective serotonin ($5HT_1$) agonists	0.0074	0.0060
N02C X	Other antimigraine preparations	0.0236	0.0238

Table 20.7: Use of Antimigraine Preparations by Drugs Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N02C A	**Ergot alkaloids**			
N02C A02	Ergotamine	Public	-	<0.0001
		Private	0.0006	0.0001
		Total	0.0006	0.0002
N02C A52	Ergotamine, combinations excl. psycholeptics	Public	0.0014	0.0004
		Private	0.0473	0.0376
		Total	0.0487	0.0380
N02C C	**Selective serotonin (5HT1) agonists**			
N02C C01	Sumatriptan	Public	0.0036	0.0024
		Private	0.0039	0.0036
		Total	0.0074	0.0060
N02C X	**Other antimigraine preparations**			
N02C X01	Pizotifen	Public	0.0198	0.0166
		Private	0.0039	0.0073
		Total	0.0236	0.0238
N02C X02	Clonidine	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-

Table 20.8: Use of Other Nervous System Drugs by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N07A	Parasympathomimetics	0.1046	0.1000
N07A A	Anticholinesterases	0.1046	0.1000
N07C	Antivertigo preparations	0.8049	0.7245
N07C A	Antivertigo preparations	0.8049	0.7245
N07X	Other nervous system drugs	0.0002	0.0001
N07X X	Other nervous system drugs	0.0002	0.0001

Table 20.9: Use of Other Nervous System Drugs by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N07A A	**Anticholinesterases**			
N07A A01	Neostigmine	Public	0.0162	0.0169
		Private	0.0132	0.0158
		Total	0.0294	0.0327
N07A A02	Pyridostigmine	Public	0.0705	0.0635
		Private	0.0046	0.0038
		Total	0.0751	0.0674
N07A A03	Distigmine	Public	-	-
		Private	-	-
		Total	-	-
N07C A	**Antivertigo preparations**			
N07C A01	Betahistine	Public	0.1880	0.2078
		Private	0.2024	0.1928
		Total	0.3885	0.4006
N07C A02	Cinnarizine	Public	0.1132	0.0925
		Private	0.2304	0.1679
		Total	0.3436	0.2604
N07C A03	Flunarizine	Public	0.0178	0.0180
		Private	0.0531	0.0455
		Total	0.0709	0.0635
N07X X	**Other nervous system drugs**			
N07X X02	Riluzole	Public	-	<0.0001
		Private	0.0002	0.0001
		Total	0.0002	0.0002

Table 20.10: Use of Interferons by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
L03A B	**Interferons**			
L03A B07	Interferon beta-1a	Public	0.0038	0.0730
		Private	0.0002	0.0004
		Total	0.004	0.0734
L03A B08	Interferon beta-1b	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

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CHAPTER 21 | USE OF DRUGS FOR PSYCHIATRIC DISORDERS

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The National Health and Morbidity Survey 2006 showed that the prevalence of psychiatric morbidity among adults in Malaysia was 11.2%.[1] This is a reflection of the importance of mental health problems, which contributes a significant and growing proportion of the global burden of disease associated with huge negative consequences on quality of life, productivity and economic burden.[2]

Antipsychotics are still the main medications used in psychiatry (38.4%). However there was a notable drop in the usage of antipsychotics in 2008 as compared to 2007 as shown in Figure 21.1.

Data from the public sector showed that there was a significant reduction in the use of haloperidol and sulpiride, which are both conventional antipsychotics. There was only a slight increase in the use of depot medications as reflected by the increase in the thioxanthene group (zuclopenthixol depot and flupenthixol depot) as well as fluphenazhine depot. Meanwhile, the data showed that the usage of atypical antipsychotics remained almost the same from 2007 to 2008 (from 26.1% to 26.6%).

Having said that, it is very important to mention that the usage of atypical antipsychotics was still relatively low compared to the rates in other Asian countries, and even lower if compared to the developed countries. In 2004, prescription patterns of inpatient schizophrenia patients in China, Hong Kong, Japan, Korea, Singapore and Taiwan were 64.7% for atypical antipsychotics.[3] In 2007, the atypical antipsychotics utilization was 77% in Australia[4] and 82% in New Zealand.[5] It may be worth exploring the reasons behind this observed 'plateau', in place of the anticipated consistent increase of atypical antipsychotics use to keep up with the global trend. Budget constraint could be one of the factors.

Anxiolytics contributed 27.8% of the total psychotropic prescription. They were mostly prescribed in the private sector (68.2%, DDD 1.1584) as compared to the public sector (31.8%, DDD 0.368). This pattern was similarly observed in 2006 and 2007. For both public and private sector, the most commonly prescribed anxiolytics were the benzodiazepine derivatives. Among them, the most frequently prescribed were alprazolam (23.8%), diazepam (15.8%) and lorazepam (11.4%) respectively. There was a slight increase in usage of all benzodiazepine derivatives except midazolam (decrease by 22% in the public sector, and 8% in the private sector). The reduction of midazolam usage may be related to better awareness of the risk of misuse or dependence. In comparison to other developed countries, our anxiolytic prescriptions (1.2727 DDD) were much lower. In Australia, the DDD for alprazolam, diazepam and Lorazepam were 6.086, 6.526 and 0.398 respectively.[6] As for Finland, the DDD for alprazolam was 9.4.[7]

Antidepressant usage comprised 25.03% of the total psychotropic utilization. From that, SSRI contributed to 76% of the antidepressant consumption, a further increase from 72.1% in 2007. Fluvoxamine remained as the leading antidepressant, being among the first in the 'non- specialist item list' since 2004; and widely available in primary care settings. However, despite the consistent increase, the utilization of antidepressants is still much lower in Malaysia (DDD 1.57) as compared to developed countries such as New Zealand (DDD 58.7)[8] and Spain (DDD 47.3)[9] in 2005.

Lithium utilization was comparatively very low at 0.0344 DDD. Taking Australia as an example, the DDD was 0.268 in the same year.[6] The low utilization may partly indicate the lack of accessibility to serum lithium level monitoring in many hospitals.

Drugs used for addictive disorder was 6.48% from the overall usage. It is worth mentioning that the utilization of these drugs has shown tremendous increase by 80.4% from 2007 to 2008. This increase in usage pattern was most likely due to the on-going implementation of the Methadone Replacement Therapy Program since 2005.[10] The prescription of methadone was noted to increase by more than two-fold in the public sector (126%). However, there was a decrease of methadone usage in the private sector by 6%. This may be due to the transfer of cases from the private settings to the government clinics which run the Methadone Program. On the other hand, the usage of buprenorphine and buprenorphine combinations had dropped significantly by 72.5% from 2007 to 2008.

Anti-dementia drugs represented only 1.04% of the total usage of psychiatric medications. The utilization remained the same from 2007 to 2008. All anti-dementia drugs were still in the specialist item list with restricted usage.

Figure 21.1: Comparison of psychiatric drug use in 2007 and 2008

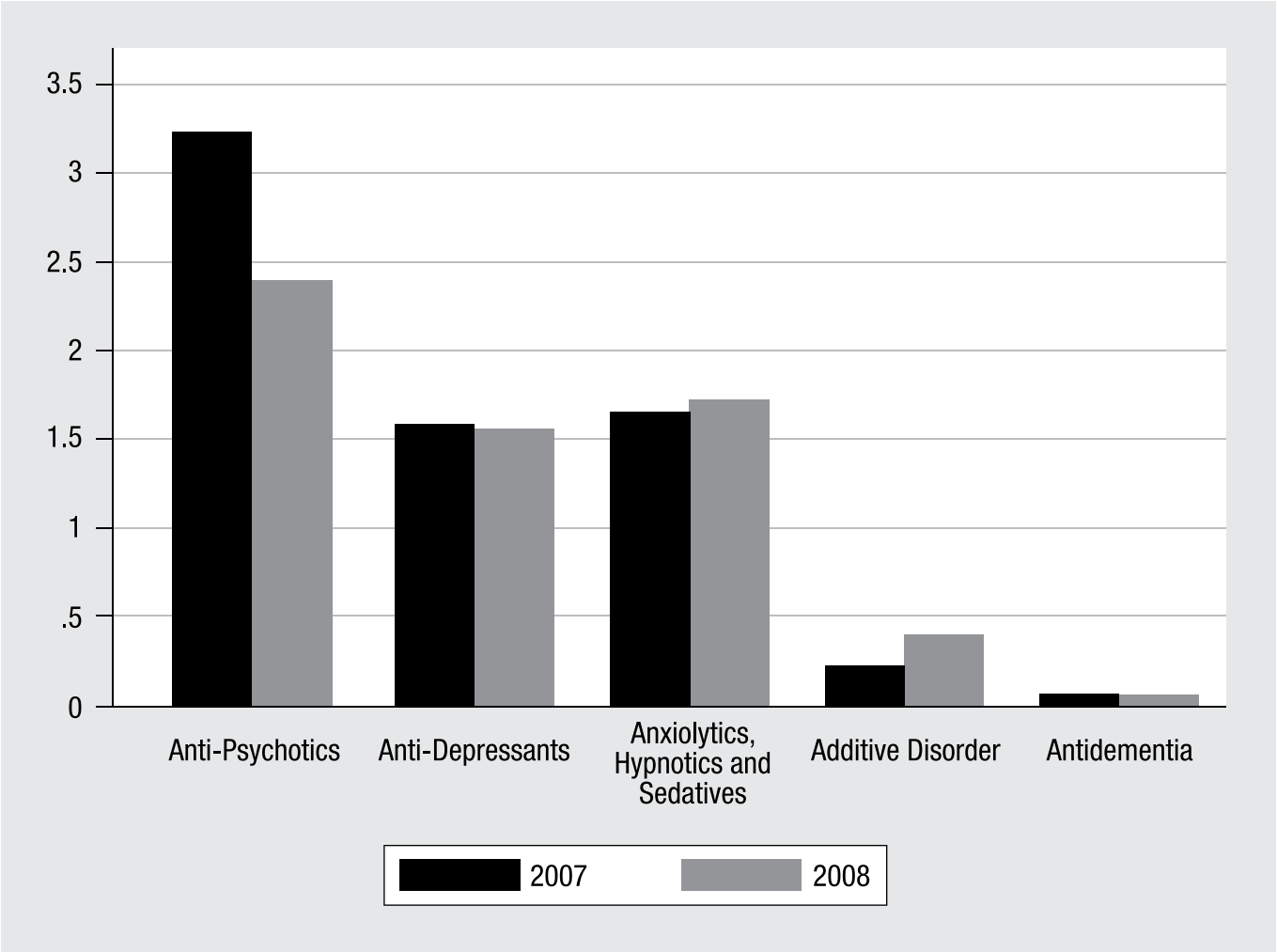

Table 21.1.1: Use of Anti-Psychotics by Drug Class, in DDD/1000 population/day 2007- 2008

ATC	DRUG CLASS	2007	2008
N05A A	Phenothiazines with aliphatic side-chain	0.4256	0.3754
N05A B	Phenothiazines with piperazine structure	0.6341	0.6269
N05A C	Phenothiazines with piperidine structure	0.0006	0.0001
N05A D	Butyrophenone derivatives	0.6790	0.3514
N05A E	Indole derivatives	0.0006	0.0009
N05A F	Thioxanthene derivatives	0.1522	0.1748
N05A H	Diazepines, oxazepines, thiazepines and oxepines	0.6331	0.4038
N05A L	Benzamides	0.3749	0.1970
N05A X	Other antipsychotics	0.3140	0.2524

Table 21.1.2: Use of Anti-Psychotics by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N05A A	**Phenothiazines with aliphatic side-chain**			
N05A A01	Chlorpromazine	Public	0.4208	0.3651
		Private	0.0048	0.0103
		Total	0.4256	0.3754
N05A B	**Phenothiazines with piperazine structure**			
N05A B02	Fluphenazine	Public	0.4530	0.4784
		Private	0.0193	0.0108
		Total	0.4723	0.4892
N05A B03	Perphenazine	Public	0.0556	0.0381
		Private	0.0082	0.0162
		Total	0.0638	0.0542
N05A B04*	Prochlorperazine	Public	0.0599	0.0533
		Private	0.0390	0.0304
		Total	0.0989	0.0837
N05A B06	Trifluoperazine	Public	0.0957	0.0704
		Private	0.0023	0.0131
		Total	0.0981	0.0835
N05A C	**Phenothiazines with piperidine structure**			
N05A C02	Thioridazine	Public	-	-
		Private	0.0006	0.0001
		Total	0.0006	0.0001
N05A D	**Butyrophenone derivatives**			
N05A D01	Haloperidol	Public	0.6647	0.3364
		Private	0.0143	0.0149
		Total	0.6790	0.3514
N05A E	**Indole derivatives**			
N05A E04	Ziprasidone	Public	<0.0001	0.0002
		Private	0.0006	0.0007
		Total	0.0006	0.0009
N05A F	**Thioxanthene derivatives**			
N05A F01	Flupentixol	Public	0.0832	0.0899
		Private	0.0046	0.0099
		Total	0.0879	0.0997
N05A F02	Clopenthixol	Public	-	-
		Private	-	-
		Total	-	-
N05A F05	Zuclopenthixol	Public	0.0635	0.0748
		Private	0.0008	0.0003
		Total	0.0644	0.0751

* Not consider as Anti-Psychotics drugs.

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N05A H	**Diazepines, oxazepines, thiazepines and oxepines**			
N05A H02	Clozapine	Public	0.0880	0.0784
		Private	0.0029	0.0022
		Total	0.0908	0.0805
N05A H03	Olanzapine	Public	0.2254	0.2224
		Private	0.1624	0.0113
		Total	0.3878	0.2336
N05A H04	Quetiapine	Public	0.0841	0.0849
		Private	0.0703	0.0047
		Total	0.1544	0.0896
N05A L	**Benzamides**			
N05A L01	Sulpiride	Public	0.3699	0.1906
		Private	0.0050	0.0059
		Total	0.3749	0.1965
N05A L05	Amisulpride	Public	-	-
		Private	-	0.0006
		Total	-	0.0006
N05A X	**Other antipsychotics**			
N05A X08	Risperidone	Public	0.2154	0.2270
		Private	0.0947	0.0051
		Total	0.3101	0.2322
N05A X12	Aripiprazole	Public	0.0014	0.0186
		Private	0.0025	0.0016
		Total	0.0039	0.0202
N05A X13	Paliperidone	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001

Table 21.1.3: Use of Antipsychotics in DDD/1000 population/day 2007-2008 Public and Private Sector

TOTAL ANTIPSYCHOTICS	2007		2008	
	DDD/1000 POPULATION/DAY	%	DDD/1000 POPULATION/DAY	%
Public	2.8208	87.8	2.2751	95.5
Private	0.3934	12.2	0.1078	4.5
Total	3.2142	100	2.3829	100

Table 21.1.4: Use of Atypical Antipsychotics in DDD/1000 population/day 2007-2008 in Public and Private Sector

ATYPICAL ANTIPSYCHOTIC	2007		2008	
	DDD/1000 POPULATION/DAY	%	DDD/1000 POPULATION/DAY	%
Public/Total	0.6144/2.8208	21.8	0.6315/2.2750	27.8
Private/Total	0.3332/0.3934	84.7	0.0262/0.1077	24.3

Table 21.2.1: Use of Mood Stabilizing Agent by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N05A N	Lithium	0.0304	0.0343

Table 21.2.2: Use of Mood Stabilizing Agent by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N05A N	**Lithium**			
N05A N01	Lithium	Public	0.0291	0.0328
		Private	0.0013	0.0016
		Total	0.0304	0.0343

Table 21.3.1: Use of Anti-Depressants by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N06A A	Non-selective monoamine reuptake inhibitors	0.3023	0.2489
N06A B	Selective serotonin reuptake inhibitors	1.1374	1.1856
N06A G	Monoamine oxidase A inhibitors	0.0160	0.0121
N06A X	Other antidepressants	0.1257	0.1053

Table 21.3.2: Use of Anti-Depressants by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N06A A	**Non-selective monoamine reuptake inhibitors**			
N06A A02	Imipramine	Public	0.0281	0.0178
		Private	0.0042	0.0112
		Total	0.0323	0.0290
N06A A04	Clomipramine	Public	0.0069	0.0117
		Private	0.0046	0.0019
		Total	0.0115	0.0136
N06A A09	Amitriptyline	Public	0.1210	0.0934
		Private	0.0519	0.0442
		Total	0.1728	0.1376
N06A A10	Nortriptyline	Public	-	0.0003
		Private	0.0007	0.0009
		Total	0.0007	0.0012
N06A A16	Dosulepin	Public	0.0672	0.0482
		Private	0.0146	0.0164
		Total	0.0818	0.0646
N06A A17	Amoxapine	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
N06A A21	Maprotiline	Public	0.0016	0.0002
		Private	0.0015	0.0025
		Total	0.0032	0.0028

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N06A B	**Selective serotonin reuptake inhibitors**			
N06A B03	Fluoxetine	Public	0.1373	0.1164
		Private	0.0260	0.0279
		Total	0.1632	0.1442
N06A B04	Citalopram	Public	0.0001	0.0019
		Private	0.0076	0.0063
		Total	0.0077	0.0083
N06A B05	Paroxetine	Public	0.0044	0.0044
		Private	0.0157	0.0079
		Total	0.0201	0.0123
N06A B06	Sertraline	Public	0.1811	0.2078
		Private	0.0955	0.053
		Total	0.2766	0.2608
N06A B08	Fluvoxamine	Public	0.4477	0.5368
		Private	0.0304	0.0438
		Total	0.4781	0.5806
N06A B10	Escitalopram	Public	0.0709	0.1163
		Private	0.1208	0.0631
		Total	0.1917	0.1794
N06A G	**Monoamine oxidase A inhibitors**			
N06A G02	Moclobemide	Public	0.0158	0.0111
		Private	0.0002	0.0010
		Total	0.0160	0.0121
N06A X	**Other antidepressants**			
N06A X03	Mianserin	Public	0.0038	0.0030
		Private	0.0006	<0.0001
		Total	0.0044	0.0031
N06A X05	Trazodone	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
N06A X11	Mirtazapine	Public	0.0269	0.0363
		Private	0.0487	0.0105
		Total	0.0757	0.0467
N06A X12	Bupropion	Public	-	0.0001
		Private	0.0014	0.0006
		Total	0.0014	0.0007
N06A X14	Tianeptine	Public	0.0005	<0.0001
		Private	0.0027	0.0011
		Total	0.0031	0.0012
N06A X16	Venlafaxine	Public	0.0241	0.0356
		Private	0.0109	0.0052
		Total	0.0349	0.0408
N06A X21	Duloxetine	Public	0.0005	0.0107
		Private	0.0056	0.0020
		Total	0.0061	0.0127

Table 21.4.1: Use of Anxiolytics, Hypnotics and Sedatives by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N05B A	Benzodiazepine derivatives	1.0207	0.8811
N05B B	Diphenylmethane derivatives	0.1794	0.4098
N05C C	Aldehydes and derivatives	0.0089	0.0446
N05C D	Benzodiazepine derivatives	0.2384	0.2070
N05C F	Benzodiazepine related drugs	0.1973	0.1713
N05C H	Melatonin receptor agonists	<0.0001	0.0003
N05C M	Other hypnotics and sedatives	<0.0001	0.0003

Table 21.4.2: Use of Anxiolytics, Hypnotics and Sedatives by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N05B A	**Benzodiazepine derivatives**			
N05B A01	Diazepam	Public	0.0921	0.0903
		Private	0.3167	0.1746
		Total	0.4088	0.2649
N05B A02	Chlordiazepoxide	Public	-	-
		Private	0.0097	0.0085
		Total	0.0097	0.0085
N05B A05	Potassium clorazepate	Public	-	-
		Private	0.0233	0.0053
		Total	0.0233	0.0053
N05B A06	Lorazepam	Public	0.0637	0.0878
		Private	0.1228	0.1042
		Total	0.1865	0.1920
N05B A08	Bromazepam	Public	0.0051	0.0030
		Private	0.0148	0.0247
		Total	0.0199	0.0277
N05B A09	Clobazam	Public	0.0009	0.0031
		Private	0.0067	0.0209
		Total	0.0077	0.0240
N05B A12	Alprazolam	Public	0.1346	0.1474
		Private	0.2303	0.2114
		Total	0.3648	0.3587
N05B B	**Diphenylmethane derivatives**			
N05B B01	Hydroxyzine	Public	0.044	0.0366
		Private	0.1354	0.3732
		Total	0.1794	0.4098
N05C C	**Aldehydes and derivatives**			
N05C C01	Chloral hydrate	Public	0.0074	0.0103
		Private	0.0011	0.0343
		Total	0.0086	0.0446
N05C C05	Paraldehyde	Public	0.0002	<0.0001
		Private	0.0001	<0.0001
		Total	0.0003	<0.0001

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N05C D	**Benzodiazepine derivatives**			
N05C D02	Nitrazepam	Public	0.0019	0.0041
		Private	0.0115	0.0094
		Total	0.0134	0.0134
N05C D05	Triazolam	Public	-	-
		Private	0.0225	0.0228
		Total	0.0225	0.0228
N05C D08	Midazolam	Public	0.0981	0.0767
		Private	0.1044	0.0972
		Total	0.2025	0.1708
N05C F	**Benzodiazepine related drugs**			
N05C F01	Zopiclone	Public	-	<0.0001
		Private	0.0668	0.0318
		Total	0.0668	0.0318
N05C F02	Zolpidem	Public	0.0697	0.0756
		Private	0.0607	0.0639
		Total	0.1304	0.1395
N05C H	**Melatonin receptor agonists**			
N05C H01	Melatonin	Public	-	0.0002
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0003
N05C M	**Other hypnotics and sedatives**			
N05C M05	Scopolamine	Public	-	<0.0001
		Private	<0.0001	0.0003
		Total	<0.0001	0.0003

Table 21.5.1: Use of Drugs used in Additive Disorder by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N07B	Drugs used in addictive disorders	0.2249	0.4029
N07B A	Drugs used in nicotine dependence	0.0018	0.0074
N07B B	Drugs used in alcohol dependence	0.0007	0.0015
N07B C	Drugs used in opioid dependence	0.2224	0.3941

Table 21.5.2: Use of Drugs used in Additive Disorder by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N07B A	**Drugs used in nicotine dependence**			
N07B A01	Nicotine	Public	0.0002	0.0005
		Private	0.0016	0.0027
		Total	0.0018	0.0032
N07B A03	Varenicline	Public	-	0.0002
		Private	-	0.0040
		Total	-	0.0042
N07B B	**Drugs used in alcohol dependence**			
N07B B04	Naltrexone	Public	0.0006	0.0009
		Private	<0.0001	0.0005
		Total	0.0007	0.0015
N07B C	**Drugs used in opioid dependence**			
N07B C01	Buprenorphine	Public	0.0003	-
		Private	0.0003	-
		Total	0.0006	-
N07B C02	Methadone	Public	0.1683	0.3782
		Private	0.0119	0.0045
		Total	0.1802	0.3827
N07B C51	Buprenorphine, combinations	Public	0.0003	0.0003
		Private	0.0412	0.0111
		Total	0.0415	0.0113

Table 21.6: Use of Antidementia Drugs by Drug Class, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS	2007	2008
N06D	Anti-dementia drugs	0.0657	0.0649
N06D A	Anticholinesterases	0.0646	0.0626
N06D X	Other anti-dementia drugs	0.0011	0.0023

Table 21.6.1: Use of Antidementia Drugs by Drug Class, in DDD/1000 population/day 2007 2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
N06D A	**Anticholinesterases**			
N06D A02	Donepezil	Public	0.0340	0.0315
		Private	0.0037	0.0109
		Total	0.0378	0.0423
N06D A03	Rivastigmine	Public	0.0257	0.0190
		Private	0.0009	0.0009
		Total	0.0266	0.0199
N06D A04	Galantamine	Public	-	-
		Private	0.0002	0.0004
		Total	0.0002	0.0004
N06D X	**Other anti-dementia drugs**			
N06D X01	Memantine	Public	<0.0001	0.0011
		Private	0.0010	0.0012
		Total	0.0011	0.0023

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CHAPTER 22 | USE OF DRUGS FOR OBSTRUCTIVE AIRWAY DISEASES 2008

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Asthma and chronic obstructive airway disease are the two commonest forms of obstructive airway diseases in Malaysia. The estimated prevalence of COPD in Malaysia 4.7% amounting to 448,000 affected persons[1] and expected to rise based on the current smoking rates. The prevalence of asthma amongst children aged 13-14 years old is 6.8 – 12.3%[2] whilst the asthma prevalence in adults is 4.5%.[3] This drug utilization survey is conducted between 2007-2008 and data does not differentiate between drug use in asthma and COPD.

In contrast to 2006-2007 which saw an increase in the usage of inhaled selective beta-2-adrenoceptor agonists, in 2007-2008 there is a marked drop of 33.4% (6.04 to 4.03 DDD/1000 population/day). This drop is largely accounted for by a decrease usage of inhaled salbutamol (34.3%) and inhaled terbutaline (5.2%) especially in the public sector. Concomitantly, the use of inhaled adrenergics in combination with other drugs for obstructive airway diseases (fenoterol/ipratropium, salbutamol/ipratropium,salmeterol/fluticasone, formoterol/budesonide) has increased by 23.4% (1.25 to 1.54 DDD/1000 population/day); this continues the trend of increased use in 2006-2007. The use of inhaled glucocorticoid monotherapy has increased slightly at 1.98 vs 1.75 DDD/1000 population/day in 2008; this may reflect a bottoming out of the trend of decreasing usage seen in previous years. The usage of inhaled anticholinergics has reduced slightly by 4.7%; while tiotropium usage recorded the most declining trend up to 25%.

The increased usage of inhaled adrenergics with other drugs for obstructive airway diseases is mainly due to salbutamol/ipratopium (16.6%) and salmeterol/fluticasone (14.8%) and formoterol/budesonide (76.7%). The reduction in inhaled bronchodilators use together with the increase in combination therapy such as salmeterol/fluticasone and formoterol/budesonide suggest that healthcare providers may be switching from inhaled bronchodilator monotherapy to combination bronchodilator therapy. It may also suggest better disease control amongst asthma and COPD patients. The introduction of inhaled formoterol/budesonide as both a controller and reliever therapy during this period may help explain the significant increase in its usage. There was also a 8.9% usage reduction of systemic beta-2-adrenoceptor agonists (1.4 vs 1.3 DDD/1000 population/day), suggesting that efforts to encourage doctors to switch from oral to inhaled routes for reliever drugs may be making headway.

The usage of xanthines was markedly reduced by 32.5% in 2008, although the usage still remains significant at 1.06 DDD/1000 population/day. This may represent a shift of prescribing preference from oral theophylline to inhaled combination ICS/LABA therapy or better symptom control in patients. The use of leukotriene receptor antagonists (montelukast) has increased by 21.0% (0.20 to 0.24 DDD/1000 population/day) and this is largely due to increased usage in the private sector.

The decreasing trend of inhaled beta-2-adrenoceptor agonist and increasing trend of inhaled ICS/LABA use is also seen in more developed countries such as Australia[4] and Scandinavia.[5] Meanwhile, theophylline usage almost twice as much in Malaysia compared to Australia (1.05 vs 0.53 DDD/1000 population/day) whilst montelukast is more widely used in Australia (0.43 vs 0.24 DDD/1000 population/day).

Table 22.1: Use of Medicines for Obstructive Airway Diseases by Drug Class, inDDD/1000 population/day 2007-2008

ATC	DRUG CLASS	AdmRCode	2007	2008
R03A C	Selective beta-2-adrenoreceptor agonists	Inhal.aerosol Inhal.powder Inhal.solution	6.0435	4.0298
R03A K	Adrenergics and other drugs for obstructive airway diseases	Inhal.aerosol Inhal.powder Inhal.solution	1.2455	1.5364
R03B A	Glucocorticoids	Inhal.aerosol Inhal.powder Inhal.solution	1.7512	1.9769
R03B B	Anticholinergics	Inhal.aerosol Inhal.powder Inhal.solution	0.4884	0.4655
R03B C	Antiallergic agents, excl. corticosteroids	Inhal.aerosol Inhal.powder Inhal.solution	-	-
R03C A	Alpha- and beta-adrenoreceptor agonists	Oral Parenteral	0.0156	-
R03C C	Selective beta-2-adrenoreceptor agonists	Oral Parenteral Rectal	1.4438	1.3147
R03D A	Xanthines	Oral Parenteral Rectal	1.5632	1.0548
R03D C	Leukotriene receptor antagonists	Oral	0.1963	0.2376

Table 22.2: Use of Medicines for Obstructive Airway Diseases by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
R03A C	**Selective beta-2-adrenoreceptor agonists**			
R03A C02	Salbutamol	Public	4.9632	3.2000
		Private	0.7656	0.5646
		Total	5.7288	3.7646
R03A C03	Terbutaline	Public	0.1938	0.2138
		Private	0.0495	0.0168
		Total	0.2433	0.2306
R03A C04	Fenoterol	Public	0.0024	0.0020
		Private	0.0281	0.0045
		Total	0.0305	0.0066
R03A C12	Salmeterol	Public	0.0305	0.0158
		Private	<0.0001	0.0021
		Total	0.0310	0.0180
R03A C13	Formoterol	Public	0.0091	0.0079
		Private	0.0008	0.0023
		Total	0.0099	0.0102
R03A C14	Clenbuterol	Public	-	-
		Private	-	-
		Total	-	-

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
R03A K	**Adrenergics and other drugs for obstructive airway diseases**			
R03A K03	Fenoterol and other drugs for obstructive airway diseases	Public	-	-
		Private	0.0631	0.0686
		Total	0.0631	0.0686
R03A K04	Salbutamol and other drugs for obstructive airway diseases	Public	0.5112	0.6177
		Private	0.1107	0.1071
		Total	0.6219	0.7248
R03A K06	Salmeterol and other drugs for obstructive airway diseases	Public	0.1736	0.2139
		Private	0.2258	0.2446
		Total	0.3994	0.4584
R03A K07	Formoterol and other drugs for obstructive airway diseases	Public	0.0705	0.1375
		Private	0.0906	0.1471
		Total	0.1611	0.2846
R03B A	**Glucocorticoids**			
R03B A01	Beclometasone	Public	0.4625	0.5255
		Private	0.0232	0.0282
		Total	0.4857	0.5537
R03B A02	Budesonide	Public	1.0278	1.258
		Private	0.1776	0.0678
		Total	1.2054	1.3258
R03B A05	Fluticasone	Public	0.0267	0.0468
		Private	0.0120	0.0294
		Total	0.0386	0.0761
R03B A07	Mometasone	Public	0.0006	-
		Private	-	-
		Total	0.0006	-
R03B A08	Ciclesonide	Public	0.0027	0.0058
		Private	0.0182	0.0155
		Total	0.0209	0.0213
R03B B	**Anticholinergics**			
R03B B01	Ipratropium bromide	Public	0.3359	0.3351
		Private	0.0241	0.0338
		Total	0.3599	0.3689
R03B B04	Tiotropium bromide	Public	0.0812	0.0776
		Private	0.0472	0.0190
		Total	0.1285	0.0966
R03B C	**Antiallergic agents, excl. corticosteroids**			
R03B C01	Cromoglicic acid	Public	-	-
		Private	-	-
		Total	-	-
R03C A	**Alpha- and beta- adrenoreceptor agonists**			
R03C A02	Ephedrine	Public	0.0097	-
		Private	0.006	-
		Total	0.0156	-

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008
R03C C	**Selective beta-2-adrenoreceptor agonists**			
R03C C02	Salbutamol	Public	0.6757	0.4458
		Private	0.5230	0.6595
		Total	1.1987	1.1053
R03C C03	Terbutaline	Public	0.1360	0.0726
		Private	0.0901	0.1259
		Total	0.2261	0.1985
R03C C04	Fenoterol	Public	-	-
		Private	0.0087	0.0019
		Total	0.0087	0.0019
R03C C08	Procaterol	Public	-	-
		Private	0.0098	0.0097
		Total	0.0098	0.0097
R03C C12	Bambuterol	Public	-	-
		Private	0.0005	-
		Total	0.0005	-
R03D A	**Xanthines**			
R03D A04	Theophylline	Public	1.0649	0.7955
		Private	0.4957	0.2548
		Total	1.5606	1.0504
R03D A05	Aminophylline	Public	0.0023	0.0025
		Private	0.0003	0.0014
		Total	0.0026	0.0039
R03D A54	Theophylline, combinations excl. psycholeptics	Public	-	-
		Private	-	0.0006
		Total	-	0.0006
R03D C	**Leukotriene receptor antagonists**			
R03D C03	Montelukast	Public	0.0980	0.1055
		Private	0.0983	0.1322
		Total	0.1963	0.2376

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CHAPTER 23 | USE OF ANTIHISTAMINES AND NASAL DECONGESTANTS

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Nasal decongestants and antihistamines are commonly used drugs for allergy and nasal symptoms in otorhinolaryngology clinics in Malaysia. The 2008 survey showed usage of nasal preparations was 1.4881 DDD/population/year and usage of antihistamines for systemic was 4.1654 DDD/population/year.

For nasal preparations, it showed significant reduction in daily and yearly usage since the year 2007. This may due to decreasing usage of the older drugs such as betamethasone and beclomethasone.

The nasal steroids used in Malaysia are beclomethasone, budesonide, betamethasone, fluticasone, mometasone, triamcinolone and fluticasone furoate. Among these, the commonly used nasal steroids in 2008 are fluticasone, mometasone and triamcinolone in both public and private sectors.

Budesonide nasal spray which has comparable efficacy with other corticosteroid nasal decongestants at lower costs of treatment is most commonly used in both public and private sectors. However our usage in 2008 was lower than the Australian data (1.5 DDD/1000 population/day)[1]. For mometasone, the usage was comparable with the Australian data (0.4 DDD/1000 population/day).[1]

The common nasal decongestant used in Malaysia is oxymetazoline. Despite the overall reduction in year 2008, the usage of oxymetazoline has increased in both public and private sectors. This data is still lower than the Australian data (1.2 DDD/1000 population/day).[1] For plain sympathomimetic ephedrine, usage was uncommon and in year 2008 there was further reduction. This is probably because of its short acting properties and rebound phenomena.

Antihistamines can be divided into several subgroups that are sedative and non-sedative antihistamines. The most common sedative antihistamines used in Malaysia are chlorpheniramine, dexchlorpheniramine, promethazine and triprolidine while the most common non-sedative antihistamines are loratadine, cetirizine, desloratadineand levocetirizine. In general the usage of sedative and non-sedative antihistamines has reduced in 2008. This also applies to the combination of antihistamines and pseudoephedrine. In comparing with the Nordic data which comprises of Denmark, Greenland, Finland, Aland, Iceland, Norway and Sweden, the usage of antihistamines in Malaysia is lower except for Greenland (7.9 DDD/1000 population/day).[2]

Table 23.1: Use of Anti-Histamines and Nasal Decongestants, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
R01	Nasal preparations	4.4978	4.0657	1.6417	1.4881
R06	Antihistamine for systematic use	11.5803	1.3807	4.2268	4.1654

Table 23.2.1: Use of Nasal Decongestants by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
R01A	Decongestant and other nasal preparation for topical use	2.1523	2.2279	0.7856	0.8154
R01A A	Sympathomimetics, plain	0.3460	0.3635	0.1263	0.1331
R01A C	Antiallergic agents, excl. corticosteroids	0.0018	0.0007	0.0007	0.0003
R01A D	Corticosteroids	1.8045	1.8636	0.6586	0.6821
R01B	Nasal decongestant for systemic use	2.3455	1.8379	0.8561	0.6727
R01B A	Sympathomimetics	2.3455	1.8379	0.8561	0.6727

Table 23.2.2: Use of Nasal Decongestants by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
R01A A	**Sympathomimetics, plain**					
R01A A03	Ephedrine	Public	0.0003	0.0003	0.0001	0.0001
		Private	0.0004	-	0.0002	-
		Total	0.0008	0.0003	0.0003	0.0001
R01A A05	Oxymetazoline	Public	0.034	0.0588	0.0124	0.0215
		Private	0.2896	0.2916	0.1057	0.1067
		Total	0.3235	0.3504	0.1181	0.1282
R01A A07	Xylometazoline	Public	-	-	-	-
		Private	0.0217	0.0128	0.0079	0.0047
		Total	0.0217	0.0128	0.0079	0.0047
R01A C	**Antiallergic agents, excl. corticosteroids**					
R01A C01	Cromoglicic acid	Public	-	-	-	-
		Private	0.0018	0.0007	0.0007	0.0002
		Total	0.0018	0.0007	0.0007	0.0002
R01A C03	Azelastine	Public	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
R01A D	**Corticosteroids**					
R01A D01	Beclometasone	Public	0.1031	0.0914	0.0376	0.0334
		Private	0.0669	0.0285	0.0244	0.0104
		Total	0.1700	0.1198	0.062	0.0439
R01A D05	Budesonide	Public	0.5859	0.6241	0.2139	0.2284
		Private	0.5107	0.4472	0.1864	0.1637
		Total	1.0967	1.0713	0.4003	0.3921
R01A D06	Betamethasone	Public	-	-	-	-
		Private	0.0020	-	0.0007	-
		Total	0.0020	-	0.0007	-
R01A D08	Fluticasone	Public	0.0134	0.0274	0.0049	0.0100
		Private	0.0653	0.1500	0.0238	0.0549
		Total	0.0787	0.1773	0.0287	0.0649
R01A D09	Mometasone	Public	0.2213	0.2565	0.0808	0.0939
		Private	0.2017	0.1922	0.0736	0.0704
		Total	0.4230	0.4487	0.1544	0.1642
R01A D11	Triamcinolone	Public	0.0018	0.0021	0.0007	0.0008
		Private	0.0325	0.0442	0.0118	0.0162
		Total	0.0343	0.0463	0.0125	0.0171
R01A D12	Fluticasone furoate	Public	-	-	-	-
		Private	-	0.0001	-	<0.0001
		Total	-	0.0001	-	<0.0001
R01B A	**Sympathomimetics**					
R01B A02	Pseudoephedrine	Public	-	0.0111	-	0.0041
		Private	0.0241	0.0142	0.0088	0.0052
		Total	0.0241	0.0253	0.0088	0.0093
R01B A52	Pseudoephedrine, combinations	Public	0.4273	0.4211	0.156	0.1541
		Private	1.8941	1.3843	0.6913	0.5066
		Total	2.3214	1.8053	0.8473	0.6607
R01B A53	Phenylephrine, combinations	Public	-	-	-	-
		Private	-	0.0072	-	0.0027
		Total	-	0.0072	-	0.0027

Table 23.3.1: Use of Anti-Histamines by Drug Class, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2007	2008	2007	2008
R06A	Antihistamines for systematic use	11.5803	11.3807	4.2268	4.1650
R06A A	Aminoalkyl ethers	0.1592	2.0331	0.0581	0.7441
R06A B	Substituted alkylamines	4.9112	3.4621	1.7926	1.2671
R06A D	Phenothiazine derivatives	0.9502	1.0480	0.3468	0.3836
R06A E	Piperazine derivatives	2.6022	2.3296	0.9498	0.8526
R06A X	Other antihistamines for systemic use	2.9574	2.5079	1.0795	0.9179

Table 23.3.2: Use of Anti-Histamines by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2007-2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
R06A A	**Aminoalkyl ethers**					
R06A A02	Diphenhydramine	Public	-	0.4351	-	0.1593
		Private	0.1433	0.245	0.0523	0.0897
		Total	0.1433	0.6801	0.0523	0.2489
R06A A04	Clemastine	Public	-	-	-	-
		Private	0.0039	0.0047	0.0014	0.0017
		Total	0.0039	0.0047	0.0014	0.0017
R06A A08	Carbinoxamine	Public	-	-	-	-
		Private	0.012	0.0032	0.0044	0.0012
		Total	0.012	0.0032	0.0044	0.0012
R06A A52	Diphenhydramine, combinations	Public	-	0.0599	-	0.0219
		Private	-	1.2852	-	0.4704
		Total	-	1.3451	-	0.4923
R06A B	**Substituted alkylamines**					
R06A B01	Brompheniramine	Public	-	-	-	-
		Private	0.0011	0.0020	0.0004	0.0007
		Total	0.0011	0.0020	0.0004	0.0007
R06A B02	Dexchlorpheniramine	Public	0.0259	0.0209	0.0095	0.0077
		Private	0.7892	0.6102	0.2881	0.2233
		Total	0.8152	0.6311	0.2975	0.2310
R06A B04	Chlorphenamine	Public	2.6345	1.775	0.9616	0.5026
		Private	1.4605	1.0482	0.5331	0.3837
		Total	4.095	2.8233	1.4947	0.8862
R06A B54	Chlorphenamine, combinations	Public	-	-	-	-
		Private	-	0.0057	-	0.0021
		Total	-	0.0057	-	0.0021
R06A D	**Phenothiazine derivatives**					
R06A D01	Alimemazine	Public	-	-	-	-
		Private	0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0001	<0.0001	<0.0001	<0.0001
R06A D02	Promethazine	Public	0.6597	0.2703	0.2408	0.0767
		Private	0.2881	0.2312	0.1052	0.0846
		Total	0.9478	0.5015	0.3460	0.1613
R06A D07	Mequitazine	Public	-	-	-	-
		Private	0.0022	0.0015	0.0008	0.0006
		Total	0.0022	0.0015	0.0008	0.0006
R06A D52	Promethazine, combinations	Public	-	-	-	-
		Private	-	0.5450	-	0.1995
		Total	-	0.5450	-	0.1995

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2007	2008	2007	2008
R06A E	**Piperazine derivatives**					
R06A E01	Buclizine	Public	0.0004	0.0010	0.0001	0.0004
		Private	0.0471	0.0180	0.0172	0.0066
		Total	0.0474	0.0189	0.0173	0.0069
R06A E05	Meclozine	Public	-	-	-	-
		Private	0.0014	0.0049	0.0005	0.0018
		Total	0.0014	0.0049	0.0005	0.0018
R06A E07	Cetirizine	Public	0.333	0.3205	0.1215	0.1173
		Private	2.0058	1.8055	0.7321	0.6608
		Total	2.3388	2.126	0.8536	0.7781
R06A E09	Levocetirizine	Public	0.0031	0.0042	0.0011	0.0016
		Private	0.2115	0.1595	0.0772	0.0584
		Total	0.2146	0.1638	0.0783	0.0599
R06A E55	Meclozine, combinations	Public	-	0.0101	-	0.0037
		Private	-	0.0059	-	0.0022
		Total	-	0.016	-	0.0059
R06A X	**Other antihistamines for systemic use**					
R06A X07	Triprolidine	Public	-	0.0062	-	0.0023
		Private	-	0.0105	-	0.0038
		Total	-	0.0167	-	0.0061
R06A X09	Azatadine	Public	-	-	-	-
		Private	0.0005	-	0.0002	-
		Total	0.0005	-	0.0002	-
R06A X12	Terfenadine	Public	-	-	-	-
		Private	-	0.0003	-	0.0001
		Total	-	0.0003	-	0.0001
R06A X13	Loratadine	Public	0.9022	0.8055	0.3293	0.2890
		Private	1.5124	1.2091	0.5520	0.4425
		Total	2.4147	2.0146	0.8813	0.7316
R06A X17	Ketotifen	Public	<0.0001	-	<0.0001	-
		Private	0.2190	0.2063	0.0800	0.0755
		Total	0.2191	0.2063	0.0800	0.0755
R06A X18	Acrivastine	Public	-	-	-	-
		Private	0.0055	0.0021	0.0020	0.0008
		Total	0.0055	0.0021	0.0020	0.0008
R06A X26	Fexofenadine	Public	0.0012	0.0033	0.0004	0.0012
		Private	0.0982	0.0729	0.0358	0.0267
		Total	0.0994	0.0761	0.0363	0.0279
R06A X27	Desloratadine	Public	0.0299	0.0191	0.0109	0.0070
		Private	0.1884	0.1727	0.0688	0.0632
		Total	0.2183	0.1918	0.0797	0.0702

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CHAPTER 24 | USE OF OPHTHALMOLOGICALS

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The National Medicine Use Survey 2008 has results on common ophthalmological agents used in Malaysia.The source data providers are from the government hospitals (100%), university hospitals (100%), army hospitals (100%), private hospitals (23%), general practitioners (7.1%) and retail pharmacies (49%). 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 agents analysed included anti-infectives, steroids and steroids in combination with anti-infectives, non-steroidal anti-inflammatory agents, anti glaucoma agents, pupil dilating agents, anti- allergens, local anaesthetics and anti-neovascularisation agents.

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 2008 was chloramphenicol (0.8588g/ml/cc per 1000 population/ day), followed by gentamicin (0.0754 g/ml/cc per 1000 population/day) and fucidic acid (0.038g/ml/cc per 1000 population/day). Usage of chloramphenicol is on a reducing trend compared to 2007 (1.4517 g/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 health care centres.[1,2] The use of fucidic acid in the public sector is on a rising trend in comparison to 2007 (0.0105 g/ml/cc per 1000 population/day). There is a decline in the use of combination antibiotics compared to 2007. Interestingly, levofloxacin, gatifloxacin and moxifloxacin are prescribed more commonly in 2008 when none was used in 2007 in the public sector. 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 have shown a marked difference between the usage in public and private sector. Overall, dexamethasone remains the drug of choice in both sectors. The use of prednisolone in the public sector has increased in 2008. On the other hand, fluromethalone is on the rise in both sectors, more so in private. Topical dexamethasone and anti-infectives in combination are still the most commonly used steroids/anti-infective combination (0.0801 g/ml/cc per 1000 population/day). As for non-steroidal anti-inflammatory agents, ketorolac still remains the most widely used drug. It is noted that nepafenac, another non-steroidal anti- inflammatory is being used in 2008.

Medical therapy has become the main stay in the management of glaucoma with 13 anti- glaucoma agents available as of 2008. Timolol, a beta blocker is still the most used anti- glaucoma agent (0.6571 DDD/1000 population/ day) in the public sector. However, its use is on the decline in the private sector (0.0353 in 2008 from 0.0814 DDD/1000 population/ day in 2007). Among the anti-glaucoma agents, latanoprost remains the second commonest used drug (0.3565 DDD/1000 population/ day). The other commonly used anti-glaucoma agents (in order of usage) were dorzolamide, betaxolol, pilocarpine, brimonidine and bimatoprost. In 2008, the fixed combination anti glaucoma agents were still not available in the Ministry of Health (MOH) drug formulary, hence its usage remains the same as of 2007 (0.0054 DDD/1000 population/ day). Clinical practice guidelines on the management of primary open angle glaucoma recommends that topical beta blocker and prostaglandin analogues are the most cost effective IOP lowering agents.[4] The findings in this survey indicated that prescribing patternsamong ophthalmologists seemed to be in accordance to the recommendations.

Among the pupillary dilating agents, tropicamide remains the most frequently used, with an increasing trend in both public and private sector (0.0266 in 2007 to 0.0321 in 2008 DDD/1000 population/ day). Among the longer acting dilating agents, homatropine (0.0202 DDD/1000 population/ day) is the most common.

Cromoglicic acid remains the commonest anti-allergen followed by olopatadine. The trend is similar to the values in 2007. Among the decongestants, tetrazoline and tetrazoline combinations has the highest usage.

In both sectors, local anaesthetics are used extensively for routine examination of the eye and ocular surgeries. However there is no data for 2008. The use of verteporfin and ranibizumab remains similar to 2007.

The range of drugs and its trend used in ophthalmology remains similar over the last two years.

Table 24.1: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01A A	**Antibiotics**				
S01A A01	Chloramphenicol	g/ml/cc	Public	0.9722	0.5710
			Private	0.4795	0.2877
			Total	1.4517	0.8588
S01A A02	Chlortetracycline	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0003	0.0018
			Total	0.0004	0.0018
S01A A03	Neomycin	g/ml/cc	Public	-	-
			Private	0.0033	-
			Total	0.0033	-
S01A A04	Oxytetracycline	g/ml/cc	Public	-	-
			Private	<0.0001	-
			Total	<0.0001	-
S01A A09	Tetracycline	g/ml/cc	Public	-	-
			Private	0.0019	0.0013
			Total	0.0019	0.0013
S01A A10	Natamycin	g/ml/cc	Public	<0.0001	0.0001
			Private	0.0002	<0.0001
			Total	0.0002	0.0002
S01A A11	Gentamicin	g/ml/cc	Public	0.0114	0.0134
			Private	0.0670	0.0620
			Total	0.0784	0.0754
S01A A12	Tobramycin	g/ml/cc	Public	0.0002	-
			Private	0.0044	0.0039
			Total	0.0046	0.0039
S01A A13	Fusidic acid	g/ml/cc	Public	0.0105	0.0156
			Private	0.0340	0.0224
			Total	0.0445	0.0380
S01A A17	Erythromycin	g/ml/cc	Public	-	-
			Private	0.0008	0.0002
			Total	0.0008	0.0002
S01A A18	Polymyxin B	g/ml/cc	Public	-	-
			Private	0.0003	-
			Total	0.0003	-
S01A A24	Kanamycin	g/ml/cc	Public	-	-
			Private	-	0.0004
			Total	0	0.0004
S01A A30	Combinations of different antibiotics	g/ml/cc	Public	0.0063	0.0067
			Private	0.0427	0.0102
			Total	0.0489	0.0170
S01A B	**Sulfonamides**				
S01A B04	Sulfacetamide	g/ml/cc	Public	0.0009	-
			Private	-	0.0003
			Total	0.0009	0.0003

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01A D	**Antivirals**				
S01A D03	Aciclovir	g/ml/cc	Public	0.0022	0.0020
			Private	0.0009	0.0005
			Total	0.0031	0.0025
S01A X	**Other antiinfectives**				
S01A X11	Ofloxacin	g/ml/cc	Public	<0.0001	-
			Private	-	-
			Total	<0.0001	-
S01A X12	Norfloxacin	g/ml/cc	Public	0.0003	0.0004
			Private	0.0186	0.0094
			Total	0.0189	0.0098
S01A X13	Ciprofloxacin	g/ml/cc	Public	0.0194	0.0174
			Private	0.0111	0.0046
			Total	0.0305	0.0220
S01A X17	Lomefloxacin	g/ml/cc	Public	0.0001	-
			Private	0.0021	0.001
			Total	0.0022	0.001
S01A X19	Levofloxacin	g/ml/cc	Public	-	-
			Private	0.0003	0.0008
			Total	0.0003	0.0008
S01A X21	Gatifloxacin	g/ml/cc	Public	-	0.0003
			Private	0.0007	0.0010
			Total	0.0007	0.0014
S01A X22	Moxifloxacin	g/ml/cc	Public	0.0003	0.0012
			Private	0.0043	0.0041
			Total	0.0047	0.0053

Table 24.2: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01B A	**Corticosteroids, plain**				
S01B A01	Dexamethasone	g/ml/cc	Public	0.0121	0.0136
			Private	0.0062	0.0053
			Total	0.0183	0.0189
S01B A04	Prednisolone	g/ml/cc	Public	0.0017	0.0038
			Private	0.0124	0.0066
			Total	0.0141	0.0104
S01B A06	Betamethasone	g/ml/cc	Public	0.0150	0.0086
			Private	0.0019	0.0009
			Total	0.0169	0.0096
S01B A07	Fluorometholone	g/ml/cc	Public	0.0024	0.0027
			Private	0.0056	0.0081
			Total	0.008	0.0109

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01B C	**Antiinflammatory agents, non-steroids**				
S01B C01	Indometacin	g/ml/cc	Public	-	-
			Private	-	-
			Total	-	-
S01B C03	Diclofenac	g/ml/cc	Public	-	-
			Private	0.0003	0.0001
			Total	0.0003	0.0001
S01B C05	Ketorolac	g/ml/cc	Public	0.0026	0.0046
			Private	0.0030	0.0033
			Total	0.0056	0.0079
S01B C10	Nepafenac	g/ml/cc	Public	-	0.0001
			Private	-	0.0004
			Total	-	0.0006

Table 24.3: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01C A	**Corticosteroids and antiinfectives in combination**				
S01C A01	Dexamethasone and antiinfectives	g/ml/cc	Public	0.0354	0.0326
			Private	0.1388	0.0475
			Total	0.1742	0.0801
S01C A05	Betamethasone and antiinfectives	g/ml/cc	Public	0.0341	0.0251
			Private	0.0042	0.0065
			Total	0.0384	0.0316
S01C A07	Fluorometholone and antiinfectives	g/ml/cc	Public	-	-
			Private	0.0007	0.0007
			Total	0.0007	0.0007
S01C B	**Corticosteroids/antiinfectives/mydriatics in combination**				
S01C B02	Prednisolone	g/ml/cc	Public	0.0025	-
			Private	-	-
			Total	0.0025	-

Table 24.4: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01E A	**Sympathomimetics in glaucoma therapy**				
S01E A05	Brimonidine	ml	Public	0.0339	0.0400
			Private	0.0375	0.0051
			Total	0.0714	0.0451
S01E B	**Parasympathomimetics**				
S01E B01	Pilocarpine	mg	Public	0.0613	0.0625
			Private	0.0063	0.0044
			Total	0.0676	0.0669
S01E B02	Carbachol	ml	Public	0.0045	0.0057
			Private	0.0008	0.0010
			Total	0.0053	0.0067
S01E C	**Carbonic anhydrase inhibitors**				
S01E C01	Acetazolamide	g	Public	0.0167	0.0189
			Private	0.0055	0.0040
			Total	0.0222	0.0230
S01E C03	Dorzolamide	ml	Public	0.1090	0.1355
			Private	0.0118	0.0011
			Total	0.1209	0.1367
S01E C04	Brinzolamide	ml	Public	0.0278	0.0345
			Private	0.0043	0.0040
			Total	0.0321	0.0385
S01E D	**Beta blocking agents**				
S01E D01	Timolol	ml	Public	0.5907	0.6218
			Private	0.0814	0.0353
			Total	0.6721	0.6571
S01E D02	Betaxolol	ml	Public	0.0693	0.0797
			Private	0.0145	0.0076
			Total	0.0838	0.0873
S01E D03	Levobunolol	ml	Public	-	-
			Private	0.0021	0.0019
			Total	0.0021	0.0019
S01E D51	Timolol, combinations	ml	Public	0.0058	0.0054
			Private	0.0239	0.0201
			Total	0.0298	0.0255
S01E E	**Prostaglandin analogues**				
S01E E01	Latanoprost	ml	Public	0.3226	0.3431
			Private	0.0230	0.0134
			Total	0.3456	0.3565
S01E E03	Bimatoprost	ml	Public	<0.0001	0.0084
			Private	0.0108	0.0076
			Total	0.0109	0.0160
S01E E04	Travoprost	ml	Public	0.0055	0.0046
			Private	0.0210	0.0086
			Total	0.0264	0.0132

Table 24.5: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01F A	**Anticholinergics**				
S01F A01	Atropine	g/ml/cc	Public	0.0060	0.0117
			Private	0.0006	0.0003
			Total	0.0066	0.0120
S01F A04	Cyclopentolate	g/ml/cc	Public	0.0081	0.0060
			Private	0.0013	0.0013
			Total	0.0094	0.0073
S01F A05	Homatropine	g/ml/cc	Public	0.0210	0.0189
			Private	0.0016	0.0013
			Total	0.0226	0.0202
S01F A06	Tropicamide	g/ml/cc	Public	0.0221	0.0258
			Private	0.0045	0.0064
			Total	0.0266	0.0321
S01F B	**Sympathomimetics excl. antiglaucoma preparations**				
S01F B01	Phenylephrine	g/ml/cc	Public	0.0095	0.0121
			Private	0.0021	0.0016
			Total	0.0116	0.0138

Table 24.6: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01G A	**Sympathomimetics used as decongestants**				
S01G A01	Naphazoline	g/ml/cc	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001
S01G A02	Tetryzoline	g/ml/cc	Public	0.0011	0.0004
			Private	0.0693	0.0403
			Total	0.0703	0.0407
S01G A05	Phenylephrine	g/ml/cc	Public	-	-
			Private	-	0.0008
			Total	-	0.0008
S01G A51	Naphazoline, combinations	g/ml/cc	Public	0.0026	0.0022
			Private	0.0362	0.0244
			Total	0.0388	0.0266
S01G A52	Tetryzoline, combinations	g/ml/cc	Public	0.0159	0.0214
			Private	0.0505	0.0186
			Total	0.0665	0.04
S01G A55	Phenylephrine, combinations	g/ml/cc	Public	-	0.0015
			Private	-	<0.0001
			Total	-	0.0016

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01G X	**Other antiallergics**				
S01G X00	Other antiallergics	g/ml/cc	Public	-	-
			Private	0.0024	-
			Total	0.0024	-
S01G X01	Cromoglicic acid	g/ml/cc	Public	0.0300	0.0327
			Private	0.0355	0.0198
			Total	0.0656	0.0526
S01G X05	Lodoxamide	g/ml/cc	Public	0.0002	0.0002
			Private	0.0041	0.0010
			Total	0.0043	0.0012
S01G X06	Emedastine	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0025	0.0014
			Total	0.0026	0.0014
S01G X08	Ketotifen	g/ml/cc	Public	-	-
			Private	0.0007	0.0010
			Total	0.0007	0.0010
S01G X09	Olopatadine	g/ml/cc	Public	0.0013	0.0012
			Private	0.0044	0.0055
			Total	0.0057	0.0067

Table 24.7: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01H A	**Local anesthetics**				
S01H A02	Oxybuprocaine	g/ml/cc	Public	<0.0001	-
			Private	0.0002	-
			Total	0.0002	-
S01H A03	Tetracaine	g/ml/cc	Public	0.0001	0.0001
			Private	<0.0001	<0.0001
			Total	0.0002	0.0002
S01H A04	Proxymetacaine	g/ml/cc	Public	0.0272	0.0238
			Private	0.0045	0.0041
			Total	0.0316	0.0279
S01H A07	Lidocaine	g/ml/cc	Public	<0.0001	-
			Private	-	-
			Total	<0.0001	0

Table 24.8: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01L A	**Antineovascularisation agents**				
S01L A01	Verteporfin	mg	Public	0.0001	<0.0001
			Private	<0.0001	<0.0001
			Total	0.0002	<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 Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S01X A	**Other ophthalmologicals**				
S01X A18	Ciclosporin	g/ml/cc	Public	-	0.0002
			Private	0.0007	0.0011
			Total	0.0007	0.0014

Table 24.10: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S03A A	**Antiinfectives**				
S03A A06	Gentamicin	g/ml/cc	Public	0.001	0.0012
			Private	0.0265	0.0077
			Total	0.0276	0.0089
S03A A08	Chloramphenicol	g/ml/cc	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001

Table 24.11: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S03B A	**Corticosteroids**				
S03B A03	Betamethasone	g/ml/cc	Public	0.0036	0.0075
			Private	0.0149	0.0026
			Total	0.0184	0.0101

Table 24.12: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S03C A	**Corticosteroids and antiinfectives in combination**				
S03C A01	Dexamethasone and antiinfectives	g/ml/cc	Public	0.0006	0.0373
			Private	0.2748	0.1606
			Total	0.2754	0.1979
S03C A06	Betamethasone and antiinfectives	g/ml/cc	Public	0.0033	0.0117
			Private	0.0605	0.0156
			Total	0.0638	0.0274

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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 antiinfectives ear drops, local corticosteroid ear drops and combination of antiinfectives and corticosteroid ear drops. There are two types of otological drugs that are mainly used, corticosteroid and non-corticosteroid antiinfective preparations. The most widely used antiinfectiveis chloramphenicol which is easily available in peripheral government clinics and to private general practitioners. However the overall usage of chloramphenicol has reduced in year 2008 which is comparable with the Australian data.[2] This is probably due to increased awareness regarding its side effects. Other drugs such as gentamicin, neomycin and polymyxin B are less commonly used. The usage of newer generation antiinfective ear drops such as ofloxacin shows an increasing trend.

Generally, there is an increasing trend in the usage of otological corticosteroid in combination with antiinfectives. The most commonly used corticosteroid in combinationwith antiinfectives is Dexamethasone and it has shown significant increase in year 2008. This is also comparable with the Australian data.[2]

Table 25.1: Use of Otologicals by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S02A A	**Antiinfectives**				
S02A A01	Chloramphenicol	g/ml/cc	Public	0.1558	0.0996
			Private	0.0689	0.0565
			Total	0.2247	0.1561
S02A A03	Boric acid	g/ml/cc	Public	-	<0.0001
			Private	-	-
			Total	-	<0.0001
S02A A07	Neomycin	g/ml/cc	Public	-	-
			Private	0.0007	-
			Total	0.0007	-
S02A A11	Polymyxin B	g/ml/cc	Public	-	-
			Private	-	0.0004
			Total	-	0.0004
S02A A13	Miconazole	g/ml/cc	Public	-	-
			Private	-	0.0004
			Total	-	0.0004
S02A A14	Gentamicin	g/ml/cc	Public	<0.0001	-
			Private	0.0007	0.0003
			Total	0.0007	0.0003
S02A A16	Ofloxacin	g/ml/cc	Public	0.0091	0.0094
			Private	0.0053	0.0103
			Total	0.0144	0.0198
S02A A30	Antiinfectives, combinations	g/ml/cc	Public	0.0224	0.0012
			Private	0.0223	0.0117
			Total	0.0447	0.0128

Table 25.2: Use of Otologicals by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S02B A	**Corticosteroids**				
S02B A00	Corticosteroids	g/ml/cc	Public	0.0004	-
			Private	-	-
			Total	0.0004	-
S02B A07	Betamethasone	g/ml/cc	Public	-	-
			Private	-	0.0003
			Total	-	0.0003

Table 25.3: Use of Otologicals by Drug Class and Agents, in DDD/1000 population/day 2007-2008

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2007	2008
S02C A	**Corticosteroids and antiinfectives in combination**				
S02C A03	Hydrocortisone and antiinfectives	g/ml/cc	Public	0.0056	0.0024
			Private	0.0028	0.0103
			Total	0.0084	0.0128
S02C A04	Triamcinolone and antiinfectives	g/ml/cc	Public	0.0051	0.0080
			Private	0.0024	0.0029
			Total	0.0074	0.0109
S02C A06	Dexamethasone and antiinfectives	g/ml/cc	Public	0.0015	0.0379
			Private	0.0032	0.0007
			Total	0.0046	0.0386

References:

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CHAPTER 26 | USE OF DRUGS FOR COUGH AND COLD

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Upper respiratory tract infections (URTIs) are the commonest indications for consultation in ambulatory care. The Third National Health and Morbidity Survey conducted in 2006 reported that the incidence of URTI was 18% in all age groups.[1] The commonest illness reported was common cold, 16.9%. The highest incidence was among children less than 5 years old, 28.8%. URTI affects daily activities and 60.6% of the population having URTI sought treatment. It has been reported that there is considerable over-prescription of antibiotics and symptomatic therapy for this group of illnesses.[2]

Drugs commonly used for symptomatic relief of URTI include antihistamines, nasal decongestants, cough suppressants, expectorants and mucolytics, whether as single-ingredient products or combination preparations.

The standard rules for ATC coding based on WHO guidelines, as shown in Figure 26.1, was followed for coding cough and cold combination products reported in this chapter.

The WHO 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] Although the WHO Guidelines does not assign DDDs for specific cough and cold combination preparations, it does recommend that fixed DDDs based on the product's recommended dosage be assigned. Therefore, for the purpose of comparing usage between the preparations, estimation of the DDDs were done using the standard dose for the main indication in adults, based on average dosage regimen of three times daily, and dosages in the upper area of the recommended dosage regimens are chosen. For combination cough & cold oral liquid formulation in this report, the proposed DDD is 30ml and for the tablets/capsules/caplets preparations, the proposed DDD is 6 tablets.

The 2008 survey showed antihistamines for systemic use (R06A) were the most commonly prescribed (11.3807 DDD/population/year), followed by nasal decongestants for systemic use (1.8379 DDD/population/year) and cough suppressants excluding combinations with expectorants (1.3457 DDD/population/year).

Antihistamines can be divided into sedating and non-sedating antihistamines. The most common sedating antihistamines used in Malaysia are chlorpheniramine, dexchlorpheniramine, promethazine and triprolidine while the most common non-sedating antihistamines are loratadine, cetirizine, desloratadine and levocetirizine. Among sedating antihistamine, chlorpheniramine has the highest total utilization while cetirizine and loratadine reported highest usage for non-sedating group. The non-sedating antihistamines such as cetirizine, levocetirizine, loratadine and desloratadine are used more frequently in the private sector.

It should be noted that although antihistamines are commonly used for cough and cold, the usage of systemic antihistamines in this report included use for other indications such as allergy and does not reflect the usage for treatment of cough and cold alone.

For nasal decongestants for systemic use, private sector consumption of pseudoephedrine combination products was three times more than public consumption. This is mainly due to widespread availability of these products in private sector particularly in private pharmacies and clinics.

Among cough suppressants, use of dextromethorphan is highest compared to pholcodine and combination products. Usage of both dextromethorphan and combination products containing cough suppressants were higher in the private sector than public sector. Cough suppressants excluding combinations with expectorants were available in both public and private sector.

Among the combination products, pseudoephedrine combinations were the most used, followed by diphenhydramine combinations and promethazine combinations, the latter being used mostly in the private sector. Combination preparations containing cough suppressants, excluding combinations with expectorants constitute the next most used preparations for cough and cold in both public and private sectors.

In general, usage of combination preparations containing expectorants and mucolytics was low. Usage of expectorants combinations was higher than mucolytics combinations and both products were only available in private sector. It must be noted, however, that usage in this report are for preparations which required prescription, and does not include expectorants and mucolytics which are over-the-counter (OTC) medicines.

In conclusion, cough and cold preparations are widely prescribed in Malaysia for symptomatic relief of URTI. One of the limitations of this study is that usage was based partially on procurement data which may not accurately reflect consumption pattern.

Figure 26.1: Guide for ATC coding of cough and cold combination preparations

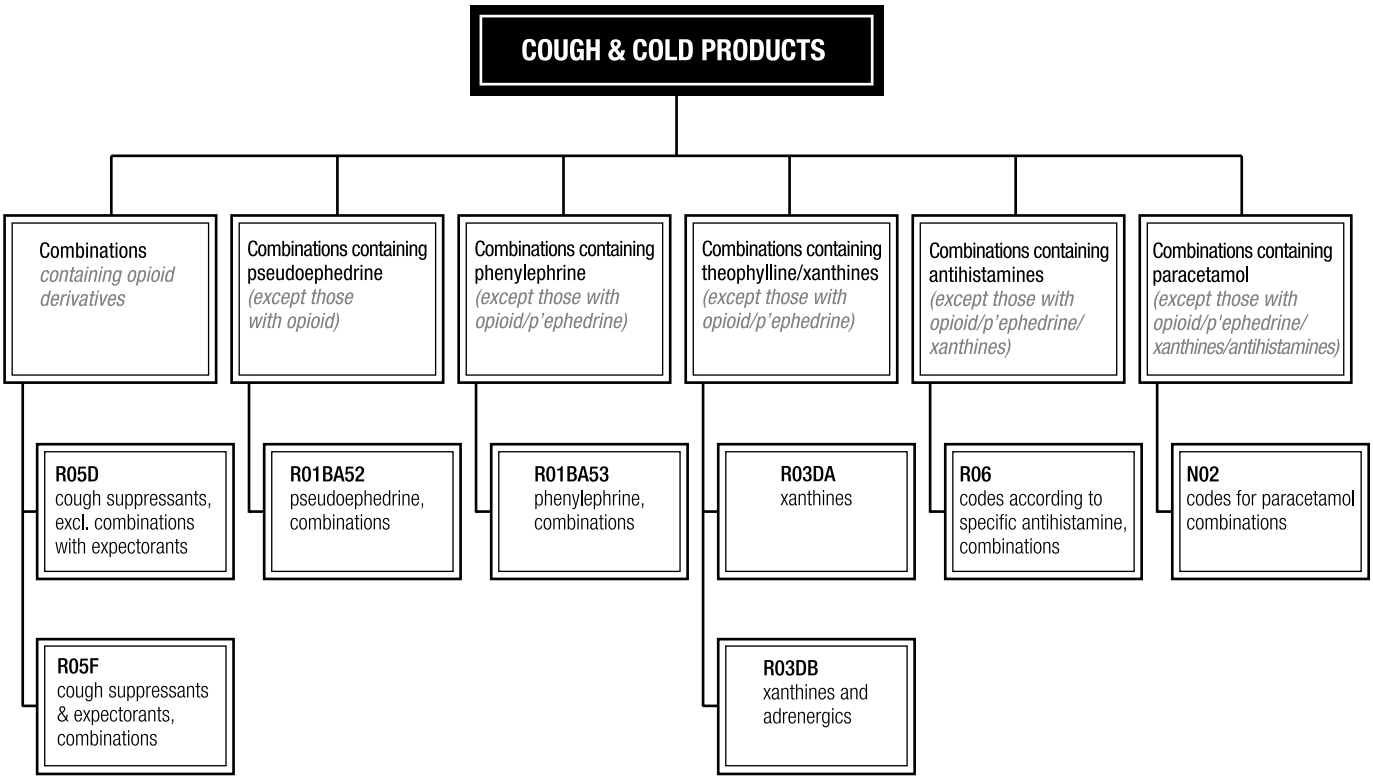

Table 26.1.1: Use of Drugs for Cough and Cold by Drug Class, in DDD/1000 population/day and DDD/population/year 2008

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY	DDD/POPULATION/YEAR
R01B	Nasal decongestant for systematic use	1.8379	0.6727
R05C	Expectorants excluding combination with cough suppressants	0.1282	0.0310
R05D	Cough suppressant, excluding combination with expectorants	1.3457	0.4924
R05F	Cough supresssant and expectorants, combination	0.0220	0.0080
R06A	Antihistamine for systematic use	11.3807	4.1654

Table 26.2.1: Use of Selected Nasal Decongestant Cough & Cold by Drug Class, in DDD/1000 population/day & DDD/population/year 2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R01B	**Nasal decongestant for systematic use**				
R01B A	**Sympathomimetics**				
R01B A02	Pseudoephedrine	Public	0.24g	0.0111	0.0041
		Private		0.0142	0.0052
		Total		0.0253	0.0093
R01B A52	Pseudoephedrine, combinations	Public	0.24g	0.4211	0.1541
		Private		1.3843	0.5066
		Total		1.8053	0.6607
R01B A53	Phenylephrine, combinations	Public	6tablet/30ml	-	-
		Private		0.0072	0.0027
		Total		0.0072	0.0027

Table 26.2.2: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/population/year 2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R05C	**Expectorants, excluding combinations with cough suppressants**				
R05C A	**Expectorants**				
R05C A10	Combinations	Public	30ml	-	-
		Private		0.065	0.0238
		Total		0.065	0.0238
R05C B	**Mucolytics**				
R05C B10	Combinations	Public	30ml	-	-
		Private		0.0196	0.0072
		Total		0.0196	0.0072

Table 26.2.3: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/population/year 2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R05D	**Cough suppressants, excluding combinations with expectorants**				
R05D A	**Opium alkaloids and derivatives**				
R05D A08	Pholcodine	Public	50mg	0.0003	0.0001
		Private		0.0446	0.0163
		Total		0.0449	0.0164
R05D A09	Dextromethorphan	Public	90mg	0.0014	0.0005
		Private		0.6750	0.2470
		Total		0.6764	0.2476
R05D A20	Combinations	Public	6 tablet/30ml	<0.0001	<0.0001
		Private		0.5253	0.1923
		Total		0.5253	0.1923
R05D B	**Other cough suppressants**				
R05D B03	Clobutinol	Public		-	-
		Private		0.0006	0.0002
		Total		0.0006	0.0002
R05D B11	Pipazetate	Public		-	-
		Private		-	-
		Total		-	-
R05D B21	Cloperastine	Public		-	-
		Private		0.0981	0.0359
		Total		0.0981	0.0359

Table 26.2.4: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/population/year 2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R05F	**Cough suppressant and expectorants, combinations**				
R05F A	**Opium derivatives and expectorants**				
R05F A01	Opium derivatives and mucolytics	Public	30ml	-	-
		Private		0.0102	0.0037
		Total		0.0102	0.0037
R05F A02	Opium derivatives and expectorants	Public	6 tablet/30ml	-	-
		Private		0.0118	0.0043
		Total		0.0118	0.0043

Table 26.2.5: Use of Antihistamines by Drug Class, in DDD/1000 population/day and DDD/population/year 2008

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R06A	**Antihistamines for systematic use**				
R06A A	**Aminoalkyl ethers**				
R06A A02	Diphenhydramine	Public		0.4351	0.1593
		Private		0.2450	0.0897
		Total		0.6801	0.2489
R06A A04	Clemastine	Public		-	-
		Private		0.0047	0.0017
		Total		0.0047	0.0017
R06A A08	Carbinoxamine	Public		-	-
		Private		0.0032	0.0012
		Total		0.0032	0.0012
R06A A52	Diphenhydramine, combinations	Public	30ml	0.0599	0.0219
		Private		1.2852	0.4704
		Total		1.3451	0.4923
R06A B	**Substituted alkylamines**				
R06A B01	Brompheniramine	Public		-	-
		Private		0.002	0.0007
		Total		0.002	0.0007
R06A B02	Dexchlorpheniramine	Public		0.0209	0.0077
		Private		0.6102	0.2233
		Total		0.6311	0.2310
R06A B04	Chlorphenamine	Public		1.7750	0.5026
		Private		1.0482	0.38837
		Total		2.8233	0.8862
R06A B06	Dexbrompheniramine	Public		-	-
		Private		-	-
		Total		-	-
R06A B52	Dexchlorpheniramine, combinations	Public		-	-
		Private		-	-
		Total		-	-
R06A B54	Chlorphenamine, combinations	Public	6 tablet / 30 ml	-	-
		Private		0.0057	0.0021
		Total		0.0057	0.0021

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R06A D	**Phenothiazine derivatives**				
R06A D01	Alimemazine	Public		-	-
		Private		<0.0001	<0.0001
		Total		<0.0001	<0.0001
R06A D02	Promethazine	Public		0.2703	0.0767
		Private		0.2312	0.0846
		Total		0.5015	0.1613
R06A D07	Mequitazine	Public		-	-
		Private		0.0015	0.0006
		Total		0.0015	0.0006
R06A D52	Promethazine, combinations	Public		-	-
		Private	30ml	0.5450	0.2008
		Total		0.5450	0.2008
R06A E	**Piperazine derivatives**				
R06A E01	Buclizine	Public		0.0010	0.0004
		Private		0.0180	0.0066
		Total		0.0189	0.0069
R06A E05	Meclozine	Public		-	-
		Private		0.0049	0.0018
		Total		0.0049	0.0018
R06A E07	Cetirizine	Public		0.3205	0.1181
		Private		1.8055	0.6656
		Total		2.1260	0.7837
R06A E09	Levocetirizine	Public		0.0043	0.0016
		Private		0.1602	0.0460
		Total		0.1645	0.0602
R06A E55	Meclozine, combinations	Public		0.0101	0.0037
		Private		0.0059	0.0022
		Total		0.0160	0.0059

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 POPULATION/DAY	DDD/POPULATION/ YEAR
R06A X	**Other antihistamines for systemic use**				
R06A X07	Triprolidine	Public		0.0062	0.0023
		Private		0.0105	0.0038
		Total		0.0167	0.0061
R06A X09	Azatadine	Public		-	-
		Private		-	-
		Total		-	-
R06A X12	Terfenadine	Public		-	-
		Private		0.0003	0.0001
		Total		0.0003	0.0001
R06A X13	Loratadine	Public		0.8055	0.2890
		Private		1.2091	0.4425
		Total		2.0146	0.7316
R06A X17	Ketotifen	Public		-	-
		Private		0.2063	0.0755
		Total		0.2063	0.0755
R06A X18	Acrivastine	Public		-	-
		Private		0.0021	0.0008
		Total		0.0021	0.0008
R06A X26	Fexofenadine	Public		0.0033	0.0012
		Private		0.0729	0.0267
		Total		0.0761	0.0279
R06A X27	Desloratadine	Public		0.0191	0.0070
		Private		0.1727	0.0632
		Total		0.1918	0.0702

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CHAPTER 27 | USE OF VACCINES

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Infectious disease is a common cause of morbidity and mortality worldwide.The introduction of vaccines into National Immunization Programmes (NIP) has significantly reduced childhood deaths associated with infectious diseases. Vaccines play an important role towards achieving Millennium Development Goal 4 target of reducing below 5 mortality rate by 2015.[1]

This report served to indicate the procurement and consumption usage of vaccines in the country. For the purpose of this report, DDD is defined as number of vaccine doses for complete vaccination for the defined population. For example, a course of DTaP vaccination (J07C A06) consists of 4 doses which represent a complete course for children below 2 years, while a course of MMR vaccination (J07B D52) consists of 2 doses indicated for children below 8 years. The population is obtained from Department of Statistics Malaysia.[2]

Overall the consumptions of bacterial vaccines are more as compared to viral vaccines. Live attenuated tuberculosis vaccine (J07A N01), or more commonly known as BCGis the most commonly used vaccine in both public and private sector with consumption in public sector being slightly more than private. Among vaccines used for general population, the utilisation of tetanus toxoid (J07A M01) is the highest. BCG is generally given to newborns and tetanus toxoid is widely used for pregnant women, 15 year old students and post injury prophylaxis. The public consumption of injectable typhoid vaccine (J07A P03) is 4 times higher than private. Typhoid vaccine is mandated for food handlers under the Food Hygiene Regulation 2009. The injectable form of typhoid vaccine consumption is 26 times more commonly prescribed compared to the oral form. The oral formulation is only used in the private sector as it is not yet available in the MOH formulary. The consumption of meningococcal vaccine is mainly for hajj and umrah.

Hepatitis B, purified antigen (J07B C01) has the highest consumption among the viral mono-antigen/mono-component vaccine. Public sector consumption of hepatitis B vaccine is twice that of private. It is given to children aged less than one year as part of the Expanded Immunisation Program (EPI). Even though measles monoantigen vaccines show a high consumption, the usage is only in Sabah for infant aged 6 months. Meanwhile, JE vaccine (J07B A02) is offered under EPI in Sarawak and rotavirus vaccine together with varicella vaccine are mainly used in private sector as it is not recommended in the National Immunization Schedule. Less commonly used viral vaccines are oral polio vaccine, varicella, rabies and yellow fever.

The most frequently used combined vaccine in the public sector is diphtheria-pertussis- tetanus-hepatitis B-*Haemophilus influenzae* b- (J0C A11), followed by diphtheria-pertussis-tetanus-poliomyelitis-*Haemophilus influenzea* b (J0C A06), and diphtheria-pertussis-tetanus-hepatitis B-(J07C A05). These antigens are recommended in the National Immunization Schedule for infant below 1 year.

There are several limitations of this report. Both procurement and consumption data could not be obtained separately due to logistical issues. It is assumed that procurement data reflects consumption. Data for certain products could not be separated according to age group such as Hepatitis B vaccine adult and paediatric dose. The age indication for some vaccines may not be adhered to in the private sector. For example, HPV vaccine is indicated for age group between 9 to 26 years old[3] but may have been offered to women in the older age group (AEFI data).[4] Certain vaccines may be indicated for specific groups, for examples typhoid vaccine for food handlers and meningococcal vaccines for hajj and umrah. Data from private specialist clinics are not captured although vaccines are expected to be widely prescribed in this setting.

In conclusion, the actual consumption may not be accurately ascertained because no definitive consumption data could be obtained. However, the data suggests a vast proportion of these vaccines are being utilized under the Expanded Programme for Immunization (EPI). Future survey should incorporate actual consumption data to accurately reflect pattern and trend of vaccine utilization in the country.

Table 27.1: Use of Vaccines by Drug Class year 2008, in Total Doses and DDD/1000 defined population/year 2008

ATC	DRUG CLASS AND AGENTS	TOTAL DOSES/YEAR ('000)	DDD/1000 SPECIFIC POP/YEAR
J07A	Bacterial vaccines	5529	4329
J07B	Viral vaccines	5383	2897
J07C	Bacterial and viral vaccines, combined	3231	1660

Table 27.2.1: Use of Bacterial Vaccines by Drug Class and Agents, in Total Doses and DDD/1000 defined population/year 2008

ATC	Drug Class and Agents	Defined Population	Population No ('000)	DDD (no of doses)	Sector	Total Doses/ year ('000)	DDD/1000 defined pop/year
J07A E01	Cholera, inactivated, whole cell	General	27728.7	1	Public		-
					Private	101	0.0036
					Total	101	0.0036
J07A G01	Hemophilus influenzae B, purified antigen conjugated	Below 1 years old	653.4	1	Public	2393	3.6621
					Private	18615	28.4897
					Total	21008	32.1519
J07A G52	Hemophilus influenzae B, combinations with pertussis and toxoids	Below 1 years old	653.4	1	Public	8899	13.6198
					Private	285	0.4367
					Total	9185	14.0565
J07A H03	Meningococcus, bivalent purified polysaccharides antigen	General	27728.7	1	Public	-	-
					Private	96	0.0035
					Total	96	0.0035
J07A H04	Meningococcus, tetravalent purified polysaccharides antigen	General	27728.7	1	Public	75522	2.7236
					Private	17393	0.6273
					Total	92915	3.3509
J07A J52	Pertussis, purified antigen, combinations with toxoids	Children less than 2 years old	1294.9	4 doses (2, 3, 5, 18 months)	Public	488085	94.2321
					Private	12073	2.3310
					Total	500158	96.5631
J07A L01	Pneumococcus, purified polysaccharides antigen	General	27728.7	1	Public	1404	0.0506
					Private	3385	0.1221
					Total	4789	0.1727
J07A L02	Pneumococcus, purified polysaccharides antigen conjugated	Children less than 2 years old	1294.9	4 (3 +1)	Public	-	-
					Private	34547	6.6698
					Total	34547	6.6698
J07A L52	Pneumococcus purified polysaccharides antigen and Haemophilus influenzae, conjugated	Children less than 2 years old	1294.9	4 (3 +1)	Public	-	-
					Private	101	0.0195
					Total	101	0.0195
J07A M01	Tetanus toxoid	General	27728.7	1	Public	2148712	77.4905
					Private	456816	16.4745
					Total	2605528	93.9650
J07A M51	Tetanus toxoid, combinations with diphtheria toxoid	7 years old	589.5	1	Public	724748	1229.4280
					Private	-	-
					Total	724748	1229.4280
J07A N01	Tuberculosis, live attenuated	Live birth	487.346	1	Public	1098374	2253.7870
					Private	289266	593.5540
					Total	1387640	2847.3410
J07A P01	Typhoid, oral, live attenuated	General	27728.7	1	Public	-	-
					Private	5490	0.1980
					Total	5490	0.1980
J07A P03	Typhoid, purified polysaccharide antigen	General	27728.7	1	Public	112112	4.0432
					Private	30641	1.1050
					Total	142753	5.1482

Table 27.2.2: Use of Viral Vaccines by Drug Class and Agents, in Total Doses and DDD/1000 defined population/year 2008

ATC	Drug Class and Agents	Defined Population	Population No ('000)	DDD (no of doses)	Sector	Total Doses/ year ('000)	DDD/1000 defined pop/year
J07B A02	Encephalitis, Japanese, inactivated, whole virus	Below 15 (Sarawak only)	810.7	7	Public	150968	26.6028
					Private	5505	0.9701
					Total	156473	27.5729
J07B B02	Influenza, inactivated, split virus or surface antigen	General	27728.7	1	Public	3801	0.1371
					Private	26559	0.9578
					Total	30360	1.0949
J07B C01	Hepatitis B, purified antigen	Below 1 years old	653.4	3	Public	574258	292.9589
					Private	246625	125.8162
					Total	820883	418.7751
J07B C02	Hepatitis A, inactivated, whole virus	General	27728.7	2	Public	51	0.0009
					Private	32795	0.5914
					Total	32846	0.5923
J07B C20	Combinations	General	27728.7	3	Public	-	-
					Private	12141	0.1460
					Total	12141	0.1460
J07B D01	Measles, live attenuated	Sabah (below 1 year old)	67.5	1	Public	144872	2146.2450
					Private	168	2.4947
					Total	145040	2148.7400
J07B D52	Measles, combinations with mumps and rubella, live attenuated	Below 8 years old	4962.1	2	Public	1316557	132.6612
					Private	40671	4.0982
					Total	1357228	136.7594
J07B F02	Poliomyelitis oral, trivalent, live attenuated	Below 8 years old	4962.1	5	Public	2557031	103.0624
					Private	8118	0.3272
					Total	2565149	103.3897
J07B F03	Poliomyelitis, trivalent, inactivated, whole virus	Children less than 2 years old	1294.9	4	Public	20	0.0038
					Private	-	-
					Total	20	0.0038
J07B G01	Rabies, inactivated, whole virus	General	27728.7	4 doses (0, 7, 14, 21 or 28 days post- bite)	Public	515	0.0046
					Private	2033	0.0183
					Total	2548	0.0230
J07B H01	Rota virus, live attenuated	Below 1 years old	653.4	3	Public	-	-
					Private	12511	6.3824
					Total	12511	6.3824
J07B J01	Rubella, live attenuated	General (female)	13614.4	1	Public	201796	14.8223
					Private	176	0.0129
					Total	201972	14.8352
J07B K01	Varicella, live attenuated	1 - < 2 years old	641.5	1	Public	229	0.3562
					Private	23804	37.1060
					Total	24032	37.4622
J07B L01	Yellow fever, live attenuated	General	27728.7	1	Public	40	0.0015
					Private	474	0.0171
					Total	514	0.0185
J07B M01	Papillomavirus (human types 6, 11, 16, 18)	General (female)	13614.4	3	Public	20	0.0005
					Private	16003	0.3928
					Total	16023	0.3923
J07B M02	Papillomavirus (human types 16, 18)	General (female)	13614.4	1	Public	-	-
					Private	4978	0.3656
					Total	4978	0.3656

Table 27.2.3: Use of Bacterial & Viral Vaccines, Combined by Drug Class & Agents, in Total Doses & DDD/1000 defined population/year 2008

ATC	Drug Class and Agents	Defined Population	Population No ('000)	DDD (no of doses)	Sector	Total Doses/ year ('000)	DDD/1000 defined pop/year
J07C A02	Diphtheria-pertussis-poliomyelitis-tetanus	1 - < 2 years old	641.5	1	Public	368	0.5734
					Private	21701	33.8282
					Total	22069	34.4016
J07C A05	Diphtheria-hepatitis B-pertussis-tetanus	Below 1 years old	653.4	3	Public	83430	42.5619
					Private	832	0.4246
					Total	84262	42.9865
J07C A06	Diphtheria-Hemophilus influenzae B-pertussis-poliomyelitis-tetanus	Below 1 years old	653.4	3	Public	833125	425.0204
					Private	76552	39.0533
					Total	909677	464.0738
J07C A09	Diphtheria-Hemophilus influenzae B-pertussis-poliomyelitis-tetanus-hepatitis B	Below 2 years old	1294.9	4	Public	31	0.0060
					Private	36581	7.0625
					Total	36612	7.0685
J07C A10	Typhoid-hepatitis A	General	27728.7	1	Public	-	-
					Private	55	0.0020
					Total	55	0.0020
J07C A11	Diphtheria-Hemophilus influenzae B-pertussis-tetanus-hepatitis B	Below 1 years old	653.4	3	Public	2178173	1111.199
					Private	-	-
					Total	2178173	1111.199

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APPENDIX 1 | 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.	Hospital Kuala Lumpur
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.	Apollo Medical Centre
4.	Arunamari Specialist Medical Centre
5.	Columbia Asia Hospital - Miri
6.	Columbia Asia Hospital - Puchong
7.	Columbia Asia Hospital Seremban
8.	Damai Medical and Heart Clinic Sdn. Bhd
9.	Darul Ehsan Medical Centre
10.	Fatimah Hospital
11.	Hospital Bersalin Razif
12.	Hospital Pantai Ayer Keroh Sdn. Bhd.
13.	Island Hospital
14.	Kempas Medical Centre
15.	Kim Fung Medical Centre (Formerly known as Sandakan Surgical & Maternity Home Sdn Bhd)
16.	Kinta Medical Centre Sdn. Bhd.
17.	KPJ Ampang Puteri Specialist Hospital
18.	KPJ Damai Specialist Hospital
19.	KPJ Damansara Specialist Hospital
20.	KPJ Ipoh Specialist Hospital
21.	KPJ Johor Specialist Hospital
22.	KPJ Kajang Specialist Hospital
23.	KPJ Kedah Medical Centre
24.	KPJ Kuantan Specialist Hospital
25.	KPJ Kuching Specialist Hospital
26.	KPJ Penang Specialist Hospital
27.	KPJ Perdana Specialist Hospital
28.	KPJ Puteri Specialist Hospital / Hospital Pakar Puteri
29.	KPJ Selangor Specialist Hospital
30.	KPJ Seremban Specialist Hospital Sdn Bhd.
31.	Kuantan Medical Centre Sdn. Bhd.
32.	Lam Wah Ee Hospital
33.	Loh Guan Lye & Sons Sdn Bhd (Loh Guan Lye Specialists Centre)
34.	Lourdes Medical Centre
35.	Mahkota Medical Centre Sdn. Bhd
36.	Mawar Renal Medical Centre
37.	Medical Specialist Centre (JB) Sdn. Bhd
38.	Miri City Medical Centre
39.	N. S. Chinese Maternity Hospital & Medical Centre
40.	National Heart Institute Sdn. Bhd.
41.	Pantai Hospital Batu Pahat
42.	Pantai Hospital Ampang
43.	Pantai Hospital Klang
44.	Pantai Hospital Penang (formerly Pantai Mutiara Hospital)
45.	Penang Adventist Hospital (Adventist Hospital & Clinic Services (M)
46.	Prince Court Medical Centre
47.	PUSRAWI Hospital Sdn. Bhd
48.	Putra Medical Centre
49.	Putra Specialist Hospital (Batu Pahat) Sdn. Bhd
50.	Putra Specialist Hospital (Melaka) Sdn. Bhd.
51.	Rafflesia Medical Centre
52.	Sibu Specialist Medical Centre
53.	Sime Darby Medical Centre Subang Jaya
54.	Sri Kota Specialist Medical Centre (SKSMC)
55.	Sri Manjung Specialist Centre Sdn Bhd
56.	Sunway Medical Centre
57.	Tanjung Medical Centre
58.	Timberland Medical Centre

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 Bandar Baharu
5.	Pejabat Kesihatan Daerah Barat Daya
6.	Pejabat Kesihatan Daerah Batang Padang
7.	Pejabat Kesihatan Daerah Batu Pahat
8.	Pejabat Kesihatan Daerah Bentong
9.	Pejabat Kesihatan Daerah Bera
10.	Pejabat Kesihatan Daerah Besut
11.	Pejabat Kesihatan Daerah Dungun
12.	Pejabat Kesihatan Daerah Gombak
13.	Pejabat Kesihatan Daerah Gua Musang
14.	Pejabat Kesihatan Daerah Hilir Perak
15.	Pejabat Kesihatan Daerah Hulu Langat
16.	Pejabat Kesihatan Daerah Hulu Perak
17.	Pejabat Kesihatan Daerah Hulu Selangor
18.	Pejabat Kesihatan Daerah Hulu Terengganu
19.	Pejabat Kesihatan Daerah Jasin
20.	Pejabat Kesihatan Daerah Jelebu
21.	Pejabat Kesihatan Daerah Jeli
22.	Pejabat Kesihatan Daerah Jempol
23.	Pejabat Kesihatan Daerah Jerantut
24.	Pejabat Kesihatan Daerah Johor Bharu
25.	Pejabat Kesihatan Daerah Kangar
26.	Pejabat Kesihatan Daerah Kemaman
27.	Pejabat Kesihatan Daerah Kerian
28.	Pejabat Kesihatan Daerah Kinta
29.	Pejabat Kesihatan Daerah Klang
30.	Pejabat Kesihatan Daerah Kluang
31.	Pejabat Kesihatan Daerah Kota Bharu
32.	Pejabat Kesihatan Daerah Kota Setar
33.	Pejabat Kesihatan Daerah Kota Tinggi
34.	Pejabat Kesihatan Daerah Kuala Kangsar
35.	Pejabat Kesihatan Daerah Kuala Krai
36.	Pejabat Kesihatan Daerah Kuala Langat
37.	Pejabat Kesihatan Daerah Kuala Lipis
38.	Pejabat Kesihatan Daerah Kuala Muda
39.	Pejabat Kesihatan Daerah Kuala Pilah
40.	Pejabat Kesihatan Daerah Kuala Terengganu
41.	Pejabat Kesihatan Daerah Kuantan
42.	Pejabat Kesihatan Daerah Kubang Pasu
43.	Pejabat Kesihatan Daerah Kulim
44.	Pejabat Kesihatan Daerah Langkawi
45.	Pejabat Kesihatan Daerah Larut Matang dan Selama
46.	Pejabat Kesihatan Daerah Machang
47.	Pejabat Kesihatan Daerah Manjung
48.	Pejabat Kesihatan Daerah Maran
49.	Pejabat Kesihatan Daerah Marang
50.	Pejabat Kesihatan Daerah Melaka Tengah
51.	Pejabat Kesihatan Daerah Mersing
52.	Pejabat Kesihatan Daerah Muar
53.	Pejabat Kesihatan Daerah Padang Terap
54.	Pejabat Kesihatan Daerah Pasir Mas
55.	Pejabat Kesihatan Daerah Pasir Puteh
56.	Pejabat Kesihatan Daerah Pekan
57.	Pejabat Kesihatan Daerah Penampang
58.	Pejabat Kesihatan Daerah Pendang
59.	Pejabat Kesihatan Daerah Perak Tengah
60.	Pejabat Kesihatan Daerah Petaling
61.	Pejabat Kesihatan Daerah Pontian
62.	Pejabat Kesihatan Daerah Port Dickson
63.	Pejabat Kesihatan Daerah Raub
64.	Pejabat Kesihatan Daerah Rembau
65.	Pejabat Kesihatan Daerah Rompin
66.	Pejabat Kesihatan Daerah Sabak Bernam
67.	Pejabat Kesihatan Daerah Seberang Perai Selatan
68.	Pejabat Kesihatan Daerah Seberang Perai Tengah
69.	Pejabat Kesihatan Daerah Seberang Perai Utara
70.	Pejabat Kesihatan Daerah Segamat
71.	Pejabat Kesihatan Daerah Semporna
72.	Pejabat Kesihatan Daerah Sepang
73.	Pejabat Kesihatan Daerah Seremban
74.	Pejabat Kesihatan Daerah Setiu
75.	Pejabat Kesihatan Daerah Sik
76.	Pejabat Kesihatan Daerah Tampin
77.	Pejabat Kesihatan Daerah Tanah Merah
78.	Pejabat Kesihatan Daerah Temerloh
79.	Pejabat Kesihatan Daerah Timur Laut
80.	Pejabat Kesihatan Daerah Tumpat

Public Health Authorities participating in NMUS survey

No.	State/ District/Area Health Departments
81.	Pejabat Kesihatan Daerah Yan
82.	Pejabat Kesihatan Kawasan Beaufort
83.	Pejabat Kesihatan Kawasan Beluran
84.	Pejabat Kesihatan Kawasan Keningau
85.	Pejabat Kesihatan Kawasan Kota Kinabalu
86.	Pejabat Kesihatan Kawasan Kudat
87.	Pejabat Kesihatan Kawasan Lahad Datu
88.	Pejabat Kesihatan Kawasan Sandakan
89.	Pejabat Kesihatan Kawasan Tawau
90.	Pejabat Kesihatan Kawasan Tuaran
91.	Pejabat Kesihatan Kuala Selangor
92.	Pejabat Kesihatan Pergigian Bahagian Betong
93.	Pejabat Kesihatan Pergigian Bahagian Labuan
94.	Pejabat Kesihatan Pergigian Bahagian Limbang
95.	Pejabat Kesihatan Pergigian Daerah Cameron Highlands
96.	Pejabat Kesihatan Pergigian Daerah Jelebu
97.	Pejabat Kesihatan Pergigian Daerah Kuala Terengganu
98.	Pejabat Kesihatan Pergigian Daerah Kulim
99.	Pejabat Kesihatan Pergigian Daerah Muar
100.	Pejabat Kesihatan Pergigian Daerah Seremban
101.	Pejabat Kesihatan Pergigian Daerah Timur Laut, Pulau Pinang
102.	Pejabat Kesihatan Pergigian Daerah Yan
103.	Pejabat Kesihatan Pergigian Kangar, Perlis
104.	Pejabat Kesihatan Pergigian Kawasan Keningau
105.	Pejabat Kesihatan Pergigian Kawasan Kudat
106.	Pejabat Kesihatan Putrajaya
107.	Pejabat Kesihatan Wilayah
108.	Pejabat Pergigian Bahagian Kuching
109.	Pejabat Pergigian Bahagian Miri
110.	Pejabat Pergigian Bahagian Samarahan
111.	Pejabat Pergigian Bahagian Sarikei
112.	Pejabat Pergigian Bahagian Sibu
113.	Pejabat Pergigian Bahagian Sri Aman
114.	Pejabat Pergigian Beaufort
115.	Pejabat Pergigian Daerah Petaling
116.	Pejabat Pergigian Daerah Seberang Perai Utara
117.	Pejabat Pergigian Negeri Perak
118.	Pejabat Pergigian Sandakan
119.	Pejabat Pergigian Tawau
120.	Pejabat Perkhidmatan Pergigian Daerah Kemaman
121.	Pejabat Timbalan Pengarah Kesihatan Wilayah Persekutuan KL (Pergigian)

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 Melaka
7.	Jabatan Kesihatan Negeri Sabah
8.	Jabatan Kesihatan Wilayah Persekutuan Kuala Lumpur
9.	National Blood Centre
10.	National Leprosy Control Center

Ministry of Health Institutions participating in NMUS survey

No.	Ministry of Health Institution
1.	College of Allied Health Science, Kuching
2.	College of Allied Health Science, Sg Buloh
3.	College of Community Nursing, Jerantut
4.	College of Community Nursing, Kulim
5.	College of Nursing, Kota Kinabalu
6.	College of Nursing, Kuala Terengganu
7.	College of Nursing, Kubang Kerian
8.	College of Nursing, Pulau Pinang
9.	Divisional Store Kapit
10.	Divisional Store Limbang
11.	Divisional Store Sibu
12.	Institute for Medical Research (IMR)
13.	Institute of Public Health (IPH)
14.	Kolej Kejururawatan Melaka
15.	Kolej Kejururawatan Perak
16.	Makmal Keselamatan dan Kualiti Makanan - P. Pinang
17.	Makmal Kesihatan Awam Kota Kinabalu
18.	Makmal Perubatan Dan Stor Kuching
19.	Makmal Ubat & Stor Miri
20.	Makmal Ubat & Stor Sarikei
21.	Makmal Ubat & Stor Sri Aman
22.	Pusat Bekalan Farmasi Negeri Sabah, Kota Kinabalu
23.	Stor Pergigian Negeri Selangor
24.	Stor Pergigian Pusat Kota Kinabalu
25.	Unit Kawalan Penyakit Bawaan Vektor, Kedah

Primary Care Clinics participating in NMUS survey

No.	Ministry of Health Clinics
1.	Klinik Kesihatan Arau
2.	Klinik Kesihatan Bandar Mentakab
3.	Klinik Kesihatan Bandar Miri
4.	Klinik Kesihatan Beserah
5.	Klinik Kesihatan Beseri
6.	Klinik Kesihatan Bintulu
7.	Klinik Kesihatan Jalan Masjid Kuching
8.	Klinik Kesihatan Jalan Oya
9.	Klinik Kesihatan Kaki Bukit
10.	Klinik Kesihatan Kampung Gial
11.	Klinik Kesihatan Kangar
12.	Klinik Kesihatan Kota Sentosa
13.	Klinik Kesihatan Kuala Perlis
14.	Klinik Kesihatan Kuala Sanglang
15.	Klinik Kesihatan Lanang
16.	Klinik Kesihatan Luyang
17.	Klinik Kesihatan Padang Besar
18.	Klinik Kesihatan Putrajaya
19.	Klinik Kesihatan Sarikei
20.	Klinik Kesihatan Tanah Puteh
21.	Klinik Kesihatan Tudan
22.	Klinik Kesihatan WP Labuan
23.	Klinik Pakar Pergigian
24.	Klinik Pergigian Bentong
25.	Klinik Pergigian Besar Baling
26.	Klinik Pergigian Besar Jalan Gambut, Kuantan
27.	Klinik Pergigian Besar Jitra
28.	Klinik Pergigian Besar Langkawi
29.	Klinik Pergigian Besar Sungai Petani
30.	Klinik Pergigian Besar Telok Wanjah
31.	Klinik Pergigian Bintulu
32.	Klinik Pergigian Daerah Kerian
33.	Klinik Pergigian Hospital Kuala Kangsar
34.	Klinik Pergigian Hospital Mentakab
35.	Klinik Pergigian Hospital Teluk Intan
36.	Klinik Pergigian Hulu Perak
37.	Klinik Pergigian Jeli
38.	Klinik Pergigian Kinta
39.	Klinik Pergigian Komuniti Tapah
40.	Klinik Pergigian Kubang Semang
41.	Klinik Pergigian Lahad Datu
42.	Klinik Pergigian Mukah
43.	Klinik Pergigian Pakar Kuala Pilah
44.	Klinik Pergigian Pasir Puteh
45.	Klinik Pergigian Perak Tengah
46.	Klinik Pergigian Rompin
47.	Poliklinik Komuniti Hospital Sri Aman

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

Primary Care Clinics participating in NMUS survey

No.	Private Clinics
29.	Jose Clinic & Surgery
30.	Kelinik Chan
31.	Kelinik Gopi, Jln Market
32.	Kelinik Liu
33.	Kelinik Mersing
34.	Kelinik Poh Soon Sim Sdn. Bhd
35.	Kelinik Radha Ampang
36.	Kelinik Ratna
37.	Kelinik S Suren
38.	Kelinik Selvam
39.	Khong Klinik
40.	Klinik Australia
41.	Klinik & Surgeri Dorai
42.	Klinik & Surgeri Dr Harvinder
43.	Klinik & Surgeri Sipitang
44.	Klinik & Surgeri Stanley Chong
45.	Klinik Aishah
46.	Klinik Al Farabi Jaya Gading
47.	Klinik Al' Azhim, Klebang
48.	Klinik Al'azhim Tampin
49.	Klinik Al-Insaan
50.	Klinik Ali
51.	Klinik Aman, Shah Alam
52.	Klinik Amardev & Surgery
53.	Klinik Aminah
54.	Klinik Anita
55.	Klinik Anthony
56.	Klinik Ariffin
57.	Klinik Baba
58.	Klinik Bala
59.	Klinik Ban
60.	Klinik Bandar Baru
61.	Klinik Bandar Raya
62.	Klinik Bandaran Sdn. Bhd, SS 15/4D
63.	Klinik Bandaran, Jalan Bunga Melor
64.	Klinik Bandaran, Section 15
65.	Klinik Bersatu
66.	Klinik Bersatu (Tikam Batu)
67.	Klinik Bersatu 16 Jam
68.	Klinik Bersatu 24 Jam
69.	Klinik Bersatu Kulim
70.	Klinik Bintulu
71.	Klinik Bukit Beruang
72.	Klinik Bukit Maluri & Surgeri
73.	Klinik C F Chong
74.	Klinik C. S. Ooi
75.	Klinik Cempaka
76.	Klinik Chai
77.	Klinik Chang
78.	Klinik Cheryan
79.	Klinik Chiew
80.	Klinik Chin
81.	Klinik Chon
82.	Klinik Chong
83.	Klinik Dan Surgeri Dr Gan
84.	Klinik Dan Surgeri Putra
85.	Klinik Dedap (Tmn Jhr Jaya)
86.	Klinik Desa, Desa Petaling
87.	Klinik Doktor Wong
88.	Klinik Dorai
89.	Klinik Doshi
90.	Klinik Dr Bazlan
91.	Klinik Dr Hamid
92.	9Klinik Dr Husna, Tmn Ria
93.	Klinik Dr Karim
94.	Klinik Dr Leela Ratos dan Rakan-Rakan Jln Ipoh
95.	Klinik Dr Mohamad
96.	Klinik Dr Rahim Omar & Rakan-Rakan
97.	Klinik Dr Ramzi
98.	Klinik Dr Ting
99.	Klinik Dr Tuan Yusof
100.	Klinik Dr Umi
101.	Klinik Dr Yong
102.	Klinik Dr. Aishah Dan Dr. Fisol
103.	Klinik Dr. Cheu Sdn. Bhd.
104.	Klinik Dr. Elvin Chong & Surgeri
105.	Klinik Dr. Roslan
106.	Klinik Dr. Wong & Dr. Lau
107.	Klinik Dr. Yasiman Perdana
108.	Klinik Dr. Zakaria & Rakan-Rakan
109.	Klinik Efendi
110.	Klinik Ehsan
111.	Klinik Elizabeth
112.	Klinik Elopura Sdn Bhd - Sedco Complex

No.	Private Clinics
113.	Klinik Endau
114.	Klinik Everlasting Sdn Bhd
115.	Klinik Faiza Woon
116.	Klinik Fateh Mohd & Rakan-Rakan
117.	Klinik Fauzi
118.	Klinik Fettes Park
119.	Klinik G.S
120.	Klinik Ganesha Vijayam
121.	Klinik George Jinivon
122.	Klinik Glugor
123.	Klinik Grace
124.	Klinik Gurdip
125.	Klinik H.T. Lee
126.	Klinik Hamidah
127.	Klinik Healthcare
128.	Klinik Hee Annandan Sdn Bhd
129.	Klinik Hemavathy
130.	Klinik Hisham
131.	Klinik Hossana
132.	Klinik Ian Ong
133.	Klinik Idaman
134.	Klinik Idzham Sdn. Bhd, Bkt Antarabangsa
135.	Klinik Idzham Sdn. Bhd, Danau Kota
136.	Klinik Idzham Sdn. Bhd, Tmn Melawati
137.	Klinik Ikhwan & Surgeri
138.	Klinik J.D.
139.	Klinik Jaafar & Partners
140.	Klinik Jauhar
141.	Klinik Jaya
142.	Klinik Jaya, Subang Jaya
143.	Klinik Jelebu
144.	Klinik Johor (Jalan Dedap)
145.	Klinik Joseph & Surgeri
146.	Klinik K V Tan
147.	Klinik Kapar, Jln Besar Kapar
148.	Klinik Kaulsay
149.	Klinik Keluarga Aishah
150.	Klinik Keluarga Dan Surgeri
151.	Klinik Khizan
152.	Klinik Koidupan
153.	Klinik Kok
154.	Klinik Kok Dan Surgeri
155.	Klinik Kok Dan Wendy
156.	Klinik Kok Wah
157.	Klinik Kok, Jln 17/1A
158.	Klinik Kong
159.	Klinik Kuantan
160.	Klinik Langkawi, Pusat Bandar Kuah
161.	Klinik Lee, Petaling Jaya
162.	Klinik Leela
163.	Klinik Leong
164.	Klinik Leong, Tmn Maluri
165.	Klinik Leong, Tmn Midah
166.	Klinik Liew & Surgeri
167.	Klinik Lim
168.	Klinik Lim & Lau
169.	Klinik Lim Chin Chong Sdn Bhd
170.	Klinik Lo
171.	Klinik Ludher, Jln Kelang Lama
172.	Klinik M Ghana
173.	Klinik Maharani
174.	Klinik Makbul
175.	Klinik Malaysia
176.	Klinik Maniraj
177.	Klinik Maria
178.	Klinik Medan Jaya
179.	Klinik Medi Pembangunan
180.	Klinik Medic Bestari
181.	Klinik Medicare, Jln Bangsar
182.	Klinik Medik 24-7, Bandar Country Homes
183.	Klinik Mediviron (formerly Poliklinik Healthsense)
184.	Klinik Melawati
185.	Klinik Metro, Puchong
186.	Klinik Mitter dan Rakan-Rakan
187.	Klinik Mogan
188.	Klinik Moorthy
189.	Klinik Muhibbah
190.	Klinik Mutiara Inanam
191.	Klinik Nagiah
192.	Klinik Najihah
193.	Klinik Nasha
194.	Klinik Nathan, Bgn Mas
195.	Klinik Neoh
196.	Klinik Noh

Primary Care Clinics participating in NMUS survey

No.	Private Clinics
197.	Klinik Noorleza
198.	Klinik Nur Aqila
199.	Klinik Nur'Aina
200.	Klinik Ong dan Surgeri
201.	Klinik Pakatan Medik
202.	Klinik Pakatan Medik
203.	Klinik Panicker
204.	Klinik Papar Medical Group
205.	Klinik Perdana
206.	Klinik Perdana - Bgn PKINK
207.	Klinik Perdana - Wisma Suara Muda
208.	Klinik Pertama (Tmn Johor Jaya)
209.	Klinik Pertama, Sg Besi
210.	Klinik Perubatan Lita Alis
211.	Klinik Petaling Jaya
212.	Klinik Prihatin
213.	Klinik Prime Care
214.	Klinik Primecare
215.	Klinik Public
216.	Klinik Rabiah
217.	Klinik Radha
218.	Klinik Rahimah
219.	Klinik Rahmat
220.	Klinik Raj (Jasin) Sdn Bhd
221.	Klinik Raj dan Rakan-Rakan, Sentul
222.	Klinik Rakyat
223.	Klinik Rakyat
224.	Klinik Rakyat, Jln Besar Kepong
225.	Klinik Ramabai & Surgeri Sdn Bhd
226.	Klinik Ratnam
227.	Klinik Rawatan Keluarga
228.	Klinik Rawatan Utama
229.	Klinik Reddy PJ
230.	Klinik Reddy Setapak
231.	Klinik Rembau
232.	Klinik Ria
233.	Klinik Roberts
234.	Klinik Roslina
235.	Klinik Sanan
236.	Klinik Sandhu Senai
237.	Klinik Saujana
238.	Klinik Saujana
239.	Klinik Segamat
240.	Klinik Segara, Jln Bangsar
241.	Klinik Senan
242.	Klinik Sentosa
243.	Klinik Sentosa Sdn. Bhd
244.	Klinik Sentosa Sdn. Bhd
245.	Klinik Seremban, Senawang Jaya
246.	Klinik Setia
247.	Klinik Shafi, Jinjang Utara
248.	Klinik Shatin
249.	Klinik Sidhu
250.	Klinik Sihat - Putrajaya
251.	Klinik Simee
252.	Klinik Sinar
253.	Klinik Siva
254.	Klinik Sri Puteri
255.	Klinik Sri Sulong
256.	Klinik Subang Perdana
257.	Klinik Sukimi (Senai)
258.	Klinik Sulaiman Jerantut
259.	Klinik Sungai Besar
260.	Klinik Syed Salleh Dan Rakan-Rakan Sdn. Bhd
261.	Klinik T.A.R.
262.	Klinik TA
263.	Klinik Tan
264.	Klinik Tan Cheng Leng
265.	Klinik Tan See Kin
266.	Klinik Tan, Sg Petani
267.	Klinik Tawakal
268.	Klinik Teh
269.	Klinik Teh
270.	Klinik Tenaga Baru
271.	Klinik Teo
272.	Klinik Teow & Teo Medicare
273.	Klinik Toh & Lim
274.	Klinik Tujuan
275.	Klinik Ummu Roihan Sdn Bhd
276.	Klinik Union
277.	Klinik Utama
278.	Klinik Utama
279.	Klinik Vaithy Nathan
280.	Klinik Venka

No.	Private Clinics
281.	Klinik Vigneshwer
282.	Klinik Voon
283.	Klinik Wang
284.	Klinik Wawasan
285.	Klinik Wawasan 14 Jam
286.	Klinik Wee (Woo Dispensary)
287.	Klinik West Jelutong
288.	Klinik Wong
289.	Klinik Wong Ching Seh
290.	Klinik Y. M. Lo
291.	Klinik Yii
292.	Klinik Yusof
293.	Klinik Zain
294.	Klinik Zainiati
295.	Klinik Zaleha
296.	Kumpulan Medic, Subang Jaya
297.	Kumpulan Perubatan SMP Sdn. Bhd (Klinik Pertama)
298.	Maha Klinik
299.	Medi Klinik Shahrol
300.	Medic-Klinik Lim
301.	Mediklinik Keluarga, Tmn Ipoh Jaya Timur
302.	Ophir Clinic
303.	Perak Medical Centre Sdn. Bhd, Kampar
304.	Perdana Polyclinic Lumut
305.	Perdana Polyclinics Selayang
306.	Poli Klinik, Jln P. Ramlee
307.	Poliklinik & Surgeri Batu Gajah
308.	Poliklinik Central & Surgeri, Jln Genting Klang
309.	Poliklinik Damai & Surgeri, Tmn Desa Jaya
310.	Poliklinik Dan Surgeri Sentosa
311.	Poliklinik Dinamik
312.	Poliklinik Dinamik
313.	Poliklinik Dinamik
314.	Poliklinik Dr Azhar, Jeniang
315.	Poliklinik Dr Norliza
316.	Poliklinik Harmoni
317.	Poliklinik Hidayah
318.	Poliklinik Hidayah
319.	Poliklinik Hidayah,
320.	Poliklinik Intan Sdn Bhd
321.	Poliklinik Jaya Skudai
322.	Poliklinik Kong
323.	Poliklinik Kumpulan City - Dataran Templer
324.	Poliklinik Kumpulan City - Jln Pahang
325.	Poliklinik Kumpulan City - Tmn Connaught
326.	Poliklinik Lai
327.	Poliklinik Liew
328.	Poliklinik Lim & Leong
329.	Poliklinik Lim & Pusat Rawatan Intan
330.	Poliklinik Md. Top
331.	Poliklinik Medic
332.	Poliklinik Meranti
333.	Poliklinik Murni
334.	Poliklinik Pertama
335.	Poliklinik Pusat Rawatan Islam (PCSB)
336.	Poliklinik Raj
337.	Poliklinik Rajen
338.	Poliklinik Rakyat
339.	Poliklinik Rakyat - Cawangan Putatan
340.	Poliklinik Rakyat, Bahau
341.	Poliklinik Raub & Surgery
342.	Poliklinik Ravi
343.	Poliklinik S. Naga
344.	Poliklinik Samudera, Sitiawan
345.	Poliklinik Sandhu
346.	Poliklinik Sentosa
347.	Poliklinik Seri Mas
348.	Poliklinik Tang
349.	Poliklinik Teoh & Ding
350.	Poliklinik Zakariya
351.	Polyklinik Rajoo
352.	Pusat Bersalin & Poliklinik Dr. C.Y.Ong Sdn. Bhd.
353.	Pusat Rawatan Desa Pandan
354.	Sham Poliklinik Sdn. Bhd
355.	Shri Senthil Clinic
356.	Sim's Medical Clinic, Miri
357.	Somu Kelinik
358.	Sushila Clinic
359.	The Key Clinic
360.	The Merican Dispensary
361.	Tiram Medical Centre
362.	Union Clinic
363.	Yoong Clinic Sdn. Bhd

Pharmacies participating in NMUS survey

No.	Private Pharmacies
1.	Mira Pharmacy
2.	51 Avenue Pharmacy Sdn Bhd - Kajang
3.	A-Remedy Pharmacy Sdn.Bhd.
4.	Abby Pharmacy
5.	Activecare Pharmacy Sdn. Bhd.
6.	AK Pharmacy & Naturopathy Centre
7.	Al Nahdi Sdn Bhd
8.	Alcare Pharmacy Sdn Bhd
9.	Alchemist Pharmacy Sdn Bhd
10.	Alex Pharmacy
11.	Allin Pharmacy
12.	Alpro Pharmacy Holdings Sdn Bhd - Pearl Point, Jln Klang Lama
13.	Alpro Pharmacy Holdings Sdn Bhd - Sirusa Jaya, Teluk Kemang
14.	Alpro Pharmacy Sdn Bhd - Oceanic Mall, Port Dickson
15.	Alsyifaa Farmasi (Jerantut) Sdn Bhd
16.	Alsyifaa Farmasi (Pekan) SB
17.	AlSyifaa Farmasi Sdn. Bhd - Muadzam Shah
18.	AM PM Pharmacy Sdn Bhd
19.	Ang Pharmacy
20.	Anis Pharmacy Sdn Bhd - Sek 19, Shah Alam
21.	Apex Pharmacy Corporate Sdn. Bhd
22.	Apex Pharmacy Sdn. Bhd - City Square
23.	Apo's Pharmacy
24.	Apple Green Pharmacy
25.	Apple Pharmacy Sdn Bhd
26.	Armanee Pharmacy Sdn Bhd
27.	Axis Pharmacy Sdn.Bhd.
28.	Axon Pharmacy Sdn. Bhd.
29.	B G Pharmacy (M) Sdn. Bhd.
30.	B Y Chan Pharmacy Sdn Bhd – Channel road
31.	B.B. Pharmacy Sdn.Bhd.
32.	B.J Pharmacy
33.	Bahau Pharmacy SB
34.	Bahau Pharmacy SB
35.	Bahau Pharmacy Sdn Bhd
36.	Baling Pharmacy Sdn. Bhd.
37.	Bath Pharmacy Sdn. Bhd.
38.	BB Boss Sdn Bhd
39.	Be Caring Pharmacy Sdn Bhd - Jalan 14/20
40.	Be Med Sdn Bhd
41.	Be Pharmacy - Puchong Perdana
42.	Be-P Pharmacy
43.	Bees Pharmacy
44.	Bemed (SP) Sdn Bhd
45.	Bemed Venture Sdn Bhd (Be Pharmacy)
46.	Berry Pharmacy
47.	Bettercare Pharmacy Sdn Bhd
48.	Big Bee Pharmacy Sdn Bhd
49.	Bintulu Pharmacy (M) Sdn Bhd - Sg Chua, Kajang
50.	Bintulu Pharmacy (Semenyih) Sdn Bhd
51.	Bio-Dimension Sdn Bhd
52.	Biochem Pharmacy
53.	Biopharma Link Pharmacy Sdn.Bhd.
54.	Bond Mega Pharmacy Sdn Bhd
55.	Boon Pharmacy Sdn.Bhd.
56.	Breeds Pharmacy
57.	Breeds Pharmacy Sdn. Bhd.
58.	Bright Pharmacy Sdn Bhd
59.	BrightCare Pharmacy
60.	BUKIT BARU PHARMACY SDN BHD
61.	Camden Pharmacy (Ipoh) Sdn Bhd
62.	Care Point Pharmacy Sdn Bhd
63.	CareLink Pharmacy
64.	Caremart Pharmacy
65.	Carene Pharmacy
66.	Caring Belle Sdn Bhd - Jln SS2/67
67.	Caring Health Solutions Sdn Bhd
68.	Caring Pharmacy Sdn Bhd
69.	Caring Pharmacy Sdn Bhd - Bandar Utama
70.	Caring Pharmacy Sdn Bhd - Happy Garden
71.	Caring Pharmacy Sdn Bhd - Hartamas
72.	Caring Pharmacy Sdn Bhd - Jln Hujan Rahmat
73.	Caring Pharmacy Sdn Bhd - Sea Park
74.	Caring Pharmacy Sdn Bhd - Tmn Kinrara
75.	Caring Pharmacy Sdn Bhd - Tmn Kok Lian
76.	Ce-Link Pharmacy Sdn Bhd
77.	Central Park Pharmacy
78.	Central Pharmacy Sdn Bhd
79.	Century Pharmacy
80.	Chen Pharmacy
81.	Choong Pharmacy
82.	Chuan Pharmacy

No.	Private Pharmacies
83.	City Medic Pharmacy (M) Sdn Bhd
84.	City Parade Pharmacy
85.	City Pharmacy
86.	City Wellness Pharmacy Sdn.Bhd.
87.	CK Pharmacy
88.	Coco Mart (M) Sdn Bhd
89.	Complete Wellness Pharmacy SB
90.	Concept Pharmacy
91.	Constant Pharmacy - Setapak
92.	Constant Pharmacy - Taman Dahlia
93.	CP Centrecare Pharmacy Sdn Bhd.
94.	CPP Healthcare
95.	D'Lo Concept Sdn Bhd
96.	Dailycare Pharmacy Sdn Bhd
97.	Damai Pharmacy [Brighton Hope Sdn Bhd] - Choice Supermall
98.	Darlina Pharmacy
99.	Darul Intelek Pharma Sdn Bhd
100.	DE Farmasi (Ampang) Sdn Bhd
101.	De Pharmacy
102.	Dekad Pharmacy
103.	Delima Farmasi Sdn Bhd
104.	Desa Farmasi Sdn Bhd - Sg. Bakap
105.	Desa Farmasi Sdn Bhd - Tmn Mutiara
106.	Desmaju Sdn Bhd
107.	Desmaju Sdn.Bhd.
108.	Dextro Pharmacy Sdn. Bhd.
109.	DF Pharmacy Sdn Bhd
110.	Dillons Pharmacy Sdn. Bhd.
111.	Donggongon Pharmacy
112.	Doses Pharmacy Sdn. Bhd.
113.	Doses Pharmacy Sdn. Bhd.
114.	Dynamic PharmaShoppe & H'care
115.	E V Care Pharmacy Sdn Bhd
116.	E.V. Care Pharmacy
117.	Econurture Sdn Bhd
118.	Eennat Pharmacy
119.	Eucare Pharmacy Sdn. Bhd.
120.	Excelcare Chemist
121.	Fable Region Sdn Bhd
122.	Fairchem Pharmacy Sdn Bhd
123.	Famasi Medizone Sdn. Bhd.
124.	Famcare Pharmacy - Off Jln Goh Hock Huat, Klang
125.	Far East Pharm (LD) Sdn Bhd
126.	Far East Pharmacy Sdn Bhd
127.	Far East Pharmacy Sdn Bhd - Fajar Complex
128.	Farmasi ABC Sdn Bhd - Tmn Cheras Makmur
129.	Farmasi Abdullah Sasee
130.	Farmasi Afid
131.	Farmasi Aidan
132.	Farmasi Aiman
133.	Farmasi Air Tawar
134.	Farmasi Akid Sdn Bhd
135.	Farmasi Aktif
136.	Farmasi Al-Ahlam
137.	Farmasi Al-Fatiha
138.	Farmasi Alang Sdn Bhd
139.	Farmasi Aldor
140.	Farmasi Alma
141.	Farmasi Alpha Sdn. Bhd
142.	Farmasi Alychem Sdn. Bhd - Kapar, Klang
143.	Farmasi Alychem Sdn. Bhd - Payar Jeras, Sg. Buloh
144.	Farmasi Alychem Sdn. Bhd - Sg. Long, Kajang
145.	Farmasi Ampangan Sdn Bhd
146.	Farmasi Ang & Ang
147.	Farmasi Anis Sdn Bhd - Kota Damansara
148.	Farmasi Apollo
149.	Farmasi Ara Jaya
150.	Farmasi Ariv Vision
151.	Farmasi Aslam
152.	Farmasi Aslam - Putatan Square
153.	Farmasi Bagan Sdn. Bhd.
154.	Farmasi Bagan Sdn.Bhd.
155.	Farmasi Bagan Serai
156.	Farmasi Baiduri Sdn Bhd
157.	Farmasi Bajrai
158.	Farmasi Balakong Sdn Bhd
159.	Farmasi Bandar Baru Klang
160.	Farmasi Banting - Jenjarom, Kuala Langat
161.	Farmasi Banting - Jln Bunga Pekan, Banting
162.	Farmasi Batu Berendam
163.	Farmasi Batu Maung Sdn.Bhd.
164.	Farmasi Bayan Sdn Bhd

Pharmacies participating in NMUS survey

No.	Private Pharmacies
165.	Farmasi Bentong
166.	Farmasi Berlian
167.	Farmasi Bersatu
168.	Farmasi Bertam
169.	Farmasi Bintang
170.	Farmasi Budaya Sdn. Bhd.
171.	Farmasi Cahaya
172.	Farmasi Cahaya Timur
173.	Farmasi Carrie Sdn Bhd
174.	Farmasi Cemerlang
175.	Farmasi Cenderawasih
176.	Farmasi Chi Liung
177.	Farmasi Chia
178.	Farmasi Delima
179.	Farmasi Derga Sdn Bhd
180.	Farmasi Dinamik
181.	Farmasi Dsafia,
182.	Farmasi Dunia Sihat Sdn. Bhd.
183.	Farmasi Durian Tunggal
184.	Farmasi Eckerd
185.	Farmasi Ehsan - Jerteh
186.	Farmasi Ehsan - Machang
187.	Farmasi Ehsan Medicare - Kuala Krai
188.	Farmasi Ehsan Rantau Panjang
189.	Farmasi Ehsan Setiu
190.	Farmasi Eng Ann
191.	Farmasi EV Care
192.	Farmasi Evergreen Health Sdn Bhd
193.	Farmasi Excel
194.	Farmasi Fajr
195.	Farmasi Famili
196.	Farmasi Fisha
197.	Farmasi Fitrah
198.	Farmasi Gamma
199.	Farmasi GH Sdn Bhd
200.	Farmasi Goh - Bdr Puchong Jaya
201.	Farmasi Golden Pills
202.	Farmasi Goodmedic (Taming Jaya) Sdn Bhd
203.	Farmasi Greenland
204.	Farmasi Greentree
205.	Farmasi Gua Musang
206.	Farmasi Haneem
207.	Farmasi Hata Square
208.	Farmasi Health Point Sdn Bhd
209.	Farmasi Hijrah Sdn Bhd
210.	Farmasi Ikhlas
211.	Farmasi Ikhtiar
212.	Farmasi Ilham Sdn Bhd - Sek 18, Klang
213.	Farmasi Iman
214.	Farmasi Indah
215.	Farmasi Inti
216.	Farmasi Ipoh Garden
217.	Farmasi Ismi
218.	Farmasi Jati
219.	Farmasi Jaya Gading
220.	Farmasi JEC
221.	Farmasi Jerteh
222.	Farmasi JH
223.	Farmasi Juara (Segamat) Sdn Bhd
224.	Farmasi Juara (Segamat) Sdn Bhd
225.	Farmasi Juru
226.	Farmasi Kelana Jaya Sdn Bhd
227.	Farmasi Kepala Batas
228.	Farmasi Kerayong
229.	Farmasi Ketereh
230.	Farmasi Kim Chuan
231.	Farmasi Kita
232.	Farmasi Kita Sdn Bhd
233.	Farmasi Klang
234.	Farmasi Klang HealthCare
235.	Farmasi Komuniti UKM
236.	Farmasi Komuniti Wawasan
237.	Farmasi Kota Sdn. Bhd.
238.	Farmasi Kris
239.	Farmasi Kuala Selangor
240.	Farmasi Kuantan
241.	Farmasi Lemed Sdn Bhd
242.	Farmasi Lemed Sdn Bhd
243.	Farmasi Liew
244.	Farmasi Linda
245.	Farmasi Lunas
246.	Farmasi Makmur Jaya

No.	Private Pharmacies
247.	Farmasi Manir
248.	Farmasi Materia Medica - Putrajaya Hospital
249.	Farmasi Mawar
250.	Farmasi Maxheal Sdn. Bhd.
251.	Farmasi Maxicare
252.	Farmasi Medi Ehsan
253.	Farmasi Medi Mesra
254.	Farmasi Medi-Nur Sdn. Bhd
255.	Farmasi Medipro
256.	Farmasi Medisa
257.	Farmasi Medivita
258.	Farmasi Mee Mi
259.	Farmasi Meru Klg
260.	Farmasi MesraPharma
261.	Farmasi Mewah
262.	Farmasi Millenium Sdn Bhd - Tmn Megah, PJ
263.	Farmasi MJ (Melaka) Sdn Bhd - Batu Berendam
264.	Farmasi Mohd Zubir
265.	Farmasi Muammar
266.	Farmasi Muar
267.	Farmasi Muda Sdn Bhd
268.	Farmasi Muhibah
269.	Farmasi Murni Marketing Sdn Bhd
270.	Farmasi Murni Marketing Sdn. Bhd.
271.	Farmasi Murni Marketing Sdn. Bhd.
272.	Farmasi Murni Marketing Sdn. Bhd.
273.	Farmasi My-Chemist Sdn.Bhd.
274.	Farmasi Nazifa (Cawangan Gurun)
275.	Farmasi Nazri Sdn.Bhd
276.	Farmasi Neu Setbury
277.	Farmasi Nevens Marketing Sdn Bhd
278.	Farmasi NS
279.	Farmasi Nur
280.	Farmasi OCare
281.	Farmasi Optima Health
282.	Farmasi Pakar
283.	Farmasi Pandan Utama
284.	Farmasi Pantai Timur
285.	Farmasi Pauh Sdn.Bhd.
286.	Farmasi Paya Terubong Sdn Bhd
287.	Farmasi PD
288.	Farmasi PD
289.	Farmasi Penawar
290.	Farmasi Pendang
291.	Farmasi Pendang
292.	Farmasi Perdana
293.	Farmasi Peringgit Sdn Bhd
294.	Farmasi Permai
295.	Farmasi Permai Sdn. Bhd.
296.	Farmasi Pertama
297.	Farmasi Petagas
298.	Farmasi Pharmacy Sdn Bhd
299.	Farmasi PJ
300.	Farmasi Plus Care (M) Sdn. Bhd.
301.	Farmasi Pontian Sdn Bhd
302.	Farmasi Prai Sdn Bhd
303.	Farmasi Prihatin Sdn Bhd
304.	Farmasi Puchong
305.	Farmasi QBIZ
306.	Farmasi R S Sdn. Bhd.
307.	Farmasi Rantau
308.	Farmasi Rapat
309.	Farmasi Rasa Sayang
310.	Farmasi Rasah Jaya
311.	Farmasi Rimadex Sdn Bhd - Jln Dusun Muda
312.	Farmasi Rimadex Sdn Bhd - Pauh Panji
313.	Farmasi Rimadex Sdn Bhd - Wakaf Che Yeh
314.	Farmasi Rin
315.	Farmasi Saiza
316.	Farmasi Sas Sdn Bhd
317.	Farmasi Saujana
318.	Farmasi Sayang
319.	Farmasi Sayang Dua
320.	Farmasi SD
321.	Farmasi Seberang Jaya
322.	Farmasi Segar Healthcare Sdn Bhd
323.	Farmasi Sejahtera
324.	Farmasi Sejati
325.	Farmasi Sekilau
326.	Farmasi Sembulan Sdn. Bhd
327.	Farmasi Seng
328.	Farmasi Sentosa

Pharmacies participating in NMUS survey

No.	Private Pharmacies
329.	Farmasi Sentosa Ria Sdn Bhd
330.	Farmasi Serdang (M) Sdn Bhd
331.	Farmasi Seri Melati
332.	Farmasi Seri Petaling Sdn Bhd
333.	Farmasi Setia
334.	Farmasi Setia Indah
335.	Farmasi Sg Ara
336.	Farmasi Sg. Karang
337.	Farmasi Sg. Soi
338.	Farmasi Sihat
339.	Farmasi Sihat Ria
340.	Farmasi Sikamat
341.	Farmasi Sinar
342.	Farmasi Sinar Kulim
343.	Farmasi Sinar Sdn Bhd
344.	Farmasi Siva
345.	Farmasi SJSC Sdn Bhd
346.	Farmasi Spektrum Sdn Bhd
347.	Farmasi Sri Ledang Sdn. Bhd.
348.	Farmasi Sri Nibong
349.	Farmasi Sri Nibong (Pekaka)Sdn.Bhd.
350.	Farmasi Sri Nibong Sdn.Bhd.
351.	Farmasi Sri Pinang
352.	Farmasi Sri Pulau Sdn.Bhd.
353.	Farmasi Sri Tengah
354.	Farmasi Suci
355.	Farmasi Sungai Way
356.	Farmasi Supremecare
357.	Farmasi Suria
358.	Farmasi Sutera
359.	Farmasi Sutera Sdn. Bhd.
360.	Farmasi Syabas - Tmn Sri Gombak
361.	Farmasi Syabas Sdn Bhd
362.	Farmasi Syaza Sdn Bhd
363.	Farmasi Tan
364.	Farmasi Tanjong Sepat
365.	Farmasi Tanjung
366.	Farmasi Tanjung Bungah
367.	Farmasi Taufiq Lim
368.	Farmasi Teck Hong
369.	Farmasi Telok Mas
370.	Farmasi Teratai
371.	Farmasi Tesa
372.	Farmasi Tiara
373.	Farmasi Tiara Sdn Bhd
374.	Farmasi Trio Sdn Bhd - Tmn Sentosa
375.	Farmasi Tunjang
376.	Farmasi Ultracare
377.	Farmasi Unidamai
378.	Farmasi Unipharm
379.	Farmasi Unipharma
380.	Farmasi USJ Sdn Bhd
381.	Farmasi Utama Sdn Bhd
382.	Farmasi Utara
383.	Farmasi Utara Sdn Bhd
384.	Farmasi V-Fung Sdn.Bhd.
385.	Farmasi Vichem & Health Products
386.	Farmasi Vista Jelita Sdn Bhd
387.	Farmasi Vitacare Sdn. Bhd - Desa Pandan
388.	Farmasi Vitacare Sdn. Bhd - Kelana Jaya
389.	Farmasi Voon Sdn Bhd
390.	Farmasi Wangsa Sdn. Bhd
391.	Farmasi Watan
392.	Farmasi Wellness Sdn. Bhd.
393.	Farmasi Wu
394.	Farmasi Wylyn Klang Utama Sdn Bhd
395.	Farmasi Yasmin
396.	Farmasi Yeo Sdn Bhd - Jln Besar, Seri Kembangan
397.	Farmasi Yeo Sdn Sdn - Tmn Bukit Serdang
398.	Farmasi Yogam
399.	Farmasi ZNZ
400.	Farmasi Zora Sdn Bhd
401.	Farmasi Zuli
402.	Farmasi Zuq Sdn Bhd
403.	Favourite Skyline Sdn Bhd
404.	Fawwaz Pharmacy
405.	Firstcare Pharmacy
406.	Flieng Care Pharmacy Sdn. Bhd.
407.	Forever Pharmacy
408.	GBLIM Pharmacy
409.	GC Grace Pharmacy Sdn.Bhd.
410.	GCH Retail (M) Sdn Bhd
411.	GCH Retail (M) Sdn Bhd - Suria KLCC
412.	GCH Retail (Malaysia) Sdn Bhd
413.	GCH Retail (Malaysia) Sdn Bhd
414.	GCH Retail (Malaysia) Sdn. Bhd.
415.	Gerak Utusan Pharmacy Sdn Bhd
416.	Glow Pharma (M) Sdn Bhd
417.	Goodwill Pharmacy
418.	GP Pharmacy
419.	Great Maestro Sdn Bhd
420.	Guardian Pharmacy (M) Sdn Bhd - 1 Utama Shopping Centre
421.	Guardian Pharmacy (M) Sdn Bhd - Alpha Angle
422.	Guardian Pharmacy (M) Sdn Bhd - Ampang Point
423.	Guardian Pharmacy (M) Sdn Bhd - Atria Shopping Centre
424.	Guardian Pharmacy (M) Sdn Bhd - Bintang Plaza Shopping Complex
425.	Guardian Pharmacy (M) Sdn Bhd - Damansara Uptown
426.	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Bayan Baru
427.	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Klang
428.	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Stadium Shah Alam
429.	Guardian Pharmacy (M) Sdn Bhd - Giant Kelana Jaya
430.	Guardian Pharmacy (M) Sdn Bhd - Giant USJ
431.	Guardian Pharmacy (M) Sdn Bhd - Great Eastern Mall
432.	Guardian Pharmacy (M) Sdn Bhd - Gurney Plaza
433.	Guardian Pharmacy (M) Sdn Bhd - Holiday Plaza
434.	Guardian Pharmacy (M) Sdn Bhd - Jalan Bercham
435.	Guardian Pharmacy (M) Sdn Bhd - Jalan Payamas
436.	Guardian Pharmacy (M) Sdn Bhd - Jalan Rahmat
437.	Guardian Pharmacy (M) Sdn Bhd - Jusco Bukit Raja
438.	Guardian Pharmacy (M) Sdn Bhd - Jusco Melaka
439.	Guardian Pharmacy (M) Sdn Bhd - Jusco Metro Prima Kepong
440.	Guardian Pharmacy (M) Sdn Bhd - KB Mall
441.	Guardian Pharmacy (M) Sdn Bhd - KLIA
442.	Guardian Pharmacy (M) Sdn Bhd - Kompleks Karamunsing
443.	Guardian Pharmacy (M) Sdn Bhd - Kompleks PKNS
444.	Guardian Pharmacy (M) Sdn Bhd - Midvalley Megamall
445.	Guardian Pharmacy (M) Sdn Bhd - OUG Plaza
446.	Guardian Pharmacy (M) Sdn Bhd - Section 14, PJ
447.	Guardian Pharmacy (M) Sdn Bhd - Seremban Parade
448.	Guardian Pharmacy (M) Sdn Bhd - Shah Alam Mall
449.	Guardian Pharmacy (M) Sdn Bhd - SS2/64
450.	Guardian Pharmacy (M) Sdn Bhd - Summit Subang USJ
451.	Guardian Pharmacy (M) Sdn Bhd - Sunway Pyramid
452.	Guardian Pharmacy (M) Sdn Bhd - Taman Danau Desa
453.	Guardian Pharmacy (M) Sdn Bhd - Taman Pelangi
454.	Guardian Pharmacy (M) Sdn Bhd - Taman Tun Dr Ismail
455.	Guardian Pharmacy (M) Sdn Bhd - Terminal 1 Shopping Plaza
456.	Guardian Pharmacy - Jaya Jusco Taman Maluri
457.	H-Point Pharmacy
458.	Haitam Health
459.	Han's Pharmacy Sdn.Bhd.
460.	Happy Pharmacy Sdn. Bhd.
461.	Harmoni Farmasi Sdn Bhd
462.	HC Pharmacy
463.	Health Lane Family Pharmacy - Jln Sentul Pasar, Sentul
464.	Health Lane Family Pharmacy - Kg Baru, Sg Buloh
465.	Health Lane Family Pharmacy - Tmn Desa Petaling
466.	Health Lifespring Sdn Bhd
467.	Health Lifespring Sdn Bhd
468.	Health Link Pharmacy
469.	Health Pharm
470.	Health Relief Pharmacy
471.	Healthline Pharmacy
472.	Healthlink Pharmacy
473.	Healthspring Sdn Bhd
474.	Herk Chung Pharmacy (K) Sdn Bhd
475.	Hock Hai Pharmacy Sdn Bhd
476.	Hock Hai Pharmacy Sdn Bhd
477.	Hoewell Pharma Sdn Bhd
478.	Holistic Pharmacy Sdn Bhd
479.	Home-Care Pharmacy Sdn Bhd
480.	Honey And Orange Pharmacy Sdn Bhd
481.	Honey Pharmacy
482.	Honeytree Pharmacy Sdn Bhd
483.	Hong Ai Pharmacy Sdn Bhd
484.	Hovid Pharmacy Sdn Bhd - Jln Yang Kalsom
485.	Howe Cheang Medical Supply S.B
486.	I Care Pharmacy Sdn Bhd
487.	I Care Pharmacy,
488.	I Medikal Pharmaceutical Sdn. Bhd.
489.	I-Venture Pharma Sdn Bhd
490.	Ideal Pharmacy
491.	Imay Pharmacy Sdn. Bhd.
492.	Impact Pharmacy Sdn Bhd

Pharmacies participating in NMUS survey

No.	Private Pharmacies
493.	Impian Pharmahealth
494.	Inanam Pharmacy
495.	Innolink Sdn. Bhd.
496.	Irispharm Ventures Sdn Bhd
497.	Island Chemist Sdn.Bhd.
498.	Izuhan Pharmacy Sdn Bhd
499.	Jasa Pharmacy - Bintang Garden Commercial Centre
500.	Jasa Pharmacy Sdn Bhd - Jalan Dunlop
501.	Jaya - Iss Farmasi
502.	Jecki Medical Supplies Sdn Bhd
503.	JH Pharmacy (Shah Alam) Sdn Bhd
504.	Jian Hong Pharmacy
505.	Jion Pharmacy Sdn Bhd
506.	Jitra Pharmacy Sdn Bhd
507.	Joy Pharmacy
508.	Joy Pharmacy Sdn Bhd
509.	K H Hoe Farmasiutika (Perak) Sdn Bhd
510.	K H Hoe Pharmacal Sdn Bhd
511.	K Pharmacy
512.	K. P. Farmasi Sdn Bhd
513.	K.K.Care Pharmacy Sdn. Bhd.
514.	Karak Pharmacy
515.	Karamunsing Pharmacy Sdn. Bhd.
516.	Karen's Pharmacy Sdn. Bhd.
517.	KC & Hazrina Healthcare Sdn Bhd - Bazaar UO
518.	Kedai Farmasi Ang Teong
519.	Kedai Ubat dan Farmasi Yit Min
520.	Kian Farmasi (Kel) Sdn Bhd
521.	Kien Fatt (Midland) Pharm Sdn Bhd
522.	Kim Yin Pharmacy Sdn. Bhd.
523.	Kinabalu Pharmacy (Batu Pahat) Sdn Bhd
524.	Kinabalu Pharmacy (Batu Pahat) Sdn. Bhd.,
525.	Kinabalu Pharmacy (Donggongon) Sdn Bhd
526.	Kinabalu Pharmacy (SP) Sdn Bhd
527.	Kinabalu Pharmacy Sdn. Bhd.
528.	KNL Medicare
529.	Kok Lian Pharmacy Sdn Bhd
530.	Kota Kinabalu Dispensary Sdn. Bhd.
531.	KU Pharmacy Sdn.Bhd.
532.	Kuala Lumpur Sports Medicine Centre Sdn Bhd (Pharmacy Kuala Lumpur Sports Medicine Centre)
533.	Kulim Pharmacy Sdn. Bhd.
534.	Kumpulan Farmasi Vitacare Sdn Bhd - Ampang Jaya
535.	Kumpulan Farmasi Vitacare Sdn Bhd - Mid Valley
536.	Kumpulan Farmasi Vitacare Sdn Bhd - The Mall
537.	Labuan Farmasi
538.	Laila Pharmacy
539.	Lau & Partners Pharmacy Sdn Bhd
540.	Lau & Partners Pharmacy Sdn Bhd
541.	Lead Pharmacy
542.	Lee Farmasi & Baby Centre Sdn Bhd
543.	Lee Farmasi & Baby Centre Sdn Bhd
544.	Leo Pharmacy Sdn Bhd
545.	Life Care Pharmacy
546.	Life Care Pharmacy Sdn Bhd
547.	Life Pharmacy Sdn. Bhd
548.	Lim Medical Supplies Sdn Bhd
549.	Limbang Pharmacy
550.	Lims' Pharmacy
551.	Ling Chemist Sdn Bhd
552.	Link Pharmacy Sdn Bhd
553.	LJ Fung Pharmacy Sdn Bhd
554.	Loo Pharmacy
555.	Loviena Pharmacy
556.	Loviena Pharmacy
557.	Lyn Pharmacy Sdn Bhd
558.	MAA Pharmacy
559.	Macallum Pharmacy Sdn.Bhd.
560.	Macro Health Care
561.	Maran PharmaShoppe & H'care SB
562.	Maxcare Pharmacy Sdn Bhd
563.	Med-Zone Sdn Bhd
564.	Medi-Home Pharmacy (Larkin) Sdn. Bhd.
565.	Medi-Home Pharmacy (Perintis) Sdn. Bhd.
566.	Medi-Home Pharmacy (Perling) Sdn. Bhd.
567.	Medi-Sinar Pharmacy
568.	Medica Pharmacy
569.	Medical Supplies (Labuan) Sdn Bhd
570.	Medicare Pharmacy
571.	Medichemie Pharmacy (M) Sdn Bhd - Jln Abu Bakar
572.	Medichemie Pharmacy (M) Sdn Bhd - Wakaf Siku
573.	Medichemie Pharmacy (M) Sdn Bhd - Wisma Dewma
574.	Medicine Chest Pharmacy Sdn.Bhd
575.	Medicine Point Sdn Bhd
576.	Mediconstan Pharmacy (D.T) Sdn Bhd - Sungai Besi
577.	Mediconstant Pharmacy (Ampang) Sdn Bhd - Jalan Ampang
578.	Mediconstant Pharmacy (Klang) Sdn Bhd
579.	Mediconstant Pharmacy (Klang) Sdn Bhd
580.	Mediconstant Pharmacy (Puchong) Sdn Bhd
581.	Mediconstant Pharmacy (TTDI) Sdn Bhd
582.	Medihouse Sdn Bhd
583.	Mediland Pharmacy
584.	Mediland Pharmacy
585.	Medilink Pharmacy (Pasir Gudang) Sdn Bhd
586.	Medishop Pharmacy
587.	Medsense Farmasi (PJ) Sdn Bhd
588.	Medsense Healthcare Sdn Bhd
589.	Mega City Pharmacy
590.	Mega Kulim Pharmacy
591.	Mega Kulim Pharmacy Sdn. Bhd.
592.	Mega Kulim Pharmacy Sdn. Bhd.
593.	Mega Kulim Pharmacy Sdn. Bhd.
594.	Mega Pharmacy Sdn. Bhd.
595.	Megacare Pharmacy
596.	Megamal Pharmacy Sdn.Bhd.
597.	Meicare Pharmacy
598.	Mercury Pharmacy Sdn. Bhd
599.	Mercury Pharmacy Sdn. Bhd - Bandar Baru, Jerantut
600.	Mercury Pharmacy Sdn. Bhd - Jln Tengku Bakar
601.	Mercury Pharmacy Sdn. Bhd - Raub
602.	Metro Care Pharmacy
603.	Mico Farmasi Sdn Bhd
604.	Min's Pharmacy Sdn.Bhd.
605.	MN Pharmacy Sdn Bhd - Jln Kuchai
606.	MPS Pharmacy
607.	Multicare Health Pharmacy Sdn Bhd
608.	Multicare Health Pharmacy Sdn Bhd
609.	Multicare Health Pharmacy Sdn Bhd
610.	Multicare Pharmacy (Bahau) SB
611.	Multipurpose Personal & Convenient
612.	Mutiara Pharmacy S/B,
613.	My Pharmacy (Kulai) Sdn. Bhd. - Taman Tampoi Indah
614.	My Pharmacy (M) Sdn. Bhd. - Giant Supermarket, Skudai
615.	My Pharmacy - Jalan Wong Ah Fook
616.	My Pharmacy - Taman Sentosa
617.	My Pharmacy - Taman Suria
618.	N.S Pharmacy Sdn. Bhd
619.	Nasra Pharmacy Sdn Bhd
620.	Nasra Pharmacy Sdn Bhd
621.	Natural Healthy Living Sdn Bhd
622.	Nature - Care Pharmacy Sdn.Bhd.
623.	Nature Pharmacy
624.	Neighbourhood Pharmacy (Georgetown) Sdn.Bhd.
625.	New Age Pharmacy Sdn.Bhd.
626.	Ng & Lee Pharmacy (JB) Sdn. Bhd.
627.	Nilam Pharmacy
628.	North Park Pharmacy
629.	Notts Pharmacy Sdn Bhd
630.	Nutra Healthcare
631.	Nutrimed Pharmacy Enterprise
632.	Oasis Pharmacy Sdn Bhd
633.	Ocean Pharmacy Sdn. Bhd.
634.	One-Stop Pharmacy Sdn Bhd
635.	Online Pursuit Sdn Bhd - Shah Alam
636.	Orange Pharmacy
637.	Orange Pharmacy Sdn. Bhd
638.	Orpla Pharmacy SB
639.	OUG Pharmacy Sdn. Bhd.
640.	Pahang Pharmacy Sdn. Bhd - Bentong
641.	Pahang Pharmacy Sdn. Bhd - Jln Teluk Sisek
642.	Pahang Pharmacy Sdn. Bhd - Kuala Lipis
643.	Pahang Pharmacy Sdn. Bhd - Raub
644.	Pai Wang Pharmacy Sdn Bhd
645.	Palm Pharmacy
646.	Park Pharmacy Sdn Bhd
647.	Paw Brothers Pharmacy Sdn Bhd
648.	PC Murni Pharmacy Sdn Bhd
649.	Pearl Pharmacy Sdn Bhd
650.	Pelangi Pharmacy Sdn Bhd
651.	People's Pharmacy Sdn Bhd - Tmn Melaka Raya
652.	Perennial Pharmacy Sdn Bhd - Plaza Tasek, Skudai
653.	Perennial Pharmacy Sdn Bhd - Tmn Ungku Tun Aminah
654.	Pharma Consult (Kulim) Sdn. Bhd.
655.	Pharma Utama

Pharmacies participating in NMUS survey

No.	Private Pharmacies
656.	Pharma-Consult Sdn Bhd
657.	PharmaCARE (Exquisite Healthcare Sdn. Bhd) - Bdr Baru Permas Jaya
658.	PharmaCARE (Exquisite Healthcare Sdn. Bhd) - Plaza Kotaraya, JB
659.	PharmaCARE (Exquisite Healthcare Sdn. Bhd) - Pusat Bdr Tampoi
660.	PharmaCARE (Exquisite Healthcare Sdn. Bhd) - Taman Perling
661.	Pharmalink Pharmacy
662.	Pharmalink Pharmacy Sdn Bhd
663.	Pharmasave Pharmacy Sdn Bhd
664.	Pharmasave Pharmacy Sdn Bhd
665.	Pharmazat Sdn. Bhd.
666.	Pharmazat Sdn. Bhd.
667.	Pharmcare Sdn Bhd
668.	Pharmex Pharma Sdn. Bhd.
669.	Pharmex Sdn. Bhd.
670.	Plaza Pharmacy Sdn Bhd
671.	Poly Khoo Pharmacy
672.	Poly Pharmacy Sdn Bhd
673.	Praise Pharmacy Sdn Bhd
674.	Prima Pharmacy Sdn Bhd - Wetex Parade, Muar
675.	Prime Pharmacy, Centre
676.	Procare Pharmacy
677.	Prochem Pharmacy
678.	Prohealth Pharmacy
679.	Prosper Pharmacy
680.	PT Bumi Sakti Pharma
681.	Public Chemist (Sabah) Sdn. Bhd
682.	Pure Pharmacy Sdn Bhd
683.	Pure Pharmacy Sdn Bhd
684.	Pure Pharmacy Sdn.Bhd.
685.	Pusat Farmasi USM (Kedai Koop)
686.	Q-Pharma Sdn Bhd
687.	Quinpharm (KL) Sdn Bhd
688.	Quinpharm (M) Sdn Bhd
689.	Radiant Pharmacy Sdn. Bhd.
690.	Radiantcare Pharmacy Sdn Bhd
691.	Rantau Pharmacy
692.	Razzaq Pharmacy
693.	Red Apple Pharmacy
694.	Revive Pharmacy
695.	Rheco Pharmacy
696.	Right Remedy Pharmacy
697.	Rite Aid Pharmacy
698.	RPS Pharmacy
699.	S.P.U. Pharmacy
700.	Safeheal Pharmacy Sdn.Bhd.
701.	Sainuka Habib Sdn Bhd - Batang Berjuntai
702.	Sam Pharmacy
703.	Satok Pharmacy Sdn Bhd
704.	Self Care Pharmacy
705.	Sentosa Pharmacy
706.	Seraya Lagenda Sdn Bhd (Farmasi Dailycare)
707.	Seremban Premier Pharmacy Sdn Bhd
708.	Seriq Medical Supplies Sdn Bhd - Kepong Baru
709.	Servicare Pharmacy Sdn Bhd
710.	Shiv Pharmacy Sdn. Bhd.,
711.	Sia & Sia Pharmacy
712.	Sia & Sia Pharmacy Sdn Bhd
713.	Siang Pharmacy
714.	Siang Pharmacy Sdn.Bhd.
715.	Sibu Pharmacy Sdn Bhd
716.	Sihat Pharmacy
717.	Sim Healthcare & Farmasi Sdn Bhd
718.	Sim Pharmacy
719.	Sim Pharmacy Sdn Bhd
720.	Sinaran Pharmacy
721.	Sincere Care Pharmacy Sdn Bhd
722.	Sincere Pharmacy
723.	Sinma Pharmacy Sdn Bhd
724.	Sinma Pharmacy Sdn Bhd
725.	Sinma Pharmacy Sdn Bhd
726.	SJ Healthtoday Pharmacy Sdn. Bhd
727.	Smartsons Pharmacy Sdn. Bhd.
728.	Sonshine Pharmacy
729.	Southern Pharmacy Sdn. Bhd.
730.	SPS Mutiara Pharmacy Sdn Bhd
731.	Sri Ehsan Pharmahealth
732.	Sri Medic Pharmacy Sdn Bhd
733.	Sri Rambai Pharmacy Sdn.Bhd.
734.	Standard Pharmacy Sdn Bhd
735.	Star Care Pharmacy Sdn Bhd

No.	Private Pharmacies
736.	Stay Caring Sdn Bhd
737.	Stay Caring Sdn Bhd - Tmn Selayang Jaya
738.	Stay Well Pharmacy Sdn.Bhd.
739.	Sterling Pharmacy Sdn Bhd
740.	Straits Pharmacy
741.	Straits Pharmacy(Ayer Keroh) Sdn Bhd
742.	Subang Pharmacy & Trading
743.	Summit Pharmacy,
744.	Sungai Pelek Health Care Enterprise
745.	Sunlight Pharmacy Sdn Bhd
746.	Sunlight Pharmacy Sdn Bhd
747.	Sunshine Pharmacy
748.	Sunshine Pharmacy Sdn.Bhd.
749.	Supreme Pharmacy Sdn Bhd
750.	Syarikat M.S. Ally Sdn Bhd
751.	T J Chua Pharmacy Sdn Bhd
752.	Tal Pharmacy
753.	Tan Pharmacy
754.	Tangkak Pharmacy
755.	Target Farmasi - Tmn Eng Ann, Klang
756.	Target Pharmacy - Sek 9, Shah Alam
757.	Thai Hing Pharmacy Sdn Bhd
758.	Timberland Pharmacy
759.	Times Pharmacy Sdn Bhd
760.	Top Wellness Pharmacy Sdn Bhd
761.	Topaz Pharmacy Sdn Bhd
762.	Total Farmasi - Air Putih, Kuantan
763.	Tuaran Pharmacy
764.	TWL Marketing Sdn Bhd
765.	Tynehealth Pharmacy
766.	U-City Care Pharmacy Sdn. Bhd.
767.	U-Kang Pharmacy Sdn Bhd
768.	U-Kang Pharmacy Sdn Bhd
769.	Udacare Pharmacy Sdn. Bhd.
770.	UKM Kesihatan Sdn Bhd
771.	Unicare Pharmacy (M) Sdn Bhd
772.	Unique Pharmacy
773.	United Caring Venture Sdn Bhd - Jln Pasar
774.	V-Care Pharmacy
775.	Vantage Pharmacy
776.	Vantage Pharmacy
777.	Vcare Pharmacy
778.	Vecare Pharmacy (Sg Dua) Sdn Bhd
779.	Vision Care Pharmacy Sdn Bhd
780.	Viva Caring Pharmacy Sdn Bhd - Jln Barat
781.	Viva Caring Sdn Bhd (Caring Pharmacy) - Jln Radin Anum
782.	Viva Caring Sdn Bhd - Lucky Garden
783.	VK Pharmacy
784.	Vycon Pharmacy Sdn Bhd
785.	Wah Choi Pharmacy Sdn Bhd
786.	Watson's Personal Care Stores Sdn Bhd
787.	Watson's Personal Care Stores Sdn. Bhd - Bandar Utama
788.	Watson's Personal Care Stores Sdn. Bhd - Gurney Plaza
789.	Watson's Personal Care Stores Sdn. Bhd - Jusco Cheras Selatan
790.	Watson's Personal Care Stores Sdn. Bhd - Jusco Taman Equine
791.	Watson's Personal Care Stores Sdn. Bhd - Jusco Tebrau City
792.	Watson's Personal Care Stores Sdn. Bhd - Mid Valley
793.	Watson's Personal Care Stores Sdn. Bhd - Prangin Mall
794.	Watson's Personal Care Stores Sdn. Bhd - Tesco Ipoh
795.	Watson's Personal Care Stores Sdn. Bhd - Tesco Penang
796.	Watson's Personal Care Stores Sdn. Bhd - The Curve
797.	We Care Pharmacy (Kepayan Ridge)
798.	We Care Pharmacy Sdn Bhd
799.	Wellcare Pharmacy
800.	Wise Pharmacy
801.	Wise Pharmacy Sdn.Bhd.
802.	Worldpharma Sdn Bhd
803.	XPLUS ONE Pharmacy Sdn. Bhd.,
804.	Xplus Pharmacy Sdn. Bhd.
805.	YHC Berkat Farmasi
806.	Yin Woh Tong Medical Supply Sdn Bhd
807.	Yunion Pharmacy
808.	YW Yong Farmasi Sdn Bhd
809.	Zenith Pharmacy - TTDI
810.	ZMN Pharmacy Sdn Bhd
811.	Zona Pharmacy Sdn Bhd
812.	Zuffa Pharmacy Sdn Bhd - Bgn Tabung Haji
813.	Zuffa Pharmacy Sdn Bhd - Jln Dewa
814.	Zuffa Pharmacy Sdn Bhd - Tmn Ria Indah