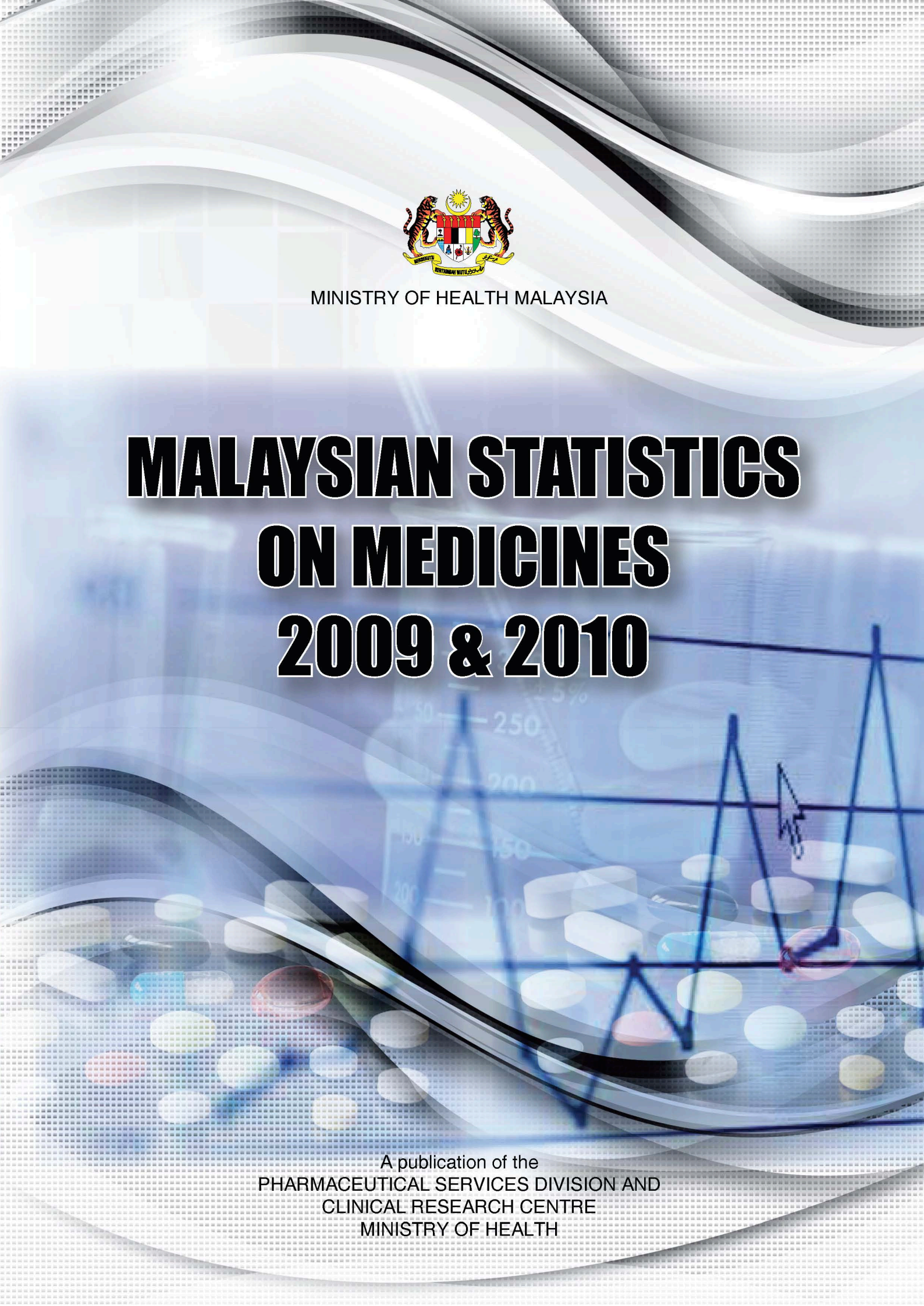
MINISTRY OF HEALTH MALAYSIA

MALAYSIAN STATISTICS ON MEDICINES 2009 & 2010



A publication of the
PHARMACEUTICAL SERVICES DIVISION AND
CLINICAL RESEARCH CENTRE
MINISTRY OF HEALTH

MALAYSIAN STATISTICS ON MEDICINES 2009 & 2010

Edited by:

Siti Fauziah A., Kamarudin A., Nik Nor Aklima N.O.

With contributions from:

Faridah Aryani MY., Fatimah AR., Sivasampu S., Rosliza L., Rosaida M.S., Kiew K.K., Tee H.P., Ooi B.P., Ooi E.T., Ghan S.L., Sugendiren S., Ang S.Y., Muhammad Radzi A.H. , Masni M., Muhammad Yazid J., Nurkhodrulnada M.L., Letchumanan G.R.R., Fuziah M.Z., Yong S.L., Mohamed Noor R., Daphne G., Chang K.M., Tan S.M., Sinari S., Lim Y.S., Tan H.J., Goh A.S., Wong S.P., Fong AYY., Zoriah A, Omar I., Amin AN., Lim CTY, Feisul Idzwan M., Azahari R., Khoo E.M., Bavanandan S., Sani Y., Wan Azman W.A., Yusoff M.R., Kasim S., Kong S.H., Haarathi C., Nirmala J., Sim K.H., Azura M.A., Suganthi T., Chan L.C., Choon S.E., Chang S.Y., Roshidah B., Ravindran J., Nik Mohd Nasri N.I, Wan Hamilton W.H., Zaridah S., Maisarah A.H., Rohan Malek J., Selvalingam S., Lei C.M., Hazimah H., Zanariah H., Hong Y.H.J., Chan Y.Y., Lin S.N., Sim L.H., Leong K.N., Norhayati N.H.S, Sameerah S.A.R, Rahela A.K., Yuzlina M.Y., Hafizah ZA ., Myat SK., Wan Nazuha W.R, Lim YS,Wong H.S., Rosnawati Y., Ong S.G., Mohd. Shahrir M.S., Hussein H., Mary S.C., Marzida M., Choo Y. M., Nadia A.R., Sapiah S., Mohd. Sufian A., Tan R.Y.L., Norsima Nazifah S., Nurul Faezah M.Y., Raymond A.A., Md. Hanip M.R., Toh C.L., Nor Hayati A., Azizul A., Mazni M.J., Umi Adzlin S., Noor Ratna N., Shamini R., Roslina A.M., Pang Y.K., Nurhayati M.M., Suhadah A., Pang S.F., Valuyeetham K.A., Leow W.L., Aswani Yanti B., Elias H., Bethel L., Shamala R., Manimegahlai S., Nur Izzura M.S., Valuyeetham K.A., Leow W.L., Aswani Yanti B., Primuharsa Putra S.H.A., Ho B.K., Husni H., Chan P.L., Norazida A.R., Saraiza A.B., Tan K.K., Rohani J., Nor Saleha I.T., Saidatul Norbaya B., Najwa A.H.

A publication of the

PHARMACEUTICAL SERVICES DIVISION AND

THE CLINICAL RESEARCH CENTRE

MINISTRY OF HEALTH

December 2014
Ministry of Health Malaysia

Published jointly by:

The National Medicines Use Survey
Pharmaceutical Services Division
Ministry of Health
Lot 36, Jalan Universiti
46350 Petaling Jaya
Malaysia

Tel : (603) 7841 3200
Fax : (603) 7968 2222
Website : http://www.pharmacy.gov.my

AND

The National Medicine Use Survey
Clincial Research Centre
Ministry of Health
3rd Floor, MMA House
124, Jalan Pahang
50286 Kuala Lumpur
Malaysia

Tel : (603) 4043 9300
Fax : (603) 4043 9400
e-mail : hsu@crc.gov.my
website : http://www.crc.gov.my

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

Funding:
The National Medicines Use Survey is funded by Operational Budget from Pharamceutical Services Division, Ministry of Health.

ISSN 1823-8300

PREFACE

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

The NMUS is into its ninth year and we are about to publish the sixth report of the Malaysian Statistics on Medicines (MSOM) 2009-2010. Initially from the first publication of MSOM 2004, we have progressively enhancing the data processing by scaling up the survey to a large sample size that requires time to compute and modify data processor to cater for the immense data.

MSOM 2009 & 2010, the drug utilization data is tabulated in such a way as to allow comparison of utilization between 2009 and 2010 as both data were analysed using the same statistical methods. The data was not compared to MSOM 2008 in order to expedite the most current data that is possible to publish at given time and resources. We are optimistic that as NMUS matures, there will be more chapters deliberated and the data processing methodologies will constantly refined, future MSOM reports will continue to produce accurate and reliable statistics on Malaysian medicines consumption at all time.

We sincerely hope that this MSOM 2009-2010 report will be useful to relevant healthcare professionals, serving as a source of reference and baseline for embarking in future research or clinical audits towards promoting rational prescribing and effective medicines use.

We would like to thank all staff who had worked very hard in ensuring the success of the NMUS, all agencies and institutions that had helped in providing data, all expert panel members and everyone who has in one way or another contributed enthusiastically to the success of the NMUS and the writing of this report. No matter how much we can do by ourselves on the national level, whether it be research or development, it is never enough. In a spirit of true cooperation, we must join in an action-oriented effort to uphold the rational use of medicine and healthcare of our nation.

Pharmaceutical Services Division
Ministry of Health Malaysia

ACKNOWLEDGEMENTS

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

- Director General of Health, Malaysia
- Deputy Director General of Health (Research and Technical Support), Ministry of Health (MOH)
- Deputy Director General of Health (Medical Services), MOH
- Deputy Director General of Health (Public Health), MOH
- Senior Director of Pharmaceutical Services Division, MOH
- 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)

- Malaysian Medical Council, Malaysian Medical Association, Malaysian Pharmaceutical Society, The Academy of Family Physicians, Primary Care Doctors Association Malaysia, Malaysian Dental Association, Malaysian Private Dental Practitioners Association

- Pharmaniaga Logistics Sdn Bhd. and Forte Tech Solutions Sdn. Bhd.

- All who have in one way or another supported and/or contributed to the success of the NMUS and this report

Dr. Salmah binti Bahri
Chairman

Dr. Goh Pik Pin
Co-Chairman

National Medicines Use Survey, Ministry of Health Malaysia

ABOUT THE NATIONAL MEDICINES USE SURVEY

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

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

NMUS STEERING COMMITTEE

Chairman

Dr. Salmah binti Bahri
Director of Pharmacy Practice and Development
Pharmaceutical Services Division, Ministry of Health, Malaysia

Co- Chairman

Dr. Goh Pik Pin
Director
Clinical Research Centre, National Institutes of Health,
Ministry of Health, Malaysia

Members

Dr. Sheamini a/p Sivasampu
Head
Healthcare Statistics Unit
Clinical Research Centre, National Institutes of Health,
Ministry of Health, Malaysia

Ms. Siti Fauziah binti Abu
Senior Principal Assistant Director
Pharmaceutical Services Division, Ministry of Health, Malaysia

Mr. Kamarudin bin Ahmad
Senior Assistant Director
Pharmaceutical Services Division, Ministry of Health, Malaysia

Ms. Nik Nor Aklima binti Nik Othseman
Senior Assistant Director
Pharmaceutical Services Division, Ministry of Health, Malaysia

NMUS PROJECT TEAM

Chairman	Dr. Salmah binti Bahri
Co-Chairman	Dr. Goh Pik Pin

NMUS Project Staff

NMUS Project Coordinator	Dr. Sheamini a/p Sivasampu Mr. Kamarudin bin Ahmad
NMUS Project Manager	Mr. Kamarudin Bin Ahmad
Pharmacist Liaison Officer	Ms. Siti Fauziah binti Abu
NMUS Pharmacist	Ms. Nik Nor Aklima binti Nik Othseman

Technical Support Staff

Pharmaco-Epidemiologist	Dr. Faridah Aryani binti Md. Yusof Dr. Nour Hanah binti Othman
Data Entry Personnel	Ms. Safura binti Saad Ms. Nurul Rahmah binti Abdul Rahim
Statistician	Dr. Hoo Ling Ping
IT Manager	Ms. Celine Tsai Pao Chien
Database Developer/Administrator	Mr. Ahmad Hafizh bin Ayob
Network Administrator	Mr. Scott Huang Li Surin Mr. Adlan bin Ab. Rahman

MEMBERS OF NMUS EXPERT PANELS

1. Pharmacoeconomics

MEMBERS	INSTITUTION
Dr. Faridah Aryani bt Md. Yusof	Pharmaceutical Services Division, Minsitry of Health
Dr. Sheamini Sivasampu	Clinical Research Centre, Ministry of Health
Dr. Nour Hanah bt Othman	Pharmaceutical Services Division, Minsitry of Health
Fatimah bt Abdul Rahim	Pharmaceutical Services Division, Minsitry of Health
Rosliza bt Lajis	Pharmaceutical Services Division, Minsitry of Health

2. Gastrointestinal Therapeutics

MEMBERS	INSTITUTION
Dr. Hjh. Rosaida bt. Mohd. Said	Ampang Hospital
Dr. Tee Hoi Poh	Tengku Ampuan Afzan Hospital
Dr Ooi Boon Phoe	Pulau Pinang Hospital
Dr. Kiew Kuang Kiat	Sultanah Bahiyah Hospital
Dr. Ooi Ee Thiam	Kuala Lumpur Hospital
Sugendiren Sugeran	Putrajaya Hospital
Ang Sie Yung	Tengku Ampuan Rahmah Hospital
Ghan Sheah Lin	Universiti Kebangsaan Malaysia Medical Centre

3. Antiobesity

MEMBERS	INSTITUTION
Dr. Masni bt. Mohamad	Putrajaya Hospital
Prof. Madya Dr. Muhammad Yazid b. Jalaludin	Universiti Malaya Medical Centre
Norafidah bt Idris	Serdang Hospital
Nurkhodrulnada bt Muhamad Lattepi	Kuala Lumpur Hospital

4. Antidiabetics

MEMBERS	INSTITUTION
Dr. G.R. Letchuman a/k Ramanathan	Taiping Hospital
Dr. Fuziah bt Mohd. Zain	Putrajaya Hospital
Dr. Yong Sy Liang	Tengku Ampuan Rahimah Hospital
Daphne Gima	Putrajaya Hospital
Mohamed Noor bin Ramli	Universiti Kebangsaan Malaysia Medical Centre

5. Haematology

MEMBERS	INSTITUTION
Dr. Sinari Salleh	Kuala Krai Hospital
Dr. Tan Sen Mui	Ampang Hospital
Lim Yeok Siew	Ampang Hospital
Tan Hui Jun	Ampang Hospital

6. Cardiovascular Therapeutics

MEMBERS	INSTITUTION
Dato' Dr. Omar Ismail	Pulau Pinang Hospital
Dato' Dr. Amin Ariff b. Nuruddin	National Heart Institute
Carilyn Lim Ti Yuen	Tengku Ampuan Rahimah Hospital
Pn. Yanti Nasyuhana bt Md Sani	Heart Centre, General Hospital Sarawak
Prof. Madya Datin Dr Zoriah Bt Aziz	Universiti Malaya

7. Antihypertensives and Renal Therapeutics

MEMBERS	INSTITUTION
Dato' Dr. Azhari Rosman	National Heart Institute
Prof. Dr. Khoo Ee Ming	Universiti Malaya Medical Centre
Dr. Sunita Bavanandan	Kuala Lumpur Hospital
Pn Yanti Nasyuhana bt Md Sani	Heart Centre, General Hospital Sarawak

8. Antilipidemia

MEMBERS	INSTITUTION
Prof. Dr. Wan Azman b. Wan Ahmad	Universiti Malaya Medical Centre
Prof. Madya Dr. Sazzli Shahlan bin Kassim	Universiti Teknologi Mara
Dr. Rahal Yusoff	Kuala Lumpur Hospital
Kong Shue Hong	Universiti Kebangsaan Malaysia Medical Centre
Haarathi Chandriah	Pharmaceutical Services Division, Minsitry of Health
Nirmala A/P Jagan	Kuala Lumpur Hospital

9. Dermatology

MEMBERS	INSTITUTION
Datuk Dr.Roshidah bt. Baba	Melaka Hospital
Dr. Choon Siew Eng	Sultanah Aminah Hospital
Dr. Chan Lee Chin	Pulau Pinang Hospital
Dr. Suganthi Thevarajah	Kuala Lumpur Hospital
Dr. Azura bt Mohd. Affandi	Kuala Lumpur Hospital
Chang Shian Yi	Raja Permaisuri Bainun Hospital

10. Obstetrics and Gynaecology

MEMBERS	INSTITUTION
Dato' Dr. Ravindran Jegasothy	Kuala Lumpur Hospital
Prof. Dato' Dr. Nik Mohd Nasri b. Nik Ismail	Universiti Sains Islam Malaysia
Dr. Wan Hamilton bt Wan Hassan	Serdang Hospital
Dr. Zaridah bt Shaffie	Tuanku Fauziah Hospital
Maisarah bt Abdul Hamid	Kuala Lumpur Hospital

11. Urology

MEMBERS	INSTITUTION
Brig. Jen.Dato' Dr. Selvalingam Sothilingam	Hospital Angkatan Tentera Tuanku Mizan
Hazimah bt Hashim	Pharmaceutical Services Division, Minsitry of Health

12. Endocrine and Metabolic Therapeutics

MEMBERS	INSTITUTION
Dr. Zanariah bt. Hussein	Putrajaya Hospital
Dr. Janet Hong	Putrajaya Hospital
Lin Shu Ning	Tengku Ampuan Rahimah Hospital
Chan Yeen Yee	Teluk Intan Hospital

13. Anti-infectives

MEMBERS	INSTITUTION
Dr. Benedict Sim	Sungai Buloh Hospital
Dr. Leong Kar Nim	Pulau Pinang Hospital
Dr. Muhammad Nazri bin Aziz	Sungai Buloh Hospital
Dr. Nor Hayati Shaharuddin	Melaka Hospital
Rahela bt Ambaras Khan	Sungai Buloh Hospital
Pn. Yuzlina bt Muhamad Yunus	Putrajaya Hospital

14. Antineoplastics, Oncology

MEMBERS	INSTITUTION
Dr. Myat Soe Khine	Sultan Ismail Hospital
Dr. Hafizah Zahara bt Ahmad	National Cancer Centre
Wan Nazuha bt Wan Rusik	Kuala Lumpur Hospital
Lim Yeok Siew	Ampang Hospital

15. Steroids and Immunosuppressives

MEMBERS	INSTITUTION
Dr. Wong Hin Seng	Selayang Hospital
Dr. Rosnawati bt. Yahya	Kuala Lumpur Hospital
Dr. Ong Swee Gaik	Kuala Lumpur Hospital

16. Musculoskeletal Therapeutics

MEMBERS	INSTITUTION
Dr. Heselyn Hussein	Putrajaya Hospital
Prof. Madya Mohd. Shahrir Mohd. Said	Universiti Kebangsaan Malaysia Medical Centre

17. Analgesics and Anaesthetics

MEMBERS	INSTITUTION
Prof. Dr Marzida bt Mansor	Universiti Malaya Medical Centre
Dr. Mary S. Cardosa	Selayang Hospital
Nadia Ahmad Ridzwan	Selayang Hospital
Choo Yan Mei	Tengku Ampuan Rahimah Hospital

18. Neurology

MEMBERS	INSTITUTION
Dato' Dr. Md. Hanip b. Rafia	Kuala Lumpur Hospital
Prof. Dato' Dr. Raymond Azman Ali	Universiti Kebangsaan Malaysia Medical Centre
Dr. Sapiah bt. Sapuan	Sultanah Aminah Hospital
Dr Raymond Tan Yen Leong	Kuala Lumpur Hospital
Dr. Mohd. Sufian Adenan	Kuala Lumpur Hospital
Norsima Nazifah bt Sidek	Sultanah Nur Zahirah Hospital
Nurul Faezah bt Mohd Yusof	Sultanah Nur Zahirah Hospital

19. Psychiatric Therapeutics

MEMBERS	INSTITUTION
Dr. Toh Chin Lee	Selayang Hospital
Dr. Azizul b. Awaluddin	Putrajaya Hospital
Dr. Mazni binti Mat Junus	Serdang Hospital
Dr. Nor Hayati Ali	Selayang Hospital
Dr. Umi Adzlin bt. Silim	Putrajaya Hospital
Noor Ratna bt. Naharuddin	Permai Hospital
Shamini a/p Rama	Bahagia Hospital

20. Respiratory Therapeutics

MEMBERS	INSTITUTION
Dr Nurhayati binti Mohd Marzuki	Institute of Respiratory Medicine
Prof. Madya Dr. Pang Yong Kek	Universiti Malaya Medical Centre
Prof. Dr. Roslina bt. Manap	Universiti Kebangsaan Malaysia Medical Centre
Pn Suhadah bt Ahad	Melaka Hospital
Pang Siow Fen	Tengku Ampuan Najihah Hospital

21. Otorhinolaryngology

MEMBERS	INSTITUTION
Dr. Veluyeetham a/l Komaru Ambu	Tuanku Jaafar Hospital
Dr. Saraiza bt. Abu Bakar	Serdang Hospital
Dr. Primuharsa Putra bin Sabir Husin Athar	KPJ Seremban Specialist Hospital/KPJ Healthcare University College
Aswani Yanti bt Baharuddin	Ampang Hospital
Leow Wooi Leong	Kuala Lumpur Hospital

22. Ophthalmology

MEMBERS	INSTITUTION
Dr. Elias Hussein	Selayang Hospital
Dr. Bethel Indira Livingstone	Tuanku Jaafar Hospital
Dr.Shamala Retnasabapathy	Sg. Buloh Hospital
Nur Izzura Akmal bt Mohd Shoid	Melaka Hospital
Manimegahlai A/P Selvaratnam	Raja Permaisuri Bainun Hospital

23. Cough and Cold

MEMBERS	INSTITUTION
Dr. Saraiza bt. Abu Bakar	Serdang Hospital
Dr. Primuharsa Putra bin Sabir Husin Athar	KPJ Seremban Specialist Hospital/KPJ Healthcare University College
Dr. Tan Kah Kee	Tuanku Jaafar Hospital
Dr. Ho Bee Kiau	Klinik Kesihatan Botanik
Dr. Husni bin Hussain	Klinik Kesihatan Putrajaya
Chan Pui Lim	Pharmacy Service Division, Ministry of Health
Norazida bt. Abdul Rahman	Clinical Research Centre, Ministry of Health

24. Vaccines

MEMBERS	INSTITUTION
Dr. Rohani bt Jahis	Disease Control Division, Ministry of Health
Dr. Tan Kah Kee	Tuanku Jaafar Hospital, Negeri Sembilan
Najwa bt Ahmad Hamdi	Family Health Development Division, Ministry of Health
Nik Nor Aklima bt Nik Othseman	Pharmacy Service Division, Ministry of Health

CONTENTS

METHODS

Lian L.M.[1], Hafizh A.A.[2], Hazimah H.[1], Gan H.H.[1], Kok L.C.[1], Leow A.Y.[1], Lim J.Y.2, Thoo S.[2], Hoo L.P.[3], Faridah A.M.Y.[4], Lim T.O.[1]

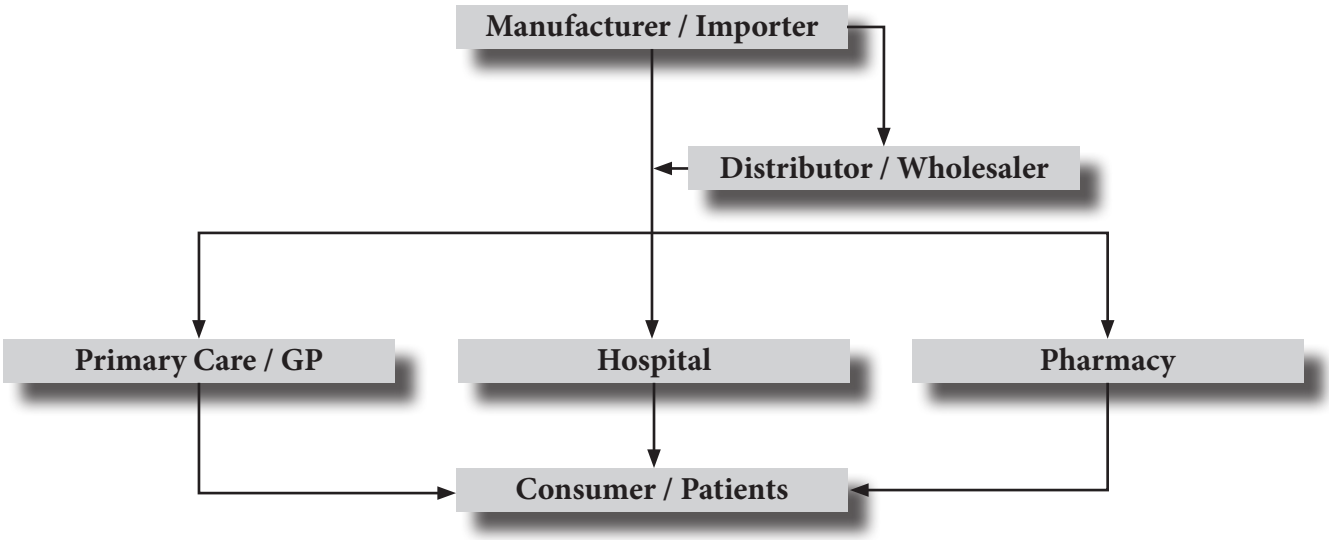
1. Clinical Research Centre, National Institutes of Health, MOH 2. Altus Solutions Sdn. Bhd.,

3. Stats Consult Sdn. Bhd., 4. Pharmaceutical Services Division, MOH

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.

Figure 1: Medicines Supply & Distribution Sysytem and Source of Data



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

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

NMUS Surveys

The NMUS 2009-2010 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)		
	b. MOH individual hospital local purchase (NonAPPL)	2009, 2010	Yes
	c. University and Armed Forces hospitals procurement	2009, 2010	No
	Private hospitals procurement	2009, 2010	No
3.2	Private GPs procurement	2009, 2010	No
3.3	Private specialist practice procurement	Data not collected	
3.4	Private pharmacies procurement	Data not collected	
3.5		Data not collected	
4.	**Medicines prescription data**		
4.1	Public (MOH) primary care practice prescription	Data not collected	No
4.2	Private GP prescription	2009, 2010	Yes
4.3	Private specialist practice prescription of highly specialised medi-	Data not collected	No
4.4	cines	Data not collected	No
	Hospital practice prescription		
5.	**Medicines dispensing data**		
5.1	Public hospital pharmacy dispensing	Data not collected	No
5.2	Private free-standing pharmacy dispensing	2009, 2010	Yes
6.	**Household medicines consumption data**	Data not collected	No
6.1	Household survey on medicines consumption		

Survey population, sampling and response or coverage rate

The surveys conducted by NMUS 2009&2010, 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 2009	COVERAGE 2009	SAMPLE SIZE 2010	COVERAGE 2010
1.	MOH Pharmaceutical procurement	133 MOH hospitals & health a. APPL b. Non APPL	300 198	100%	344 175	100%
2.	Private hospitals pharmaceutical procurement	142 Private hospitals	73	51%	57	40%
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	3 University 2 Armed Forces hospitals	100% for University 100% for Armed Forces
4.	Private GP prescription	6,013	344	7%	845	17%
5.	Private pharmacy dispensing	1663	129	7%	1109	60%

Data collection

The surveys conducted by NMUS collected data either by
1. Download from existing databases
2. Primary data collection
3. 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 and health district local purchase database
2.	Private hospitals pharmaceutical procurement	Individual hospitals' pharmaceutical procurement databases
3.	University and Armed Forces hospital pharmaceutical procurement	Individual hospitals' pharmaceutical procurement databases
4.	Private GP prescription	A sample of GPs collected prescription data in a randomly selected week. The sample being distributed over 3 four-monthly cycle
5.	Private Pharmacy dispensing	A sample of pharmacies with resident pharmacist collected dispensing data in a randomly selected week. The sample being distributed over 3 four-monthly cycle

Data management

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

The NMUS database was created in MS SQL Server. The application has three modules: Contact Management, Data Entry (Retail Pharmacy) 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, prescription booklets or template.
- **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 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 • eNMUS Web Application • National Medical Care Survey (NMCS) Primary Care Prescription dataset The data downloaded could be in flat file format, e.g. TXT/ XLS/PDF and etc, or database files such as Access/ Oracle/ SQL and etc.
2.	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 imported into database and then 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 be linked to the respective SDP in the main contact table.

NO.	DATA PROCESSING FOR PRIMARY SURVEY DATA
1.	*Data entry* Data was entered into the Data Entry module of the database. Prior to data entry, data entry personnel were briefed on how to use the application and enter the data. Necessary precautions were given verbally, for example, to check each clinic by office ID and name, as there 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 were not sufficient, more survey dates were included. Items checked: a. Number of patients were same in survey form and database b. Number of drug entry/ drug prescribed was same in survey form and database. c. Age, sex of patient was entered correctly. d, Drug particulars were entered correctly.
3.	Calculations and Derived variables • Dose per day was obtained by Dosage*frequency • Dose per visit was obtained by Dosage*frequency* duration
4.	Visual review and manual assessment of entries if there were misspellings.

NO.	COMMON DATA PROCESSING STEPS
1.	*BPFK Registered Product List* An estimated 11,305 'prescription' products from 35,570 products registered with BPFK were coded to ATC INN (Level 5). The coded BPFK drugs list served as an internal drug dictionary for medicines data coding.
2.	*Data Parsing by programming* The variables 'Drug Description' and 'Packaging Description' in medicines (procurement/ prescription/ dispensing) data were parsed into smaller parts using a specially written computer program. Parsing facilitated the auto-coding process and dosage calculation later. The variable 'Drug Description' was parsed into 'Brand', 'INN', 'Dosage', 'Unit' and 'Route' e.g. Zocor Tab 80 mg Brand – Zocor Inn – none Dosage – 80 Unit- mg Route – Tab The variable 'Packaging Description' was parsed into 'Big Unit', 'Small Unit' and 'Factor' e.g. Pack of 10 tabs Big Unit – Pack Small Unit – tabs Factor – 10
3.	*ATC Coding* • The parsed 'Brand' was then linked to the coded BPFK drug list to obtain the ATC, INN and DDD. However, if a certain brand had more than 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.

NO.	COMMON DATA PROCESSING STEPS
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). This is recommended by the WHO to be used for drug utilization research and for purpose of comparisons of drug consumption statistics between countries, between regions or population groups within country and to evaluate trends in drug use over time.

Structure of the ATC Classification system

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

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

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

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 simply a technical measure 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 utilisation 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 utilisation 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:

$$\text{DDDs/1000 inhabitants/day} = \frac{\hat{T} \times 1000}{ddd \times P \times 365}$$

$$\text{DDDs/1000 inhabitants/year} = \frac{\hat{T} \times 1000}{ddd \times P}$$

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_{2009} = 28, 081, 500; P_{2010} = 28, 588, 600), 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 below.

NO.	SURVEY	ESTIMATION PROCEED
1	MOH Pharmaceutical procurement: APPL, Non APPL, University and Armed Forces' hospital pharmaceutical procurement	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. $\hat{T} = \sum_{i=1}^{I} T_i$ The total is where T_i is the value of the quantity of drug procured of the i^{th} hospital in the year.
2	Private hospitals pharmaceutical procurement	Data were available for only a sample of hospitals. The total is estimated by $\hat{T} = \sum_{i=1}^{I_j} \sum_{j=1}^{4} w_j T_i$ where T_i is the value of the quantity of drug procured of the i^{th} hospital in the year, j = strata according to bed strength of the hospital, j = 1: bed strength ≤ 20, j = 2: 21 ≤ bed strength ≤ 50, j = 3: 51 ≤ bed strength ≤ 100, j = 4: bed strength ≥ 101. The sampling weight of each strata, $w_j = \frac{B_j}{b_j}$ j = 1, 2, 3, and 4, B_j is total number of beds for hospitals in the population and b_j is total number of beds in the sample for strata j
3	i) Private GP prescription ii) Private pharmacy dispensing	Data were collected only for a sample of GP or pharmacy and for each respondent, data collected only for a sample of days in a year (working days only). The total is estimated by $\hat{T} = \sum_{i=1}^{I} \sum_{j=1}^{7} w_i T_j$ where T_{ij} is the value of the quantity of drug prescribed by the ith GP or pharmacy on the j^{th} day. The sampling weight of the i^{th} GP or pharmacy, $w_i = \frac{N}{n} \times \frac{D}{d_i}$ where N is total number of GP or pharmacy in the population, n is number of responding GP or pharmacy (sample), d_i is the total number of working days in a year, and is the number of survey days of ith 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, UniversityHospitals under the Ministry of Higher Education and MilitaryHospitals 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 utilisation x Price of drug

Quantity of drug utilisation (*DDD*s/1000 inhabitants/day) is determined from the drug utilisation data presented elsewhere in this report.

'Price of drug' is the median price for each drug chemical substance (5^{th} 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 $\mathbf{E_i = p50_i}$ * DDDi where p50 is the median price, DDD is the quantity of utilisation and "i" refers to the drug chemical substance. The total expenditure on a drug chemical substance in a particular sector is the sum of all procurement, prescription and dispensing of the item items in that sector. The total expenditure for the country is the sum of total expenditure in all the sectors.

References:

WHO Collaborating Centre for Drug Statistics Methodology, Guidelines for ATC classification and DDD assignment 2011. Oslo, 2011.

ABBREVIATIONS

5HT1	Serotonin
5-ARI	5 Alpha-reductase inhibitor
ACEI	Angiotensin Converting Enzyme Inhibitors
ACC/AHA	American College of Cardiology / American Heart Association
ACS	Acute Coronary Syndrome
ACTH	Adrenocorticotropic hormone
AdmR	Administration Route
ADHD	Attention Deficit Hyperactivity Disorder
AED	Antiepileptics
ALLHAT	The Antihypertensive and Lipid-Lowering Treatment to Preevnt Heart Attack Trial
APPL	Approve Product Purchase List
ARB	Angiotensin II Antagonists/ Angiotensin Receptor Blocker
ARI	Acute Respiratory Illness
ASCVD	Atherosclerotic Cardiovascular Risk
ATC	Anatomical Therapeutic Chemical
BCG	Bacille Calmette–Guérin
BPFK	Biro Pengawalan Farmaseutikal Kebangsaan
CCB	Calcium Channel Blockers
CNS	Central Nervous System
COMT	Catechol-O-Methytransferase
COPD	Chronic Obstructive Pulmonary Disease
CPG	Clinical Practice Guidelines
CRF	Case Report Form
CRE	Cabapenem Resistant Enterobacterceae
CVD	Cardiovascular Disease
DDA	Dangerous Drugs Act
DDD	Defined Daily Dose
DES	Drug Eluting Stents
DMARD	Disease-modifying antirheumatic drugs
DPP-4	Dipeptidyl peptidase-4
DTaP	Diphtheria Tetanus and Pertussis
EPS	Extrapyramidal Syndrome
EMA	European Medicines Agency
ESBL	Extended spectrum beta-lactamase
ESRD	End-Stage Renal Disease
EGFR	Epidermal Growth Factor Receptor
FDA	Food and Drug Administration
FDC	Fixed-Dosed Combination
GORD/GERD	Gastro-Oesophageal Reflux Disease
GP	General Practitioner
GRACE	Global Registry of Acute Coronary Events
H2RA	H2 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
IPD	Invasive Pneumococcal Disease
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
MDR-TB	Multi drug Resistant Tuberculosis
MMR	Measles Mumps Rubella
MRO	Multiresistant Organism
MOH	Ministry of Health
MSOM	Malaysian Statistics On Medicines
NCVD	National Cardiovascular Database
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
PD	Parkinson's Disease
PDE5	Phosphodiesterase Type-5
PPI	Proton Pump Inhibitors
RAS	Renin-Angiotensin System
PTU	Propylthiouracil
PUVA	Psoralen Ultraviolet light A
rHuEPO	Recombinant Human Erythropoietin
RRMS	Remitting-Relapsing Multiple Sclerosis
SDP	Service Data Provider
SERMS	Selective Estrogen Receptor Modulators
SKU	Stock Keeping Unit
SL	Sublingual
SLE	Systemic Lupus Erythematosus
SSRIs	Selective Serotonin Reuptake Inhibitors
T3	Liothyronine sodium
T4	Levothyroxine
TB	Tuberculosis
TD	Transdermal
TNF	Tumor Necrosis Factor
UFH	Unfractionated Heparin
URTI	Upper respiratory Tract Infection
WFH	World Federation of Haemophilia
WHO	World Health Organisation

CHAPTER 1 : USE OF MEDICINES IN MALAYSIA

Faridah Aryani M.Y.[1], Fatimah A.R.[1], Sivasampu S.[2], Rosliza L.[1]

1.Pharmaceutical Services Division, Ministry of Health, 2.National Clinical Research Centre, Ministry of Health

In this chapter, we report the national estimates for use of medicines in Malaysia from the National Medicines Use Survey 2009 and 2010. This is in line with MOH policy in keeping timely evidence based informations. 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. Statistics are tabulated to facilitate comparison with 2009 and 2010 utilisation.

As in previous years, the National Medicines Use Survey (NMUS) 2009 and 2010 included only drugs which were prescription medicines. Meanwhile, non-prescription medicines such as over-the-counter (OTC) medicines, traditional and complimentary medicines were excluded from the analysis.

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. The Malaysian Statistics on Medicines (MSOM) 2009 and 2010, 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, Opthalmologicals, Otologicals, Cough and 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 for sex hormones and modulators of the genital system drugs have moved into the top 10 list in 2010 and the increase is apparent in the public side. It is interesting to note that corticosteroids has increased greatly in private sector in 2009 and normalised in 2010. However, this phenomenon is unexplainable.

Among the therapeutic groups, drugs used in diabetes (A10) were still the highest in terms of utilisation for both years (Table 1.1, Table 1.2). An estimate of 4.89% (2009) and 5.97% (2010) of the Malaysian population was on drugs from this therapeutic group. This increment of utilisation was apparent in the public sector (24.6%) and highlights the magnitude of the burden of non-communicable disease in the public sector.

For both years, almost all the drugs used for the cardiovascular systems, has increased in the public sector. This increase was highest for calcium channel blockers (C08) followed by lipid modifying agents (C10) and agents acting on the renin angiotensin system (C09) as shown in Table 1.1 and 1.2. However, there is only a slight decrease for beta-blocking agents.

There was a notable reduction (21.8%) for anti-inflammatory and antirheumatic medicines over the 2 years period. It was clearly shown that the private sector is the major contributor with the percentage of reduction of 26.6%. The other therapeutic groups mostly used are antibacterials and antihistamines for systemic use where the drugs were amoxicillin, chlorphenamine, cetirizine and loratadine.

There was an increase (40.8%) in the drug utilisation for the top 30 therapeutic groups over the two years in the public sector. In contrast, the private sector showed 22.1% reduction.

Overall, there was not much difference in ranking for the top 10 individual drug by utilisation when compared to 2010 and 2009. Details are available in Table 1.3 and Table 1.4.

Amlodipine was the most utilised drug in 2010 (Table 1.3). The high utilisation (three fold) of amlodipine was due to change in prescribing category in the MOH formulary listing from A to B and the introduction of generic amlodipine in the public sector. Gliclazide ranked the second highest drug utilised in 2010 but topped the list in 2009 (Table 1.4). Due to its characteristic with less hypoglycaemic effect, Gliclazide was a more preferred choice compared to Glibenclamide.

Most drug in top 20 drugs utilised in 2010 and 2009 were drugs for diabetes and cardiovascular disorders (Table 1.5). This is consistent with the increasing prevalence of chronic disease in Malaysia. The NHMS 20112, 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.

Cardiovascular drugs dominated the top 10 drugs by utilisation for Australia for both years.[3,4] Meanwhile antidiabetic drugs and cardiovascular drugs both appeared among the top 10 drugs listing in Malaysia. Ranking for individual drugs for Malaysia differed somewhat from that of Australia as shown in Table 1.6 and 1.7. This could be

explained by the high prevalence of diabetes in Malaysia compared to Australia.[5]

In conclusion, the overall utilisation pattern of medicines in the country for 2009-2010 appeared to be in accordance with the prevalence of chronic diseases reported in NHMS 2011.[2]

Table 1.1: Top 30 Therapeutic groups by Utilisation in DDD/1000 population/day 2010

RANK	ATC	THERAPEUTIC GROUP	PUBLIC	PRIVATE	TOTAL
1	A10	Drugs used in diabetes	52.4156	7.3012	59.7167
2	C08	Calcium channel blockers	38.5636	4.8431	43.4066
3	C09	Agents acting on the renin-angiotensin system	27.6719	9.6986	37.3705
4	G03	Sex hormones and modulators of the genital system	10.7076	11.6693	22.3769
5	C10	Lipid modifying agents	16.9941	3.8454	20.8395
6	C07	Beta blocking agents	18.3468	1.7139	20.0608
7	C03	Diuretics	16.7267	1.3053	18.0320
8	J01	Antibacterials for systemic use	7.9543	6.6974	14.6517
9	R06	Antihistamines for systemic use	7.6514	5.4770	13.1284
10	M01	Antiinflammatory and antirheumatic products	2.9872	8.8073	11.7945
11	B01	Antithrombotic agents	6.2383	2.7915	9.0298
12	R03	Drugs for obstructive airway diseases	6.2580	2.7590	9.0170
13	R01	Nasal preparations	4.9132	4.0383	8.9515
14	A02	Drugs for acid related disorders	5.1402	1.5727	6.7130
15	A03	Drugs for functional gastrointestinal disorders	4.5504	1.9366	6.4870
16	S01	Ophthalmologicals	4.9918	0.5661	5.5579
17	N05	Psycholeptics	3.5967	1.7163	5.3130
18	H02	Corticosteroids for systemic use	3.5000	1.6913	5.1913
19	A11	Vitamins	3.6406	0.1616	3.8022
20	C01	Cardiac therapy	2.8707	0.8132	3.6839
21	N07	Other nervous system drugs	3.1871	0.3024	3.4895
22	C02	Antihypertensives	2.7234	0.1504	2.8738
23	A07	Antidiarrheals, intestinal antiinflammatory/antiinfective agents	2.0902	0.7206	2.8109
24	N03	Antiepileptics	2.4038	0.1737	2.5775
25	H03	Thyroid therapy	1.5014	0.2781	1.7795
26	N06	Psychoanaleptics	0.8682	0.7684	1.6366
27	M04	Antigout preparations	1.0636	0.4918	1.5554
28	R05	Cough and cold preparations	0.0064	0.9921	0.9985
29	N02	Analgesics	0.3183	0.6681	0.9863
30	J04	Antimycobacterials	0.8476	0.0722	0.9198
		Total utilisation for top 30 therapeutic groups	**260.7291**	**84.0229**	**344.7520**

Table 1.2: Top 30 Therapeutic groups by utilization in ddd/1000 population/day 2009

RANK	ATC	THERAPEUTIC GROUP	PUBLIC	PRIVATE	TOTAL
1	A10	Drugs used in diabetes	42.0556	6.9074	48.9630
2	C08	Calcium channel blockers	20.4728	10.6096	31.0823
3	C09	Agents acting on the renin-angiotensin system	19.7722	4.4640	24.2362
4	C07	Beta blocking agents	17.6028	2.5778	20.1806
5	C03	Diuretics	14.6048	4.3189	18.9237
6	M01	Antiinflammatory and antirheumatic products	3.0869	11.9973	15.0843
7	C10	Lipid modifying agents	8.6305	4.6590	13.2895
8	J01	Antibacterials for systemic use	4.7513	7.9885	12.7398
9	R06	Antihistamines for systemic use	4.3263	7.9234	12.2497
10	H02	Corticosteroids for systemic use	3.6126	8.1238	11.7364
11	G03	Sex hormones and modulators of the genital system	1.3510	10.1422	11.4932
12	R03	Drugs for obstructive airway diseases	6.2667	2.9919	9.2586
13	B01	Antithrombotic agents	5.7784	3.2917	9.0701
14	S01	Ophthalmologicals	6.3974	0.7739	7.1713
15	A02	Drugs for acid related disorders	3.2316	3.2321	6.4637
16	R01	Nasal preparations	2.5914	3.2159	5.8073
17	A03	Drugs for functional gastrointestinal disorders	3.1702	2.5351	5.7053
18	N05	Psycholeptics	3.6577	1.8570	5.5147
19	C01	Cardiac therapy	2.8595	1.0786	3.9381
20	N07	Other nervous system drugs	3.3200	0.6009	3.9209
21	A11	Vitamins	0.4381	2.2543	2.6924
22	C02	Antihypertensives	2.2620	0.1174	2.3794
23	M04	Antigout preparations	0.9109	1.3927	2.3036
24	H03	Thyroid therapy	1.2978	0.5449	1.8427
25	N03	Antiepileptics	1.3146	0.5192	1.8339
26	N06	Psychoanaleptics	0.7139	0.6840	1.3978
27	G01	Gynecological antiinfectives and antiseptics	0.0991	1.0527	1.1519
28	M03	Muscle relaxants	0.0705	0.8362	0.9066
29	A07	Antidiarrheals, intestinal antiinflammatory/antiinfective agents	0.5343	0.3535	0.8878
30	R05	Cough and cold preparations	0.0020	0.8401	0.8421
		Total utilisation for top 30 therapeutic groups	**185.1829**	**107.8840**	**293.0669**

Table 1.3: Top 40 Drugs by Utilisation in DDD/1000 population/day 2010

RANK	ATC	THERAPEUTIC GROUP	PUBLIC	PRIVATE	TOTAL
1	C08C A01	Amlodipine	26.7411	2.9817	29.7228
2	A10B B09	Gliclazide	23.7710	1.9930	25.7640
3	C09A A04	Perindopril	13.7130	0.6026	14.3156
4	A10B A02	Metformin	13.1892	1.1200	14.3092
5	C08C A05	Nifedipine	10.0114	1.5413	11.5527
6	C03A A03	Hydrochlorothiazide	10.6896	0.2586	10.9482
7	G03C A57	Conjugated estrogens	3.6887	6.9684	10.6570
8	C07A B02	Metoprolol	9.8532	0.1297	9.9829
9	C07A B03	Atenolol	7.9423	1.2049	9.1472
10	A10B B01	Glibenclamide	7.6174	0.8190	8.4364
11	C10A A02	Lovastatin	7.3184	0.2211	7.5395
12	R01B A52	Pseudoephedrine, combinations	4.4340	2.9215	7.3556
13	B01A C06	Acetylsalicylic acid	5.0216	1.9351	6.9567
14	C09D B01	Valsartan and amlodipine	0.0806	5.7898	5.8704
15	C03C A01	Furosemide	4.8706	0.6665	5.5370
16	R06A B04	Chlorphenamine	4.3666	0.9880	5.3546
17	C09A A02	Enalapril	4.9205	0.3401	5.2606
18	C10A A01	Simvastatin	3.9898	1.0345	5.0243
19	G03A A07	Levonorgestrel and estrogen	4.3375	0.2362	4.5737
20	C10B X03	Atorvastatin and amlodipine	3.3133	0.9495	4.2628
21	A03B B01	Butylscopolamine	3.3572	0.4494	3.8065
22	G03A C06	Medroxyprogesterone	1.3965	2.2563	3.6528
23	A02B A02	Ranitidine	3.3156	0.2599	3.5754
24	A11C C04	Calcitriol	3.2677	0.1364	3.4041
25	M01A B05	Diclofenac	0.9917	2.3148	3.3066
26	C09A A01	Captopril	3.1559	0.0848	3.2407
27	M01A C06	Meloxicam	0.0725	2.9517	3.0242
28	N07B C02	Methadone	2.6689	0.0604	2.7293
29	M01A G01	Mefenamic acid	0.9959	1.4929	2.4889
30	A10B D02	Metformin and sulfonamides	2.0592	0.3336	2.3928
31	J01C A04	Amoxicillin	1.2172	1.1551	2.3723
32	C02C A01	Prazosin	2.1489	0.0409	2.1898
33	H02A B02	Dexamethasone	1.8031	0.3815	2.1845
34	A10A D01	Insulin & analogues, intermediate-acting combined fast-acting (human)	1.6578	0.5265	2.1842
35	H02A B06	Prednisolone	1.1869	0.9066	2.0935
36	C10A A05	Atorvastatin	1.1493	0.9348	2.0841
37	R06A B02	Dexchlorpheniramine	0.3026	1.7607	2.0633
38	S01E D01	Timolol	1.8964	0.0284	1.9248
39	S01E E01	Latanoprost	1.8319	0.0204	1.8523
40	R06A X13	Loratadine	1.0527	0.7838	1.8365

Table 1.4: Top 40 Drugs by Utilisation in DDD/1000population/day 2009

RANK	ATC	THERAPEUTIC GROUP	PUBLIC	PRIVATE	TOTAL
1	A10B B09	Gliclazide	18.1778	1.6803	19.8581
2	C08C A01	Amlodipine	7.4084	8.9012	16.3096
3	A10B A02	Metformin	12.0487	1.5376	13.5863
4	C08C A05	Nifedipine	11.4735	1.1987	12.6721
5	C03A A03	Hydrochlorothiazide	9.8410	1.3575	11.1985
6	C09A A04	Perindopril	9.4235	0.6801	10.1036
7	C07A B02	Metoprolol	9.5684	0.4117	9.9802
8	A10B B01	Glibenclamide	8.6126	0.7069	9.3196
9	C07A B03	Atenolol	7.5067	1.4346	8.9413
10	B01A C06	Acetylsalicylic acid	4.3759	2.1484	6.5243
11	R06A B04	Chlorphenamine	3.0701	2.5798	5.6499
12	H02A B02	Dexamethasone	1.9373	3.6842	5.6214
13	H02A B06	Prednisolone	1.1475	3.8942	5.0417
14	M01A B05	Diclofenac	0.7527	4.1403	4.8929
15	C10A A02	Lovastatin	4.5844	0.2734	4.8578
16	G03A C06	Medroxyprogesterone	0.3037	4.2866	4.5903
17	C03C A01	Furosemide	3.5595	0.5820	4.1416
18	C09A A02	Enalapril	3.7143	0.4149	4.1293
19	R01B A52	Pseudoephedrine, combinations	2.3108	1.4735	3.7844
20	C10A A01	Simvastatin	2.3137	1.4305	3.7441
21	M01A G01	Mefenamic acid	1.0816	2.3208	3.4024
22	C09A A01	Captopril	3.2357	0.0267	3.2624
23	M01A H01	Celecoxib	0.5008	2.7031	3.2039
24	N07B C02	Methadone	3.0291	0.0050	3.0341
25	S01E D01	Timolol	2.8547	0.0704	2.9251
26	C10A A05	Atorvastatin	0.8377	2.0559	2.8937
27	A03F A01	Metoclopramide	1.3942	1.4387	2.8329
28	R03A C02	Salbutamol	2.3432	0.4322	2.7755
29	G03C A57	Conjugated estrogens	0.1121	2.5707	2.6828
30	A11C C04	Calcitriol	0.3999	2.2021	2.6020
31	A02B C01	Omeprazole	1.0069	1.3640	2.3709
32	J01C A04	Amoxicillin	1.1804	1.1819	2.3623
33	S01E B01	Pilocarpine	2.1927	0.1438	2.3366
34	R06A E07	Cetirizine	0.1615	2.0564	2.2179
35	A03B B01	Butylscopolamine	1.7398	0.4049	2.1447
36	A02B A02	Ranitidine	1.6647	0.4556	2.1203
37	R06A X13	Loratadine	0.7892	1.3043	2.0936
38	C03B A11	Indapamide	0.0194	1.8839	1.9032
39	C02C A01	Prazosin	1.7816	0.0277	1.8094
40	C08C A02	Felodipine	1.3870	0.3641	1.7511

Table 1.5: Top 40 Drugs by Utilisation in DDD/1000population/day 2010 versus 2009

RANK 2010	ATC	DRUG	2010			2009			RANK 2009
			PUBLIC	PRIVATE	TOTAL	PUBLIC	PRIVATE	TOTAL	
1	C08C A01	Amlodipine	26.7411	2.9817	29.7228	7.4084	8.9012	16.3096	2
2	A10B B09	Gliclazide	23.7710	1.9930	25.7640	18.1778	1.6803	19.8581	1
3	C09A A04	Perindopril	13.7130	0.6026	14.3156	9.4235	0.6801	10.1036	6
4	A10B A02	Metformin	13.1892	1.1200	14.3092	12.0487	1.5376	13.5863	3
5	C08C A05	Nifedipine	10.0114	1.5413	11.5527	11.4735	1.1987	12.6721	4
6	C03A A03	Hydrochlorothiazide	10.6896	0.2586	10.9482	9.8410	1.3575	11.1985	5
7	G03C A57	Conjugated estrogens	3.6887	6.9684	10.6570	0.1121	2.5707	2.6828	29
8	C07A B02	Metoprolol	9.8532	0.1297	9.9829	9.5684	0.4117	9.9802	7
9	C07A B03	Atenolol	7.9423	1.2049	9.1472	7.5067	1.4346	8.9413	9
10	A10B B01	Glibenclamide	7.6174	0.8190	8.4364	8.6126	0.7069	9.3196	8
11	C10A A02	Lovastatin	7.3184	0.2211	7.5395	4.5844	0.2734	4.8578	15
12	R01B A52	Pseudoephedrine, combinations	4.4340	2.9215	7.3556	2.3108	1.4735	3.7844	19
13	B01A C06	Acetylsalicylic acid	5.0216	1.9351	6.9567	4.3759	2.1484	6.5243	10
14	C09D B01	Valsartan and amlodipine	0.0806	5.7898	5.8704	0.0043	0.1746	0.1789	177
15	C03C A01	Furosemide	4.8706	0.6665	5.5370	3.5595	0.5820	4.1416	17
16	R06A B04	Chlorphenamine	4.3666	0.9880	5.3546	3.0701	2.5798	5.6499	11
17	C09A A02	Enalapril	4.9205	0.3401	5.2606	3.7143	0.4149	4.1293	18
18	C10A A01	Simvastatin	3.9898	1.0345	5.0243	2.3137	1.4305	3.7441	20
19	G03A A07	Levonorgestrel and estrogen	4.3375	0.2362	4.5737	0.1596	0.3402	0.4998	97
20	C10B X03	Atorvastatin and amlodipine	3.3133	0.9495	4.2628	0.0016	0.0246	0.0262	325
21	A03B B01	Butylscopolamine	3.3572	0.4494	3.8065	1.7398	0.4049	2.1447	35
22	G03A C06	Medroxyprogesterone	1.3965	2.2563	3.6528	0.3037	4.2866	4.5903	16
23	A02B A02	Ranitidine	3.3156	0.2599	3.5754	1.6647	0.4556	2.1203	36
24	A11C C04	Calcitriol	3.2677	0.1364	3.4041	0.3999	2.2021	2.6020	30
25	M01A B05	Diclofenac	0.9917	2.3148	3.3066	0.7527	4.1403	4.8929	14
26	C09A A01	Captopril	3.1559	0.0848	3.2407	3.2357	0.0267	3.2624	22
27	M01A C06	Meloxicam	0.0725	2.9517	3.0242	0.1028	0.5284	0.6313	81
28	N07B C02	Methadone	2.6689	0.0604	2.7293	3.0291	0.0050	3.0341	24
29	M01A G01	Mefenamic acid	0.9959	1.4929	2.4889	1.0816	2.3208	3.4024	21
30	A10B D02	Metformin and sulfonamides	2.0592	0.3336	2.3928	0.7030	0.4135	1.1165	48
31	J01C A04	Amoxicillin	1.2172	1.1551	2.3723	1.1804	1.1819	2.3623	32
32	C02C A01	Prazosin	2.1489	0.0409	2.1898	1.7816	0.0277	1.8094	39
33	H02A B02	Dexamethasone	1.8031	0.3815	2.1845	1.9373	3.6842	5.6214	12
34	A10A D01	Insulin & analogues, intermediate-acting combined fast-acting (human)	1.6578	0.5265	2.1842	0.6095	0.0630	0.6725	74
35	H02A B06	Prednisolone	1.1869	0.9066	2.0935	1.1475	3.8942	5.0417	13
36	C10A A05	Atorvastatin	1.1493	0.9348	2.0841	0.8377	2.0559	2.8937	26
37	R06A B02	Dexchlorpheniramine	0.3026	1.7607	2.0633	0.0167	0.6600	0.6767	72
38	S01E D01	Timolol	1.8964	0.0284	1.9248	2.8547	0.0704	2.9251	25
39	S01E E01	Latanoprost	1.8319	0.0204	1.8523	0.5075	0.0600	0.5675	91
40	R06A X13	Loratadine	1.0527	0.7838	1.8365	0.7892	1.3043	2.0936	37

Table 1.6: Comparison of Top 10 Drugs by Utilisation in DDD/1000 population/day 2009 Malaysia and Australia

RANK	MALAYSIA			AUSTRALIA		
	ATC	DRUG	USE	ATC	DRUG	USE
1	A10B B09	Gliclazide	19.9	C10A A05	Atorvastatin	79.3
2	C08C A01	Amlodipine	16.3	C09C A04	Irbesartan	46.4
3	A10B A02	Metformin	13.6	C09A A04	Perindopril	40.0
4	C08C A05	Nifedipine	12.7	C09A A05	Ramipril	38.4
5	C03A A03	Hydrochlorothiazide	11.2	C09C A06	Candesartan	27.3
6	C09A A04	Perindopril	10.1	C10A A01	Simvastatin	26.8
7	C07A B02	Metoprolol	10.0	N02B E01	Paracetamol	25.4
8	A10B B01	Glibenclamide	9.3	C10A A07	Rosuvastatin	21.8
9	C07A B03	Atenolol	9.0	A02B C05	Esomeprazole	21.5
10	B01A C06	Acetylsalicyclic acid	6.5	C08C A01	Amlodipine	21.0

Table 1.7: Comparison of Top 10 Drugs by Utilisation in DDD/1000 population/day 2010 Malaysia and Australia

RANK	MALAYSIA			AUSTRALIA		
	ATC	DRUG	USE	ATC	DRUG	USE
1	C08C A01	Amlodipine	29.7	C10A A05	Atorvastatin	82.9
2	A10B B09	Gliclazide	25.8	C09C A04	Irbesartan	44.6
3	C09A A04	Perindopril	14.3	C09A A04	Perindopril	40.4
4	A10B A02	Metformin	14.3	C09A A05	Ramipril	36.5
5	C08C A05	Nifedipine	11.6	C10A A07	Rosuvastatin	29.5
6	C03A A03	Hydrochlorothiazide	12.0	C09C A06	Candesartan	29.5
7	G03C A57	Conjugated estrogens	11.0	N02B E01	Paracetamol	28.2
8	C07A B02	Metoprolol	10.0	C10AA01	Simvastatin	25.4
9	C07A B03	Atenolol	9.1	C08C A01	Amlodipine	22.6
10	A10B B01	Glibenclamide	8.4	A02B C05	Esomeprazole	22.2

References:

1. *Guidelines for ATC Classification and DDD Assignment 2012;* WHO Collaborating Centre for Drug Statistics Methodology Printing Office: Oslo December 2012.
2. *National Health and Morbidity Survey:* Non Communicable Diseases 2011 Vol II; Institute for Public Health (IPH) Ministry of Health Malaysia Printing Office: Kuala Lumpur 2011.
3. *Australian Statistics on Medicines 2010;* Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2012.
4. *Australian Statistics on Medicines 2009;* Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2011
5. Australian Bureau of Statistics Home Page. http://www.abs.gov.au/AUSSTATS (accessed Oct 2014)

CHAPTER 2 : EXPENDITURE ON MEDICINES IN MALAYSIA

Faridah Aryani M.Y.[1], Rosliza L.[1], Fatimah A.R.[1], Sivasampu S.[2], Nour Hanah O.[1]

1. Pharmaceutical Services Division, Ministry of Health; 2. Clinical Research Centre, Ministry of Health

This chapter discusses the drug expenditure for 2010 in comparison to that of 2009. The comparison was made 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.

There was a 7.6% increase in drug expenditure for the top 50 drugs in 2010 when compared to 2009. This increase (16.2%) was mainly contributed by the public sector expenditure. In comparison there was a small increase in expenditure (3.1%) seen in the private sector. A similar trend was evident when comparing the top 150 drugs by expenditure; with notable increase in public sector expenditure.

Among the top 40 drugs, the highest expenditure was reported for amlodipine in 2009 (RM123.0 million) and simvastatin in 2010 (RM101.2 million). For these two drugs, more than 50% of the total expenditure was contributed by the private sector. The drugs which were common for both years in the top 10 list of expenditure were simvastatin, atorvastatin, propranolol, perindopril and amlodipine. Amlodipine becomes much more affordable when its generic form was introduced in 2009. This was evident in the public sector as the expenditure for amlodipine dropped 10-fold, from RM85.8 million in 2008 to RM8.2 million in 2010 (Table 2.1).

Antibacterial for systemic use was the highest ranked therapeutic group (J01) in expenditure for both years. The five common antibacterial agents used in both years were ciprofloxacin, cefuroxime, piperacillin and enzyme inhibitor, amoxacillin and enzyme inhibitor, and azithromycin (Table 2.1 and 2.2). Another important finding is that the total expenditure of lipid modifying agents (C10) has increased from RM210.1 million in 2009 to RM328.9 million in 2010; an increase of more than 50%. The expenditure for diabetic drug (A10) has increased by 23.8% for the private sector as compared to only 15.2% in public sector. Beta blocking agents, antihistamines for systemic use and agents acting on the renin-angiotensin system remain in the top 10 therapeutic groups in both years as shown in Table 2.3 and 2.4.

Antidiabetics, lipid modifying agents and cardiovascular drugs were next in the expenditure ranking. There was an increase in the expenditure for antidiabetic drugs by 14.7% in 2010 when compared to 2009 and a great increase (56.0%) for lipid modifying agents as presented in Table 2.6. Conversely, there is a decline in spending on cardiovascular drugs and this is due to a significant drop in drug spending by the private sector.

The total expenditure for antineoplastics (L01) and psycholeptics (N05) in 2010 ranked 5th and 6th respectively, however both the therapeutic groups were not in the top 10 list in 2009 as shown in Table 2.4. The fact that the psycholeptics are being ranked 6th for the total expenditure in Malaysia for 2010 and was absent in the top 10 expenditure for private sector, reflected the burden of mental illness in the public sector. It is also noted that antineoplastics have made an appearance in both sectors in 2010 but was absent in 2009. This is not unexpected in view of the rising usage and emergence of new specialised drugs in the market. In Australia, antineoplastics ranked 4th in the top 10 expenditure list for therapeutic groups for 2009-2010 period[2].

The Malaysian statistics was compared with the Australian drug expenditure list in Table 2.7. In both sectors in Malaysia, antibacterials for systemic use accounted for the highest costs for in 2009 and 2010. Interestingly, this therapeutic group was not among the top 10 drug expenditure for Australia since 2007. Both countries share the common disease burden of non-communicable diseases where the therapeutics groups related to their treatment were mostly listed in the top 10 expenditure.

In conclusion, the increase in expenditure on medicines every year is an indication of the increasing burden of diseases whereby the commitment of the healthcare industries in the country to treat the population and to combat the emerging diseases is essential.

Table 2.1: Top 50 Drugs by Expenditure in RM '000 2010

RANK	ATC	DRUGS	PUBLIC	PRIVATE	TOTAL
1	C10A A01	Simvastatin	14504	86738	101242
2	J01M A02	Ciprofloxacin	5580	94240	99820
3	C10A A05	Atorvastatin	12283	83886	96169
4	C07A A05	Propranolol	92162	831	92993
5	C09A A04	Perindopril	83894	6105	90000
6	N05A H03	Olanzapine	81981	5458	87440
7	J01D C02	Cefuroxime	17784	67867	85651
8	C10A X09	Ezetimibe	2583	68115	70698
9	C08C A01	Amlodipine	8220	52358	60579
10	A02B C01	Omeprazole	6402	50834	57236
11	J05A B01	Aciclovir	3624	52205	55829
12	J07C A06	Diphtheria-Hemophilus influenzae B-pertussis-poliomyelitis-tetanus	50878	3612	54490
13	A10B B09	Gliclazide	26270	28095	54365
14	A02B C02	Pantoprazole	8493	45389	53882
15	R01B A52	Pseudoephedrine, combinations	7122	42881	50003
16	L04A A06	Mycophenolic acid	21225	28311	49536
17	R05D A20	Combinations, cough suppressants opioid alkaloids and derivatives	<1	47596	47596
18	J01C F02	Cloxacillin	5725	38045	43771
19	J01C R05	Piperacillin and enzyme inhibitor	41726	1925	43651
20	B01A C04	Clopidogrel	1931	40549	42480
21	J01C A01	Ampicillin	2223	39736	41959
22	A10B D07	Metformin and sitagliptin	90	39647	39738
23	A10A D01	Insulin & analogues, intermediate-acting combined fast-acting (human)	23275	15271	38545
24	L01X E08	Nilotinib	36145	1385	37530
25	A10B A02	Metformin	20926	16298	37223
26	J01C R02	Amoxicillin and enzyme inhibitor	7284	29450	36735
27	A02B C05	Esomeprazole	13863	21470	35333
28	N07B C02	Methadone	34490	709	35199
29	N03A G01	Valproic acid	23457	11580	35037
30	B02B D08	Eptacog alfa (activated)	4185	30179	34363
31	J01D C04	Cefaclor	0	34100	34100
32	J01M A14	Moxifloxacin	73	33446	33519
33	M01A B01	Indometacin	294	32108	32402
34	J01D H02	Meropenem	30600	1382	31983
35	R06A A02	Diphenhydramine	22705	9200	31905
36	J01F A10	Azithromycin	5079	25534	30613
37	A02B A02	Ranitidine	7050	23126	30175
38	C09A A02	Enalapril	16508	13405	29913
39	A03B B01	Butylscopolamine	15494	14137	29631
40	J01X X08	Linezolid	25568	3717	29285
41	J01E A01	Trimethoprim	86	28405	28491
42	N03A F01	Carbamazepine	4149	24099	28248
43	C09D A07	Telmisartan and diuretics	1882	25069	26950
44	G03D C02	Norethisterone	262	26596	26858
45	A08A B01	Orlistat	18808	7998	26806
46	B03X A01	Erythropoietin	18148	8443	26591
47	L02B G04	Letrozole	5172	21392	26564
48	L01B C06	Capecitabine	3093	23150	26242
49	J02A C01	Fluconazole	6912	19105	26017
50	R06A E07	Cetirizine	145	25781	25926
		Total Top 20 drugs by Expenditure in 2010	**492388**	**845041**	**1337429**
		Total Top 50 drugs by Expenditure in 2010	**840355**	**1450956**	**2291311**
		Total Top 150 drugs by Expenditure in 2010	**1560415**	**2294719**	**3855134**

Table 2.2: Top 50 Drugs by Expenditure in RM '000 2009

RANK	ATC	DRUGS	PUBLIC	PRIVATE	TOTAL
1	C08C A01	Amlodipine	2341	120677	123018
2	C07A A05	Propranolol	71603	6213	77816
3	C07A G01	Labetalol	3294	74138	77432
4	C10A A05	Atorvastatin	7732	63758	71489
5	M01A H01	Celecoxib	4466	65205	69671
6	B01A C04	Clopidogrel	7539	59314	66853
7	C10A A01	Simvastatin	10913	49642	60555
8	C09A A04	Perindopril	54630	5806	60435
9	C07A G02	Carvedilol	15408	43362	58770
10	J01D C02	Cefuroxime	16776	38322	55097
11	C01D A08	Isosorbide dinitrate	1819	51711	53530
12	J01M A02	Ciprofloxacin	2264	49117	51381
13	A10B F01	Acarbose	42397	6823	49220
14	R05D A20	Combinations, cough suppressants opioid alkaloids and derivatives	0	47583	47583
15	A10B B09	Gliclazide	19178	28362	47540
16	N05A H03	Olanzapine	45436	657	46092
17	J01F A01	Erythromycin	6559	37917	44476
18	J01C R02	Amoxicillin and enzyme inhibitor	3793	40508	44301
19	N03A X14	Levetiracetam	38362	5880	44242
20	J01D D08	Cefixime	0	43352	43352
21	M01A B05	Diclofenac	647	41532	42179
22	B02B D08	Eptacog alfa (activated)	404	40849	41253
23	N03A F01	Carbamazepine	32268	8211	40480
24	N06B X03	Piracetam	511	39237	39748
25	R06A E07	Cetirizine	63	38853	38916
26	R03A C02	Salbutamol	33015	5866	38881
27	A10B A02	Metformin	18787	17829	36616
28	J07B F02	Poliomyelitis oral, trivalent, live attenuated	35648	13	35661
29	N07B C02	Methadone	35317	58	35375
30	J07C A06	Diphtheria-Hemophilus influenzae B-pertussis-poliomyelitis-tetanus	30921	3966	34887
31	C10A A07	Rosuvastatin	2415	30028	32443
32	C03B A11	Indapamide	709	31364	32073
33	C08C A05	Nifedipine	8875	23140	32014
34	R06A E01	Buclizine	0	30635	30635
35	J01E E01	Sulfamethoxazole and trimethoprim	1601	28944	30545
36	A02B C05	Esomeprazole	7300	23211	30512
37	C07A B02	Metoprolol	21673	7266	28940
38	A02B C02	Pantoprazole	7702	20703	28405
39	C01A A05	Digoxin	2986	25088	28074
40	J01C R05	Piperacillin and enzyme inhibitor	26627	1413	28040
41	C07A B03	Atenolol	7830	19994	27824
42	A03F A01	Metoclopramide	2884	23415	26298
43	R06A A52	Diphenhydramine, combinations	15447	10348	25795
44	G03A A07	Levonorgestrel and estrogen	5611	19999	25610
45	J01F A10	Azithromycin	13879	11167	25047
46	N07B C51	Buprenorphine, combinations	0	24891	24891
47	A02B C01	Omeprazole	7781	17101	24882
48	N03A X11	Topiramate	20947	3528	24475
49	B03X A01	Erythropoietin	5309	18356	23665
50	J07B D52	measles, combinations with mumps and rubella, live attenuated	21719	1188	22907
		Total Top 20 drugs by Expenditure in 2009	**354508**	**838346**	**1192855**
		Total Top 50 drugs by Expenditure in 2009	**723385**	**1406543**	**2129927**
		Total Top 150 drugs by Expenditure in 2009	**1184152**	**2219397**	**3403549**

Table 2.3: Top 10 Therapeutic Groups by Expenditure in RM '000 2010

RANK	ATC	THERAPEUTIC	PUBLIC	PRIVATE	TOTAL
1	J01	ANTIBACTERIALS FOR SYSTEMIC USE	246469	558698	805167
2	C10	LIPID MODIFYING AGENTS	48818	280078	328896
3	A10	DRUGS USED IN DIABETES	129441	170227	299668
4	C09	AGENTS ACTING ON THE RENIN-ANGIOTENSIN SYSTEM	181880	110749	292629
5	L01	ANTINEOPLASTIC AGENTS	148126	139146	287271
6	N05	PSYCHOLEPTICS	142892	84333	227225
7	C07	BETA BLOCKING AGENTS	156274	43400	199674
8	A02	DRUGS FOR ACID RELATED DISORDERS	38463	154315	192778
9	R06	ANTIHISTAMINES FOR SYSTEMIC USE	29858	138423	168281
10	J05	ANTIVIRALS FOR SYSTEMIC USE	84517	79761	164278

Table 2.4: Top 10 Therapeutic Groups by Expenditure in RM '000 2009

RANK	ATC	THERAPEUTIC	PUBLIC	PRIVATE	TOTAL
1	J01	ANTIBACTERIALS FOR SYSTEMIC USE	146469	404845	551314
2	C07	BETA BLOCKING AGENTS	122431	159211	281642
3	A10	DRUGS USED IN DIABETES	112341	137525	249865
4	C10	LIPID MODIFYING AGENTS	39094	170956	210050
5	C09	AGENTS ACTING ON THE RENIN-ANGIOTENSIN SYSTEM	111395	73445	184840
6	C08	CALCIUM CHANNEL BLOCKERS	25757	152775	178531
7	N03	ANTIEPILEPTICS	116924	57977	174901
8	R06	ANTIHISTAMINES FOR SYSTEMIC USE	21582	143829	165410
9	M01	ANTIINFLAMMATORY AND ANTIRHEUMATIC PRODUCTS	10231	150547	160778
10	B01	ANTITHROMBIC AGENTS	45827	112939	158767

Table 2.5 Top 40 Drugs Ranked by Expenditure for year 2009 and 2010 in RM '000

RANK	ATC	DRUGS	PUBLIC		PRIVATE		TOTAL	
			2009	2010	2009	2010	2009	2010
1	C10A A01	Simvastatin	10913	14504	49642	86738	60555	101242
2	J01M A02	Ciprofloxacin	2264	5580	49117	94240	51381	99820
3	C10A A05	Atorvastatin	7732	12283	63758	83886	71489	96169
4	C07A A05	Propranolol	71603	92162	6213	831	77816	92993
5	C09A A04	Perindopril	54630	83894	5806	6105	60435	90000
6	N05A H03	Olanzapine	45436	81981	657	5458	46092	87440
7	J01D C02	Cefuroxime	16776	17784	38322	67867	55097	85651
8	C10A X09	Ezetimibe	2276	2583	3104	68115	5380	70698
9	C08C A01	Amlodipine	2341	8220	120677	52358	123018	60579
10	A02B C01	Omeprazole	7781	6402	17101	50834	24882	57236
11	J05A B01	Aciclovir	2276	3624	9122	52205	11398	55829
12	J07C A06	Diphtheria-Hemophilus influenzae B-pertussis-poliomyelitis-tetanus	30921	50878	3966	3612	34887	54490
13	A10B B09	Gliclazide	19178	26270	28362	28095	47540	54365
14	A02B C02	Pantoprazole	7702	8493	20703	45389	28405	53882
15	R01B A52	Pseudoephedrine, combinations	1261	7122	16408	42881	17669	50003
16	L04A A06	Mycophenolic acid	3467	21225	6090	28311	9557	49536
17	R05D A20	Combinations, cough suppressants opioid alkaloids and derivatives	<1	<1	47583	47596	47583	47596
18	J01C F02	Cloxacillin	6787	5725	10146	38045	16934	43771
19	J01C R05	Piperacillin and enzyme inhibitor	26627	41726	1413	1925	28040	43651
20	B01A C04	Clopidogrel	7539	1931	59314	40549	66853	42480
21	J01C A01	Ampicillin	2660	2223	2150	39736	4810	41959
22	A10B D07	Metformin and sitagliptin	0	90	15764	39647	15764	39738
23	A10A D01	Insulin & analogues, intermediate-acting combined fast-acting (human)	8910	23275	1303	15271	10213	38545
24	L01X E08	Nilotinib	465	36145	0	1385	465	37530
25	A10B A02	Metformin	18787	20926	17829	16298	36616	37223
26	J01C R02	Amoxicillin and enzyme inhibitor	3793	7284	40508	29450	44301	36735
27	A02B C05	Esomeprazole	7300	13863	23211	21470	30512	35333
28	N07B C02	Methadone	35317	34490	58	709	35375	35199
29	N03A G01	Valproic acid	8927	23457	8499	11580	17427	35037
30	B02B D08	Eptacog alfa (activated)	404	4185	40849	30179	41253	34363
31	J01D C04	Cefaclor	46	0	2069	34100	2115	34100
32	J01M A14	Moxifloxacin	37	73	8892	33446	8929	33519
33	M01A B01	Indometacin	370	294	272	32108	642	32402
34	J01D H02	Meropenem	837	30600	994	1382	1831	31983
35	R06A A02	Diphenhydramine	90	22705	7158	9200	7248	31905
36	J01F A10	Azithromycin	13879	5079	11167	25534	25047	30613
37	A02B A02	Ranitidine	5643	7050	15667	23126	21310	30175
38	C09A A02	Enalapril	12199	16508	4418	13405	16617	29913
39	A03B B01	Butylscopolamine	9167	15494	5410	14137	14577	29631
40	J01X X08	Linezolid	6719	25568	786	3717	7505	29285

**ranking acording to 2010*

Table 2.6: Top 10 Therapeutic Groups, Ranked by Expenditure

ATC	DRUG CLASS	2009			2010		
		PUBLIC	PRIVATE	TOTAL	PUBLIC	PRIVATE	TOTAL
A10	**DRUGS USED IN DIABETES**						
A10A	Insulins and analogues	22688	22554	45242	56048	24826	80874
A10B A	Biguanides	18787	17829	36616	20926	16298	37223
A10B B	Sulfonamides, urea derivatives	22063	48593	70656	29499	41820	71319
A10B D	Combinations of oral blood glucose lowering drugs	1483	21260	22743	4646	48477	53124
A10B F	Alpha glucosidase inhibitors	42397	6823	49220	8218	2395	10613
A10B G	Thiazolidinediones	2581	7773	10354	6609	2986	9595
A10B X	Other blood glucose lowering drugs, excl. Insulins	2217	1996	4213	2681	8920	11602
	Subtotal	**112216**	**126828**	**239044**	**128627**	**145722**	**274350**
C	**CARDIOVASCULAR SYSTEM DRUGS**						
C02A	Antiadrenergic agents, centrally acting	1995	716	2711	2982	925	3906
C02C A	Alpha-adrenoreceptor antagonists	7875	5347	13222	9473	3588	13061
C02D	Arteriolar smooth muscle, agents acting on	829	6565	7394	784	5355	6140
C02K	Other antihypertensives	215	1671	1885	1636	1932	3568
C03A	Low-ceiling diuretics, thiazides	4634	1149	5782	5148	214	5362
C03B	Low-ceiling diuretics, excl. Thiazides	711	31388	32098	2436	4344	6780
C03E	Diuretics and potassium-sparing agents in combination	854	569	1423	754	414	1168
C07	Beta blocking agents	122431	159211	281642	156274	43400	199674
C08	Calcium channel blockers	25757	152775	178531	28519	64549	93068
C09A	Ace inhibitors, plain	79584	17480	97064	113589	23561	137150
C09B	Ace inhibitors, combinations	1	1709	1710	69	1143	1212
C09C	Angiotensin II antagonists, plain	18353	23997	42351	30595	30351	60946
C09D	Angiotensin II antagonists, combinations	13456	30259	43715	37607	54489	92095
	Subtotal	**276695**	**432836**	**709528**	**389866**	**234265**	**624130**
C10	**LIPID MODIFYING AGENTS**						
C10A A	HMG CoA reductase inhibitors	24026	149401	173427	32745	188850	221595
C10A B	Fibrates	12330	11858	24188	9266	7071	16336
C10A C	Bile acid sequestrants	0	191	191	703	111	814
C10A D	Nicotinic acid and derivatives	0	41	41	0	224	224
C10A X	Other lipid modifying agents	2276	3104	5380	2583	68115	70698
C10B A	HMG CoA reductase inhibitors in combination with other lipid modifying agents	414	5197	5611	2660	13359	16019
	Subtotal	**39046**	**169792**	**208838**	**47957**	**277730**	**325686**
	Grand Total	**427957**	**729456**	**1157410**	**566450**	**657717**	**1224166**

Table 2.7: Top 10 Therapeutic Groups, Ranked by Expenditure

RANK	MALAYSIA, 2010			AUSTRALIA, 2009-10
	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	Agents Acting On The Renin-Angiotensin System (C09)	Lipid Modifying Agents (C10)	Lipid Modifying Agents (C10)	Drugs For Acid Related Disorders (A02)
3	Beta Blocking Agents (C07)	Drugs Used In Diabetes (A10)	Drugs Used In Diabetes (A10)	Agents Acting On Renin-Angiotensin System (C09)
4	Antineoplastic Agents (L01)	Drugs For Acid Related Disorders (A02)	Agents Acting On The Renin-Angiotensin System (C09)	Antineoplastic Agents (L01)
5	Psycholeptics (N05)	Antineoplastic Agents (L01)	Antineoplastic Agents (L01)	Psychoanaleptics (N06)
6	Drugs Used In Diabetes (A10)	Antihistamines For Systemic Use (R06)	Psycholeptics (N05)	Drugs For Obstructive Airway Disease (R03)
7	Antivirals For Systemic Use (J05)	Agents Acting On The Renin-Angiotensin System (C09)	Beta Blocking Agents (C07)	Psycholeptics (N05)
8	Vaccines (J07)	Sex Hormones And Modulators Of The Genital System (G03)	Drugs For Acid Related Disorders (A02)	Drugs Used In Diabetes (A10)
9	Drugs For Obstructive Airway Diseases (R03)	Antiinflammatory And Antirheumatic Products (M01)	Antihistamines For Systemic Use (R06)	Ophtalmologicals (S01)
10	Immunosuppressants (L04)	Psycholeptics (N05)	Antivirals For Systemic Use (J05)	Analgesics (N02)

References:

1. *National Health and Morbidity Survey;* Non Communicable Diseases 2011. Vol II. Institute for public Health Printing Office: Kuala Lumpur 2011.
2. *Australian Statistics on Medicine 2010*. Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2010
3. Pharmaceutical Benefits Pricing Authority Annual Report. *For the year ended 30 June 2010.* http://www.pbs.gov.au/industry/pricing/pbs-items/historical/pbpa-pdf/pbpa-annual-report-2010 (accessed October, 2014)

CHAPTER 3 : USE OF DRUGS FOR ALIMENTARY DISORDERS

Rosaida M.S.[1], Kiew K.K.[2], Tee H.P.[3], Ooi B.P.[4], Ooi E.T.[5], Ghan S.L.[6], Sugendiren S.[7], Ang S.Y.[8], Muhammad Radzi A.H.[2]

1. Hospital Ampang, Selangor, 2. Hospital Sultanah Bahiyah, Alor Setar, 3. Hospital Tengku Ampuan Afzan,Kuantan, 4. Hospital Pulau Pinang, Pulau Pinang, 5. Hospital Kuala Lumpur, 6. UKM Medical Centre, Selangor, 7. Hospital Putrajaya, Putrajaya, 8. Hospital Tengku Ampuan Rahimah, Klang, Selangor.

Acid-related diseases comprise a variety of disorders that affect the esophagus, stomach and duodenum. Peptic ulcer disease and gastro-oesophageal reflux disease (GORD) remain the common cause of acid-related gastrointestinal diseases. Even though the prevalence of GORD in Asian countries is 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 this survey, the total utilisation of medicines for acid-related disorder in 2010 increased to 6.7124 DDD/1000 population/day compared to 6.5802 DDD/1000 population/day in 2009, contributed mainly by an increase usage in H2RA. The trend of medication used for acid related disorders has reverted from proton pump inhibitors to H2-receptor antagonist (H2RA) from 2009 – 2010, i.e. 3.5456 vs. 3.0213 and 2.6693 vs. 4.033 DDD/1000 population/ day respectively.

Ranitidine (2.1203 DDD/1000 population/day in year 2009 and 3.5754 DDD/1000 population/day in year 2010) was the most commonly H2-receptor antagonists prescribed followed by Cimetidine (0.5032 DDD/1000 population/day in year 2009 and 0.2994 DDD/1000 population/day in year 2010). The usage of Ranitidine had increased by 68.6% from year 2009 to year 2010 whereas the usage of Cimetidine had reduced by 40.5% during the same period. The other H2-receptor antagonists such as Famotidine is not widely prescribed in Malaysia and mainly used by the private practitioner. Similar with Cimetidine, the usage was in reducing trend (60%) too. Ranitidine (80.74%) and Cimetidine (11.39%) accounted for 92.13% of H2-receptor antagonists being used in 2009 and 2010. This trend shows that Ranitidine is more preferable than other H2-receptor antagonists. The trend is more obvious in the public sector whereby Ranitidine use increased from 1.6647 DDD/1000 population/day to 3.3156 DDD/1000 population/day. The preference for H2-receptor antagonists may be explained by easy access to the drugs, familiarity with prescription and cheaper cost especially with the generic formulation.

Amongst the PPI, the trend showed an increasing trend from 2007-2009 (2.9856- 3.5456 DDD/1000 population/day) but it showed a sharp drop in 2010 to 2.6693 DDD/1000 population. The most commonly prescribed PPI in 2010 remains omeprazole (1.627 DDD/1000 population/day), accounting for 60% of total PPI prescribed, followed by pantoprazole 18.5%, esomeprazole 17.1%, lansoprazole 2.2% and rabeprazole 1.4%. The reason for the sharp drop in the trend of PPI use in 2010 can probably be attributed to the multiple warnings issued by the FDA and EMA[7-11] with regards to the PPI-Clopidogrel interaction where the efficacy of Clopidogrel is postulated to be reduced due to the interaction of PPI with the CYP2C19 enzyme needed for the activation of the prodrug Clopidogrel to active drug. This reduction trend however was not reflected in the statistics of Australia, Finland and Norway where the use of PPI continued to increase in 2010. The predominant PPI were also different in Australia[12] (Esomeprazole), Finland[13] (Pantoprazole) and Norway[14] (Esomeprazole) showing a global difference in trend.

The data collected for eradication of H. Pylori regimen is inadequate to do a meaningful analysia. 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. The limited data available on combined therapy of pantoprazole-amoxicillin-clarithromycin (used only in private sector) showed a decrease in usage from 0.0011 to 0.0004 (63%) DDD/1000 population/day. This trend is consistent with the decrease in the prevalence of H. Pylori infection in Malaysia. One local study showed the prevalence of H. Pylori associated duodenal ulcers dropped from 90.1% (1989-90) to 69.8% (1999-2000) while the prevalence of gastric ulcers dropped from 86.6% (1989-90) to 56.8% (1999-2000)[5].

The usage of drugs for functional bowel disorders was generally in the increasing trend, 0.1614 DDD/1000 population/day (2009) and 0.2433 DDD/1000 population/day (2010) compared to 0.1138DDD/1000 population/day in 2008. The usage was lower than Australia[12] (0.3DDD/1000 population/day in 2010) and Finland[13] (1.43DDD/1000 population/day in 2009). Mebeverine was the most popular drug used in this group of gastrointestinal disorder in 2009 (0.3623) but there was a surge in usage of Trimebutine in 2010 (from 0.003DDD/1000 population/day in 2009 to 0.1911DDD/1000 population/day in 2010), mainly in the private sector. Trimebutine was more popular than Mebeverine in 2010. Dicycloverine and Glycopyrronium bromide usage remained low in both years.

Antispasmodic drugs usage was low in general. Butylscopolamine was the commonest drug used. There

was a markedly increase usage of this drug from 2.1447 to 3.8065DDD/1000 population/day especially from the public sector, doubling form 2009 to 2010. Silicones was only used in private sector (0.1515 and 0.2361DDD/1000 population/day in 2009 and 2010)

In the management of motility disorders, Metoclopromide remained the most popular drug but its usage in decreased (2.8329 to 1.5776DDD/1000 population/day from 2009 to 2010). Domperidone usage was doubled from 2009 to 2010 in public.

Conclusion

There is a drop in the usage of PPI in the study period due to concern issued by FDA on concomitant use with Clopidogrel. This reduced use of PPI has resulted in the use of H2 receptor antagonist overtaking that of PPI and became the preferred drugs for acid-related disorders from 2009-2010.

Table 3.1: Use of Medicines for Acid Related Disorders by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
A02B A	H2-receptor antagonists	3.0213	4.0333
A02B B	Prostaglandins	0.0124	0.0099
A02B C	Proton pump inhibitors	3.5456	2.6693
A02B D	Combinations for eradication of Helicobacter pylori	0.0011	0.0004
A02B X	Other drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)	<0.0001	<0.0001

Table 3.2: Use of Medicines for by Acid Related Disorders Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A02B A	**H2-receptor antagonists**			
A02B A01	Cimetidine	Public	0.1968	0.0992
		Private	0.3064	0.2002
		Total	0.5032	0.2994
A02B A02	Ranitidine	Public	1.6647	3.3156
		Private	0.4556	0.2599
		Total	2.1203	3.5754
A02B A03	Famotidine	Public	<0.0001	-
		Private	0.3978	0.1585
		Total	0.3978	0.1585
A02B B	**Prostaglandins**			
A02B B01	Misoprostol	Public	<0.0001	<0.0001
		Private	0.0124	0.0099
		Total	0.0124	0.0099
A02B C	**Proton pump inhibitors**			
A02B C01	Omeprazole	Public	1.0069	1.2584
		Private	1.3640	0.3685
		Total	2.3709	1.6270
A02B C02	Pantoprazole	Public	0.2109	0.2685
		Private	0.2291	0.2238
		Total	0.4400	0.4923
A02B C03	Lansoprazole	Public	0.0240	0.0244
		Private	0.0507	0.0344
		Total	0.0747	0.0587
A02B C04	Rabeprazole	Public	0.0204	0.0096
		Private	0.1918	0.0274
		Total	0.2123	0.0370

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A02B C05	Esomeprazole	Public	0.1124	0.1645
		Private	0.3354	0.2898
		Total	0.4477	0.4543
A02B D	**Combinations for eradication of Helicobacter pylori**			
A02B D04	Pantoprazole, amoxicillin and clarithromycin	Public	-	-
		Private	0.0011	0.0004
		Total	0.0011	0.0004
A02B X	**Other drugs for peptic ulcer and gastro-oesophageal reflux disease (GORD)**			
A02B X05	Bismuth subcitrate	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

Table 3.3: Use of Medicines for Gastrointestinal Disorders by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A03A A	**Synthetic anticholinergics, esters with tertiary amino group**			
A03A A04	Mebeverine	Public	0.0193	0.0196
		Private	0.3430	0.0297
		Total	0.3623	0.0493
A03A A05	Trimebutine	Public	-	0.0002
		Private	0.0030	0.1910
		Total	0.0030	0.1911
A03A A07	Dicycloverine	Public	-	-
		Private	0.0014	0.0011
		Total	0.0014	0.0011
A03A B	**Synthetic anticholinergics, quaternary ammonium compounds**			
A03A B02	Glycopyrronium bromide	Public	0.0001	0.0006
		Private	<0.0001	<0.0001
		Total	0.0002	0.0006
A03A D	**Papaverine and derivatives**			
A03A D01	Papaverine	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
A03A D02	Drotaverine	Public	-	-
		Private	0.0703	0.0474
		Total	0.0703	0.0474
A03A X	**Other drugs for functional bowel disorders**			
A03A X13	Silicones	Public	-	-
		Private	0.1515	0.2361
		Total	0.1515	0.2361
A03A X58	Alverine, combinations	Public	-	<0.0001
		Private	0.0099	0.0072
		Total	0.0099	0.0072
A03B A	**Belladonna alkaloids, tertiary amines**			
A03B A01	Atropine	Public	0.0059	0.0441
		Private	0.0095	0.0068
		Total	0.0154	0.0509

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A03B B	**Belladonna alkaloids, semisynthetic, quaternary ammonium compounds**			
A03B B01	Butylscopolamine	Public	1.7398	3.3572
		Private	0.4049	0.4494
		Total	2.1447	3.8065
A03B B03	Methylscopolamine	Public	-	-
		Private	0.0012	-
		Total	0.0012	-
A03F A	**Propulsives**			
A03F A01	Metoclopramide	Public	1.3942	0.9937
		Private	1.4387	0.5838
		Total	2.8329	1.5776
A03F A02	Cisapride	Public	-	-
		Private	0.0117	-
		Total	0.0117	-
A03F A03	Domperidone	Public	0.0826	0.1350
		Private	0.5484	0.3842
		Total	0.6310	0.5192

References:

1. Dent, J. et al. Epidemiology of Gastro-oesophageal Reflux Disease: a systemic review. *Gut* May 2005, 54(5), 710-717.
2. Goh, K. L. et al. Gastro-oesophageal reflux disease in Asia. J. *Gastroenterol Hepatol* Mar 2000, 15(3), 230-238.
3. Hye-Kyung Jung. Epidemiology of Gastroeophageal Reflux Disease in Asia: A systemic review. *J Neurogastroenterol Motil*. Jan 2011, 17(1), 14-2.
4. Goh, K. L. Prevalence of and risk factors of Helicobacter pylori in a multiracial population undergoing endoscopy. *J Gastroenterol Hepatol* 1997, 12, S29-35.
5. Rosaida, M. S.; Goh, K. L. Gastroesophageal reflux disease, reflux oesophagitis, and non-erosive reflux disease, gastric and oesophageal cancers in a multiracial asian population. *Aliment Pharmacol Ther*. 2009, 29(7), 774-780.
6. Locke, G. R. 3rd et al. Prevalence and clinical spectrum of gastro-oesophageal reflux: a population based study in Olmsted County. *Minnesota Gastroenterology* 1997, 112, 1448-1456.
7. U.S. Food Drug Administration Home Page. http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/DrugSafetyInformationforHeathcareProfessionals/ucm079520.htm (accessed Nov 2013).
8. European Medicines Agency Home Page. http://www.ema.europa.eu/ema/index.jsp?curl=pages/news_and_events/news/2009/11/news_detail_000194.jsp&mid=WC0b01ac058004d5c1 (accessed Nov 2013).
9. FDA Announces New Warning on Plavix: Avoid Use with Prilosec/Prilosec OTC. U.S. *Food Drug Administration Home Page* [Online]. http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/2009/ucm191169.htm (accessed Nov 2013).
10. FDA Drug Safety Communication: Reduced effectiveness of Plavix (clopidogrel) in patients who are poor metabolizers of the drug. U.S. Food Drug Administration Home Page [Online]. http://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm203888.htm (accessed Nov 2013).
11. Interaction between clopidogrel and proton-pump inhibitors *European Medicines Agency Home Page* [Online]. http://www.ema.europa.eu/docs/en_GB/document_library/Public_statement/2010/03/WC500076346.pdf (accessed Nov 2013)
12. *Australian Statistics on Medicines 2010;* Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2012
13. *Finnish Statistics on Medicines 2009;* Finnish Medicines Agency Fimea Printing Office: Helsinki 2010
14. Sakshaug, S. et al. *Drug Consumption in Norway* 2008-2012; Norwegian Institute of Public Health Printing Office: Oslo, March 2013

CHAPTER 4 : USE OF ANTIOBESITY AGENTS

Masni M.[1], Muhammad Yazid J.[2], Nurkhodrulnada M.L.[3]

1. Putrajaya Hospital, Putrajaya. 2. University Malaya Medical Centre, Selangor, 3. Hospital Kuala Lumpur, Kuala Lumpur

The total consumption of antiobesity agents in Malaysia for 2009 and 2010 were 0.3278 and 0.1332 DDD/1000 population/day respectively. Data for both years showed a decline in the use of all antiobesity drugs compared to previous years[1]. Centrally acting antiobesity agent continued to be the most commonly prescribed in 2009 and 2010, representing 93.5% and 92.3% of total drug used respectively. The declining trend is also seen in Australia[2,3]. Among the centrally acting agents used, phentermine was favoured especially in private sector, accounting for 76.2% and 89.6% for the years 2009 and 2010 respectively. This trend is similarly seen in Australia[2,3]. Unlike in Finland where Phentermine is not available, Sibutramine usage was increased in 2009 but dropped drastically in 2010[4]. From our data, Rimonabant, a new antiobesity agent introduced in 2008 showed no usage after 2009 onwards.

Of the antiobesity agents utilised, consumption in the private sector was higher (97.0%, 95.6%) compared to public sector (3.0%, 4.4%) for the year 2009 and 2010 respectively. The differing utilisation rates could be influenced by the drug cost and availability. There was a reduction in the total usage of antiobesity agents compared to the previous years even though the prevalence of overweight and obesity has increased as evidence by the National Health Morbidity Survey (43.1% in 2006 compared to 21.0% in 1996)[5]. The decline in the usage of antiobesity agents was probably due to the unavailability of these drugs in the government healthcare system and higher price in the private health sector.

The obesity rate among adult middle aged Finnish population was comparable to Malaysia (14.9% versus 14.1% in 2009), however the overall consumption of antiobesity agents was 5.1 times higher[6]. Although the rate of obesity in Australia is only 1.5 times higher compared to Malaysia (21% versus 14.1%), the consumption of antiobesity agents in Australia was much higher, ie: 7.8 folds in 2009 and 15.6 fold in 2010[7]. This is likely due to the availability and Medicare coverage for antiobesity agents.

Table 4.1: Use of antiobesity medicines by drug class, in DDD/1000 population/ day 2009 - 2010

ATC	DRUG CLASS	2009	2010
A08A	Antiobesity preparations, excl. Diet products	0.3278	0.1332
A08A A	Centrally acting antiobesity products	0.3066	0.1230
A08A B	Peripherally acting antiobesity products	0.0212	0.0101
A08A X	Other antiobesity drugs	<0.0001	-

Table 4.2: Use of antiobesity medicine by drug class and agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A08A A	**Centrally acting antiobesity products**			
A08A A01	Phentermine	Public	<0.0001	-
		Private	0.2336	0.1102
		Total	0.2336	0.1102
A08A A10	Sibutramine	Public	0.0057	0.0022
		Private	0.0672	0.0107
		Total	0.0729	0.0129
A08A B	**Peripherally acting antiobesity products**			
A08A B01	Orlistat	Public	0.0041	0.0037
		Private	0.0171	0.0064
		Total	0.0212	0.0101
A08A X	**Other antiobesity drugs**			
A08A X01	Rimonabant	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-

References:

1. *Malaysian Statistics on Medicines 2008*; Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. *Australian Statistics on Medicine 2009 15th Edition;* Australian Government Department of Health and Ageing Printing Office: Commonwealth of Australia 2011.
3. *Australian Statistics on Medicine 2010 16th Edition;* Australian Government Department of Health and Ageing Printing Office: Commonwealth of Australia 2012.
4. *Finnish Statistics of Medicine 2010;* Finnish Medicines Agency Fimea & Social Insurance Institution Printing Office: Helsinki 2011.
5. *The Third National Health and Morbidity Survey (NHMS III) 2006;* Institute for Public Health (IPH) Ministry of Health Malaysia Printing Office: Kuala Lumpur 2008.
6. Metadata for OECD Health Data 2011-version November 2011. *OECD Home Page* [Online]. http://www.oecd.org/redirect/health/health-systems/oecdhealthdata2012-frequentlyrequesteddata.htm (accessed Nov 27 2013).
7. Australian Bureau of Statistics Home Page. http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/4364.02007-2008%20(Reissue)?OpenDocument (accessed Nov 27 2013).

CHAPTER 5 : USE OF ANTI-DIABETIC DRUGS

Letchumanan G.R.R.[1], Fuziah M.Z.[2], Yong S.L.[3], Mohamed Noor R.[4], Daphne G.[2]

1. Taiping Hospital, Perak, 2. Putrajaya Hospital, W.P. Putrajaya, 3. Tengku Ampuan Rahimah Hospital, Klang 4. University Malaya Medical Centre, Selangor

In the year 2009, the total consumption of anti-diabetic medications was 51.3862 DDD/1000 population/day which was lower than 2010 (60.0626 DDD/1000 population/day)[1]. This could be driven by the higher purchase of Gliclazide MR which became a contract item in the public sector in 2009. However, the overall trend of the use of antidiabetic has increased by 28.6% over the period of 2007/2008 to 2009/2010, reflecting higher prevalence of diabetes and hopefully, more appropriate early therapy.

Oral Hypoglycaemic Agents

The use of sulphonylurea in 2009/2010 had increased by 16.2% as compared to 2007/2008. The overall use of glibenclamide had reduced, and chlorpropamide was not used in the public sector at all. Gliclazide was still the main sulphonylurea being used in both the public and private sectors. This was consistent with the trend where second generation of sulphonylureas were being used more widely because of less hypoglycaemia.

The use of metformin had steadily increased over the years in the public sector and this was expected as it is the first line therapy. However, the use of metformin had reduced in the private sector as more combinations of oral hypoglycaemic agents with metformin were being used. This is in line with the rule that usage of combinations improves compliance and cost saving.

The use of acarbose was higher in 2009 than in 2010. The use of the DPP-4 inhibitors almost doubled within a year, and this was higher in the private sector, also probably due to its higher cost. This is due to the fact that this group are weight neutral, causes less hypoglycemia, and can be used in renal impairment. The overall use of thiazolidinediones was low at that time due to its widely reported adverse events. Finally, the use of repaglinide and nateglinide remained low due to its high cost, multiple dosing and no positive outcome trials.

Insulin

The overall use of insulin in 2010 had increased remarkably. This could be due to multiple factors such as, the launching of CPG Type 2 Diabetes Mellitus in 2009 and increased awareness of insulin via nationwide road shows. As a whole, it is noticed that premixed insulin are still more popular in Malaysia as compared to other insulins because of patients' preference for lesser injections.

There was a decrease in the use of insulin glargine in the private sector as compared to the years 2007/2008 as there were reports of possible association of glargine with cancer then, which were later refuted. We observe an increase in the use of insulin analogues, both in the private and public sectors between 2009/2010. There was an unexpected drop in the private sector in the use of premixed insulin in 2010.

Comparison with Other Countries

The overall insulin use in Malaysia (5.7884 DDD/1000/day) is far behind compared to Australia (18.141 DDD/1000/day) in 2010, and it is observed that Australia used predominantly insulin analogues (14.303 DDD/1000/day), which was about three quarter of their total insulin usage. In comparison, Malaysia's usage of insulin analogues only constituted less than 10% of the total insulin usage. In contrast, Australia's usage of premixed insulin 33.4% of their total insulin usage, whereas Malaysia's premixed insulin use was 46.7% of our total insulin use.

Our biguanide use was comparable to Australia (13.984 DDD/1000/day for Australia vs 14.5749 DDD/1000/day). In contrast, Australia's use of sulphonylureas (15.463 DDD/1000/day) and acarbose (0.139 DDD/1000/day) was lower compared to Malaysia. Finally, Australia's use of DPP-4 inhibitors (0.935 DDD/1000/day vs 0.4555 DDD/1000/day) was higher compared to Malaysia.

Conclusion

In conclusion, there was an encouraging rise in the use of metformin and insulin in the country in 2009/2010. However, our overall use of insulin was still much lower compared to Australia. There was a trend of rise in the use of newer antidiabetics such as the DPP-4 inhibitors and insulin analogues. It was also interesting to note that there was a difference in the prescribing tendency of doctors between private and public sectors. There was an immediate drop in the usage of insulin glargine in the private sector after adverse reports, and also high use of combination oral therapy in the private sector.

Table 5.1: Use of Anti-Diabetics by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
A10A	Insulins and analogues	2.4267	5.7884
A10B A	Biguanides	13.5929	14.5749
A10B B	Sulfonamides, urea derivatives	29.8889	34.7268
A10B D	Combinations of oral blood glucose lowering drugs	1.4454	3.6747
A10B F	Alpha glucosidase inhibitors	3.4349	0.7213
A10B G	Thiazolidinediones	0.1628	0.1063
A10B H	Dipeptidyl peptidase 4 (DPP-4) inhibitors	0.2236	0.4555
A10B X	Other blood glucose lowering drugs, excl. insulins	0.2110	0.0147

Table 5.2: Use of Anti-Diabetics by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A10A B	**Insulins and analogues for injection, fast-acting**			
A10A B01	Insulin (human)	Public	0.5680	1.6862
		Private	0.0665	0.0435
		Total	0.6345	1.7297
A10A B04	Insulin lispro	Public	0.0003	0.0010
		Private	0.0041	0.0030
		Total	0.0044	0.0040
A10A B05	Insulin aspart	Public	0.0002	0.0343
		Private	0.0048	0.0196
		Total	0.0051	0.0538
A10A B06	Insulin glulisine	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
A10A C	**Insulins and analogues for injection, intermediate-acting**			
A10A C01	Insulin (human)	Public	0.5954	1.2579
		Private	0.0242	0.0171
		Total	0.6196	1.2750
A10A D	**Insulins and analogues for injection, intermediate-acting combined with fast-acting**			
A10A D01	Insulin & analogues, intermediate-acting combined fast-acting (human)	Public	0.6937	1.8650
		Private	0.0411	0.0183
		Total	0.7348	2.3978
A10A D04	Insulin lispro	Public	-	<0.0001
		Private	0.0003	0.0009
		Total	0.0003	0.0009
A10A D05	Insulin aspart	Public	0.0155	0.0696
		Private	0.3316	0.1378
		Total	0.3471	0.2074
A10A E	**Insulins and analogues for injection, long-acting**			
A10A E04	Insulin glargine	Public	0.0561	0.0905
		Private	0.0146	0.0074
		Total	0.0708	0.0979
A10A E05	Insulin detemir	Public	-	0.0123
		Private	0.0103	0.0096
		Total	0.0103	0.0218

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A10B A	**Biguanides**			
A10B A02	Metformin	Public	12.0811	13.2175
		Private	1.5119	1.3575
		Total	13.5929	14.5749
A10B B	**Sulfonamides, urea derivatives**			
A10B B01	Glibenclamide	Public	8.6252	7.6266
		Private	0.7037	0.9432
		Total	9.3289	8.5697
A10B B02	Chlorpropamide	Public	-	-
		Private	0.0001	0.0023
		Total	0.0001	0.0023
A10B B07	Glipizide	Public	0.0718	0.2147
		Private	0.2310	0.0363
		Total	0.3028	0.2509
A10B B09	Gliclazide	Public	17.7235	23.8472
		Private	1.5964	1.5533
		Total	19.3199	25.4006
A10B B12	Glimepiride	Public	0.0219	0.0176
		Private	0.9153	0.4856
		Total	0.9372	0.5032
A10B D	**Combinations of oral blood glucose lowering drugs**			
A10B D02	Metformin and sulfonamides	Public	0.7034	2.0897
		Private	0.3957	0.3543
		Total	1.0991	2.4440
A10B D03	Metformin and rosiglitazone	Public	0.0021	0.0014
		Private	0.0178	0.0642
		Total	0.0199	0.0656
A10B D07	Metformin and sitagliptin	Public	-	0.0023
		Private	0.3264	0.6502
		Total	0.3264	0.6525
A10B D08	Metformin and vildagliptin	Public	-	-
		Private	-	0.5125
		Total	-	0.5125
A10B F	**Alpha glucosidase inhibitors**			
A10B F01	Acarbose	Public	3.2215	0.6586
		Private	0.2135	0.0627
		Total	3.4349	0.7213
A10B G	**Thiazolidinediones**			
A10B G02	Rosiglitazone	Public	0.0501	0.0666
		Private	0.0968	0.0326
		Total	0.1469	0.0992
A10B G03	Pioglitazone	Public	0.0033	0.0023
		Private	0.0127	0.0048
		Total	0.0160	0.0071

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
A10B H	**Dipeptidyl peptidase 4 (DPP-4) inhibitors**			
A10B H01	Sitagliptin	Public	0.0038	0.0229
		Private	0.2198	0.4297
		Total	0.2236	0.4527
A10B H02	Vildagliptin	Public	-	<0.0001
		Private	-	0.0028
		Total	-	0.0028
A10B X	**Other blood glucose lowering drugs, excl. Insulins**			
A10B X02	Repaglinide	Public	0.1237	0.0078
		Private	0.0578	0.0030
		Total	0.1815	0.0107
A10B X03	Nateglinide	Public	<0.0001	<0.0001
		Private	0.0082	0.0006
		Total	0.0083	0.0006
A10B X04	Exenatide	Public	0.0002	0.0001
		Private	0.0006	0.0008
		Total	0.0009	0.0009
A10B X06	Benfluorex	Public	-	-
		Private	0.0204	0.0024
		Total	0.0204	0.0024

References:

1. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. *Australian Statistics on Medicines 2010;* Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2012.
3. *Consumption in the Nordic Countries 2004-2008;* Nordic Medico Statistical Committee, Medicines Printing Office: Copenhagen 2009.
4. *Guidelines for ATC Classification and DDD Assignment 2012;* WHO Collaborating Centre for Drug Statistics Methodology Printing Office: Oslo December 2012.

CHAPTER 6 : USE OF ANTIANAEMIC DRUGS

Chang K.M.[1], Tan S.M.[1], Sinari S.[2], Lim Y.S.[1], Tan H.J.[1], Goh A.S.[3], Wong S.P.[1]

1. Ampang Hospital, Ampang, 2. Kuala Krai Hospital, Kelantan, 3. Pulau Pinang Hospital, Pulau Pinang.

As compared to 2007-2008, generally the usage of antianaemic drugs appeared to be reduced in 2009-2010. However the most commonly prescribed antianaemic in 2009-2010 were still erythropoietin injections (0.1138 and 0.1236 ascompared to 0.3258 DDD/1000 population/day in 2008) 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[1]. The purchase and the usage of erythropoietin is a well-kept record. There is a 62% reduction in the usage of erythropoietin in 2009-2010 as compared to 2007-2008. This does not reflect the actual usage of erythropoietin as expected as we know that there is an increase of patients requiring erythropoietin, namely end stage renal disease (ESRD) and hematology patients[2,3]. The usage of erythropoietin is not paralleled to the increase of the number of patients may be explained by the limitation such as budget constraint as well as poor access to the drug. As compared to 2007-2008, the usage in the government sector was still higher than the private sector in 2009-2010.

The usage of erythropoietin in Australia is still much lower than Malaysia[4]. This is likely due to the fact that the transplant program in Australia is well advanced and robust[5].

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

For erythropoietin to be effective, it should be supplemented with iron. Parenteral iron was used in cases where the intake of oral iron was inadequate and absorption was not reliable1. 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 2009-2010

ATC	DRUG CLASS	2007	2008	2009	2010
B03	Antianemic preparations	0.1552	0.3277	0.1138	0.1236

Table 6.2.1: Use of Anti-Anemic by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2007	2008	2009	2010
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	0.1138	0.1236
B03X A	Other antianemic preparations	0.1552	0.3258	0.1138	0.1236

Table 6.2.2: Use of Anti-Anemic by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008	2009	2010
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	0.0608	0.1025
		Private	0.0404	0.0526	0.0530	0.0211
		Total	0.1552	0.3258	0.1138	0.1236

References:

1. *British National Formulary September 2006;* British Medical Association & Royal Pharmaceutical Society Printing Office: UK October 2006.
2. Fairul Asmaini, M.P. Kidney disease on the rise in Malaysia. *New Straits Times,* May 17 2013.
3. Ghazali, A. Use of Patient Regitry Data In clinical Practice. *Malaysian Dialysis and Transplant Registry,* National Renal Registry [Online]. http://www.crc.gov.my/pdf/National%20Renal%20Registry.pdf (accessed Nov 28, 2013)
4. *Australian Statistics on Medicines 2008.* Australia Government Department of Health and Ageing, Commonwealth of Australia 2009 [Online]. http://www.pbs.gov.au/info/statistics/asm/asm-2008 (accessed Nov 28, 2013)
5. *Dialysis and kidney transplantation in Australia 1991-2010.* Australian Institute Of Health and Welfare, Australian Government [Online]. http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737422288 (accessed Nov 28, 2013)

CHAPTER 7 : USE OF ANTIHAEMORRHAGICS

Chang K.M.[1], Tan S.M.[1], Sinari S.[2], Lim Y.S.[1], Tan H.J.[1], Goh A.S.[3], Wong S.P.[1]

1. Ampang Hospital, Ampang, 2. Kuala Krai Hospital, Kelantan, 3. Pulau Pinang Hospital, Pulau Pinang.

The usage of antihaemorrhagics did not differ much from 2007 to 2010. The most used class of antihaemorrhagics was still the class of amino acids, namely tranexamic acid (0.0781 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 its use 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]. However there is no usage in 2009-2010 in the government sector whereas the private sector still maintained the low usage.

There is a surge in the usage of vitamin K from 2007-2008 (0.0101 DDD/1000 population/day) to 2009-2010 (0.0666 DDD/1000 population/day). This might be explained by the increase usage of anticoagulant in particular warfarin among patients with heart disease as the number of patients with heart disease has increased tremendously as shown by the data from World Health Rankings Research and Features. The age adjusted death rate due to coronary heart disease for Malaysia is 138.75 per 100,000 of population and it put Malaysia at number 57 in the world rank whereby Australia's age adjusted death rate is 60.34 per 100,000 of population (number 162 in the world rank)[3]. With the increase of anticoagulant usage, that might lead to the increase of overwarfarinization needing vitamin K as antidote.

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[4]. 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 2009 and 2010 (comparable to 2007 and 2008). The main reason is due to majority of the patient is concentrated in public sector. However there is an overall marked increase in the usage of blood clotting factors, mainly factor VIII. This is likely due to a few possibilities such as change of practice from on demand therapy to upfront prophylaxis, increase in number of acquired haemophilia cases which required more factor VIII and the existing paediatric population growing into adulthood.

Von Willebrand factor and factor VIII inhibitor bypassing activity are hardly been used in our practice as there are alternative formulas available. Coagulation factor XIII deficiency is a very rare disorder in our country that so far we have encountered only one case nationwide.

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[5]. However, its overall usage was still very minimal at <0.0001 DDD/1000 population/day, perhaps due to its exorbitant price tag of ~RM 5000 per vial of 2mg. The usage of recombinant factor VIIa or eptacog alfa (activated) is still appropriate as the length of stay in critically ill patients that need reversal of coagulopathy can be shortened and the costs of hospitalisation can be reduced[6].

Table 7.1: Use of Antihaemorrhagics, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2007	2008	2009	2010
B02	Antihemorrhagics	0.0700	0.0734	0.0597	0.2099

Table 7.2.1: Use of Antihaemorrhagics by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2007	2008	2009	2010
B02A	Antifibrinolytics	0.0685	0.0618	0.0567	0.0783
B02A A	Amino acids	0.0681	0.0618	0.0556	0.0781
B02A B	Proteinase inhibitors	0.0003	<0.0001	0.0011	0.0002
B02B	Vitamin K and other hemostatics	0.0015	0.0116	0.0031	0.1316

ATC	DRUG CLASS	2007	2008	2009	2010
B02B A	Vitamin K	-	0.0101	0.0016	0.0666
B02B D	Blood coagulation factors	0.0015	0.0015	0.0014	0.0650

Table 7.2.2: Use of Antihaemorrhagics by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2007	2008	2009	2010
B02A A	**Amino acids**					
B02A A02	Tranexamic acid	**Public**	0.0535	0.0469	0.0344	0.0469
		Private	0.0146	0.0148	0.0211	0.0312
		Total	0.0681	0.0618	0.0556	0.0781
B02A B	**Proteinase inhibitors**					
B02A B01	Aprotinin	**Public**	0.0001	<0.0001	-	-
		Private	0.0002	<0.0001	0.0011	0.0002
		Total	0.0003	<0.0001	0.0011	0.0002
B02B A	**Vitamin K**					
B02B A01	Phytomenadione	**Public**	-	0.0083	0.0001	0.0659
		Private	-	0.0018	0.0015	0.0007
		Total	-	0.0101	0.0016	0.0666
B02B D	**Blood coagulation factors**					
B02B D02	Coagulation factor VIII	**Public**	0.0006	0.0004	0.0003	0.0634
		Private	<0.0001	<0.0001	-	<0.0001
		Total	0.0006	0.0004	0.0003	0.0634
B02B D03	Factor VIII inhibitor bypassing activity	**Public**	<0.0001	-	-	-
		Private	-	-	-	-
		Total	<0.0001	-	-	-
B02B D04	Coagulation factor IX	**Public**	0.0008	0.0010	0.0011	0.0014
		Private	-	-	-	-
		Total	0.0008	0.0010	0.0011	0.0014
B02B D05, D08	Coagulation factor VII and Eptacog alfa (activated)	**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
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	-	-	-	-

References:

1. *British National Formulary September,* 2006.
2. *European Medicines Agency. European Medicines Agency Recommends Lifting Suspension of Aprotinin* 2012. http://www.ema.europa.eu/docs/en_GB/document_library/Press_release/2012/02/WC500122914.pdf (accessed Nov 28, 2013).
3. *World Health Rankings***.** http://www.worldlifeexpectancy.com/world-health-rankings (accessed Nov 28, 2013).
4. 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.
5. Ampaiwan C., Pantep A., Nongnuch S. Critical Appraisal of The Role of Recombinant Activated Factor VII in The Treatment of Haemophilia Patients with Inhibitors. *Journal of Blood Medicine***.** 2010, 1, 37–48.
6. Lyseng-Williamson K.A., Plosker G.L. Recombinant Factor VIIa (Eptacog alfa): A Pharmacoeconomic Review of its Use in Haemophiliain Patients with Inhibitors to Clotting Factors VIII and IX. *Pharmacoeconomics* 2007, 25, 1007-1029.

CHAPTER 8 : USE OF DRUGS FOR CARDIOVASCULAR DISORDERS

Fong A.Y.Y.[1], Zoriah A.[2], Omar I.[3], Amin A.N.[4], Lim C.T.Y.[5], Feisul Idzwan M.[6]

1. Sarawak General Hospital 2. Faculty of Medicine, University of Malaya 3. Penang Hospital 4. National Heart Institute 5. Hospital Tengku Ampuan Rahimah, Klang 6. Disease Control Division, Ministry of Health Malaysia

This chapter presents information on the use of antithrombotic agents (B01) and drugs for cardiovascular disorders excluding antihypertensive (C02) and lipid modifying agents (C10) for the year 2009 and 2010.

Drugs used in management of cardiovascular disease (CVD) remain frequently prescribed in Malaysia. In 2009 and 2010, there was predominant usage of evidence based drugs, in part due to the rising prevalence of cardiovascular risk factors and improved access of patients with CVD to healthcare facilities[1-2].

Listed in Table 8.1 are the DDD/1000 population/day for antithrombotic agents and drugs for cardiovascular disorders by therapeutic subgroups. Overall in 2010 compared to data from previous year, there was little change in the use of antithrombotic agents (down by 31.2%)

Antithrombotic drugs are commonly prescribed in 2009 and 2010, with an overall DDD/1000 population/day of 10.1730 & 10.7483 respectively. Within this group, aspirin (acetylsalicyclic acid) was the commonly used, with a rising DDD/1000 population/day of 6.5070 in 2009, 7.4262 in 2010, with the rise primarily being accounted for at the public centres. Thus, aspirin remained the most widely used agent in 2010 constituting more than69% of the total use of all antithrombotic agents.

Among oral anti-thrombotic drugs, clopidogrel was most commonly prescribed, followed by ticlopidine – 0.8680 vs 0.6240. It was noted that clopidogrel use fell in 2010 compared to previous year. However, its use was substantially higher in the private compared to public centres – 0.6390 vs 0.2290, in 2010; while the opposite was true for ticlopidine – 0.0590 vs 0.5640 in private compared to public centres. While 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 periods, the perceived problem with stents has now been resolved with the introduction of newer third generation's stents. Since parsugrel was only introduced in June 2010, it was unlikely that the decrease use of clopidogrel in 2010 could be attributed to the intoduction of parsugrel even though it has been noted that therapy with parsugrel has been associated with significantly reduced rates of ischemic events, including stent thrombosis[3].

Table 8.2.1 shows that of all types of antithrombotic agents, over the one-year period the use of heparin group (BO1AB) decreased considerably by 2.8 fold predominantly in the private sector. The use of alternatives such as enoxaparin (0.0972 in 2009, 0.1128 in 2010) and fondaparinux (0.0043 in 2009, 0.0153 in 2010) remained relatively low, and we were therefore unable to completely explain the drop in Heparin usage. It is reassuring to note the overall slight increase in the use of subcutaneous enoxaparin which offer several advantages over unfractionated heparin (UFH). The use of UFH during percutaneous coronary intervention is limited by its unpredictable effect, risk of infection, the need for close monitoring, and the uncertainty around optimal levels of activated clotting time[4-6].

Warfarin use in 2009 and 2010 was significant in Malaysia, and the amount reduced from year 2009 to 2010: 0.7340 to 0.3599, respectively. Among thrombolytics/fibrinolytics, the most commonly used was Streptokinase, and predominantly used in the public centres compared to private centres (0.0007 vs 0.0004, in 2009; 0.0008 vs <0.0001, in 2010). The use of other injectable antithrombotics remained low over the 2009 to 2010 period (<0.0001).

The established cardiac glycoside digoxin remained commonly used in Malaysia, being indicated for use in both heart failure and arrhythmias, with a DDD/1000 population/day of 3.9566 in 2009 and 0.4037 in 2010. Other commonly prescribed antiarrhythmics were amiodarone and flecainide. Amiodarone use was 0.0740 in 2009 and 0.0690 in 2010, while flecainide was 0.0092 in 2009 and 0.0133 in 2010. Both these drugs were used more commonly in private compared to public centres.

For adrenergic and dopaminergic agents, with the exception of ephedrine, the use of these drugs remained low and were consistent between 2009 and 2010. The use of ephedrine increased from 0.0027 in 2009 to 0.0102 in 2010, most likely due to its use for non-cardiac indications.

The use of oral nitrates revealed interesting findings, with the shorter acting isosorbide dinitrate demonstrating a higher usage compared to the longer acting isosorbide mononitrate version. The DDD/1000 population/day for the former was 1.0276 and 1.1204 in 2009 and 2010 respectively; while for the latter, 0.4313 and 0.4615, in 2009 and 2010 respectively. The majority of the dinitrate was prescribed in the public sector, while the mononitrate in the private sector. The anti-ischaemic compound trimetazidine was commonly prescribed in Malaysia, with a DDD/1000 population/day of 5.1812 in 2009, and 1.2401 in 2010, respectively, and with more the twice the use seen in the public sector compared

to the private sector. The use of Ivabradine also increased in use; with a score of 0.0028 in 2009 to 0.0045 in 2010.

Overall, similar to data from Norway[7] and the Department of Health and Aging, Australia for 2009 and 2010[8-9] our data also demonstrated that among the agents for cardiac therapy the use of digoxin showed a slight decrease over the one-year period whereas the utilization of anti-arrhythmics drugs (Table 8.4.1), cardiac stimulants (Table 8.5.1), vasodilators (Table 8.6.1) and did not change substantially. The decrease in use of digoxin in Malaysia may be due in part to the increasing number of heart failure patients undergoing cardiac resynchronization therapy(personal communication, Nov 2013).

Hydrochlorthiazide is now the most commonly prescribed thiazide diuretic, with a DDD/1000 population/day score of 11.1948 and 10.9678 in 2009 and 2010, respectively. While the use of metolazone increased from <0.0001 to 0.0009 in 2009 and 2010, the use of indapamide reduced from 1.9032 in 2009 to 0.1417 in 2010. There was a corresponding rise in the use of both furosemide 4.1532 (4.1532 in 2009, to 5.7365 in 2010) and bumetanide (0.0169 in 2009, to 0.1122 in 2010). The use of spironolactone decreased from 0.5457 in 2009, to 0.2966 in 2010, while the other potassium sparing diuretic amiloride increased from 0.0092 in 2009, to 0.0636 in 2010. The peripheral vasodilator pentoxifylline saw consistent usage between 2009 and 2010, with a score of 0.0500 DDD/1000 population/day.

Similarly, the Australian data from the same source[8-9] and our data showed that the overall use of diuretics (Table 8.6.2 and Table 8.7.1) in heart diseases for 2010 did not change much from 2009. However, it is encouraging to note the overall utilization of diuretics in combinations with angiotensin II antagonists (ARB) showed an increase (Table 8.12.1) in keeping with current recommendations on Clinical Practice Guidelines.

The most commonly prescribed beta-blockers in 2009 and 2010 were metoprolol, atenolol and bisoprolol. DDD/1000 population/day scores were highest for metoprolol 10.0045 in 2009 and 10.0150 in 2010) and atenolol (8.9445 in 2009 and 9.1761 in 2010), with 5 times greater usage in public compared to private centres. Bisoprolol scores were 0.2707 in 2009 and 0.2811 in 2010, with a similar usage in both public and private centres in 2010. Carvedilol scores were noted to be 0.2644 in 2009 and 0.2401 in 2010, with approximately similar usage in both public and private centres. Nebivolol was only used in private centres, with an increase in the DDD/1000 population/day score of <0.0001 in 2009 to 0.0004 in 2010.

Similar to Australia[8-9], in Malaysia the use of beta-blockers as a group did not show considerable change from 2009 to 2010 (Table 8.9.1). However, the use of propranolol, and carvedilol actually fell in 2010. The drop in carvedilol use was a bit puzzling because carvedilol has been proven to be useful as it reduces mortality in patients with heart failure and that it serves as better options compared to conventional beta-blockers[10].

The dihydropyridine calcium channel antagonist amlodipine was widely prescribed in Malaysia, with a DDD/1000 population/day score of 16.2358 in 2009, increasing substantially to 34.8113 in 2010. On the other hand, felodipine scores were 1.7536 in 2009 and 1.9157 in 2010. Nifedipine, in most preparations is not a monotherapy drug, is still commonly prescribed, with a score of 12.6417 in 2009, and 11.7657 in 2010, and with six times more commonly used in the public compared with the private sector. Of the two non-dihydropyridine calcium channel antagonists, diltiazem was more commonly used than verapamil, with scores of 0.2483 in 2010 for the former, and 0.0386 in 2010 for the latter.

Thus, among the calcium channel blockers, only amlodipine showed significant increase in usage from 2009 to 2010. Table 8.10.1 shows whereas the use of amlodipine has expanded almost to double from 2009 to 2010 particularly in the public sector. The increased use of amlodipine could partly be explained by the introduction of generic amlodipine in the first quarter of 2009 and the relegation of its prescribing category from List A to B in the last quarter of 2009. The convenience of once-a-day dosing of amlodipine compared to thrice a day dosing for nifedipine and diltiazem could also explain the rise of amlodipine use. It is encouraging to see that the utilization of amlodipine showed an upward trend as several studies[11-12] including ALLHAT[13] support the effectiveness and safety of amlodipine. Within the group of agents acting on the Renin-Angiotensin System (RAS), angiotensin converting enzyme inhibitors (ACE-Is) are the most used subgroup accounting 72.77% of the total agents used in 2010. Their consumption was up by 30% from previous year. Among the ACE-Is, while the use of captopril, ramipril and enalapril been consistent in 2009 and 2010, the use of the most common ACE-I perindopril increased substantially from 9.7852 in 2009 to 14.6065 in 2010 DDD/1000 population/day.

Table 8.12.1 shows data for both single agents within the ARBs group or products containing their combinations. Following the introduction of telmisartan in the Drug Formulary in 2008, telmisartan remains the most commonly utilised ARB, followed closely by irbesartan and losartan. With the exception of candesartan and olmesartan showing a decrease in use, others such as losartan (0.7872 in 2009, 0.8563 in 2010), valsartan (0.3525 in 2009, 0.4380 in 2010), telmisartan (0.9187 in 2009, 1.1804 in 2010) and irbesartan (0.7079 in 2009, 0.9312 in 2010) showed marginal increases in DDD/1000 population/day scores. It is single ARB in combination with diuretics, which

demonstrate a substantial increase in use between 2009 and 2010: losartan with diuretics (0.4259 to 1.1099), valsartan with diuretics (0.8169 to 1.1453), telmisartan with diuretics (0.2856 to 0.9860) and irbesartan (0.9000 to 1.1113). As far as single ARB formulation or in combination with diuretics, most of the usage of these drugs are found in the public sector, except for losartan-diuretic and telmisartan-diuretic combinations, which was more used in the private sector. The unique combination of amlodipine and valsartan also saw a substantial increase in use, with a score of 0.1789 to 5.8704, and the majority of the use noted from the private sector. Combined consumption of products containing combinations of ARBs with diuretics was 10.278 DDD in 2010 (up by almost 4.0 fold) from previous year. The considerable increase could partly be due to aggressive marketing by drug companies.

In summary, the most commonly prescribed antiplatelets were aspirin, clopidogrel and ticlopidine while warfarin was the most commonly prescribed oral anticoagulant. The most utilise cardiovascular drugs are the calcium channel blockers, followed by ACE-Is, beta-blockers, diuretics and ARBs while the five most commonly used single drugs to treat cardiovascular disease were amlodipine, perindopril, nifedipine, hydrochorthiazide and metoprolol. Increase use in some of the drug classes appear to be based on trial evidence or clinical practice guidelines. However, marketing may also play a larger role in the increase use of newer drugs such as ARBs while increase use in specific drug such as amlodipine is partly because of the current drug policy in the country. In conclusion, except for minimal decrease in utilization of digoxin, diuretics and beta-blockers there has been significant increase in utilization of most of the cardiovascular drug class from 2009 to 2010.

Table 8.1: Use of Drugs for Cardiovascular disorders, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
B01	Antithrombotic agents	10.1730	10.7483
C01	Cardiac therapy	11.2361	3.7909
C01A	Cardiac glycosides	3.9566	0.4037
C01B	Antiarrhythmics, class I and III	0.0891	0.0835
C01C	Cardiac stimulants excl. Cardiac glycosides	0.2568	0.2847
C01D	Vasodilators used in cardiac diseases	1.7463	1.7694
C01E	Other cardiac preparations	5.1873	1.2496
C02	Antihypertensives	2.7174	2.9298
C03	Diuretics	18.9316	18.2511
C04	Peripheral vasodilators	0.0529	0.0470
C07	Beta blocking agents	22.0525	20.1303
C08	Calcium channel blockers	30.9812	48.8160
C09	Agents acting on the renin-angiotensin system	23.9178	36.8821
C09A	Ace inhibitors, plain	18.1716	23.0230
C09B	Ace inhibitors, combinations	0.0871	0.0751
C09C	Angiotensin II antagonists, plain	2.9942	3.5041
C09D	Angiotensin II antagonists, combinations	2.6650	10.2778
C09X	Other agents acting on the renin-angiotensin system	-	0.0021

Table 8.2.1: Use of Anti-Thrombotic Drugs by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
B01A A	Vitamin K antagonists	0.3119	0.3234
B01A B	Heparin group	0.5458	0.1931
B01A C	Platelet aggregation inhibitors excl. heparin	8.2069	8.4971
B01A D	Enzymes	0.0012	0.0009
B01A X	Other antithrombotic agents	0.0043	0.0153

Table 8.2.2: Use of Anti-Thrombotic Drugs by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
B01A A	**Vitamin K antagonists**			
B01A A03	Warfarin	Public	0.3098	0.2786
		Private	0.4243	0.0813
		Total	0.7340	0.3599
B01A B	**Heparin group**			
B01A B01	Heparin	Public	0.3962	0.0127
		Private	0.0265	0.0504
		Total	0.4227	0.0631
B01A B05	Enoxaparin	Public	0.0664	0.0978
		Private	0.0308	0.0150
		Total	0.0972	0.1128
B01A B06	Nadroparin	Public	<0.0001	-
		Private	0.0006	<0.0001
		Total	0.0006	<0.0001
B01A B10	Tinzaparin	Public	-	0.0016
		Private	0.0006	0.0004
		Total	0.0006	0.0020
B01A B11	Sulodexide	Public	<0.0001	<0.0001
		Private	0.0248	0.0152
		Total	0.0248	0.0152
B01A C	**Platelet aggregation inhibitors excl. heparin**			
B01A C04	Clopidogrel	Public	0.1392	0.2295
		Private	0.8823	0.6386
		Total	1.0216	0.8682
B01A C05	Ticlopidine	Public	0.5391	0.5643
		Private	0.0783	0.0592
		Total	0.6174	0.6235
B01A C06	Acetylsalicylic acid	Public	4.3962	5.1120
		Private	2.1108	2.3142
		Total	6.5070	7.4262
B01A C07	Dipyridamole	Public	0.0396	0.0396
		Private	0.0014	0.0031
		Total	0.0410	0.0427
B01A C11	Iloprost	Public	-	<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

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
B01A C18	Triflusal	Public	-	-
		Private	0.0017	0.0006
		Total	0.0017	0.0006
B01A C23	Cilostazol	Public	0.0002	-
		Private	0.0007	0.0055
		Total	0.0009	0.0055
B01A D	**Enzymes**			
B01A D01	Streptokinase	Public	0.0007	0.0008
		Private	0.0004	<0.0001
		Total	0.0011	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	-	<0.0001
		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	0.0032	0.0140
		Private	0.0011	0.0014
		Total	0.0043	0.0153

Table 8.3.1: Use of Cardiac Glycosides by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C01A	**Cardiac glycosides**			
C01A A05	Digoxin	Public	2.4799	0.3328
		Private	1.4768	0.0709
		Total	3.9566	0.4037

Table 8.4.1: Use of Anti-Aryhtmics by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C01B A	**Antiarrhythmics, class Ia**			
C01B A02	Procainamide	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
C01B B	**Antiarrhythmics, class Ib**			
C01B B01	Lidocaine	Public	0.0042	<0.0001
		Private	<0.0001	0.0001
		Total	0.0043	0.0002
C01B B02	Mexiletine	Public	-	
		Private	-	-
		Total	-	-

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C01B C	**Antiarrhythmics, class Ic**			
C01B C03	Propafenone	Public	-	<0.0001
		Private	0.0016	0.0009
		Total	0.0016	0.0010
C01B C04	Flecainide	Public	0.0008	0.0009
		Private	0.0085	0.0124
		Total	0.0092	0.0133
C01B D	**Antiarrhythmics, class III**			
C01B D01	Amiodarone	Public	0.0270	0.0289
		Private	0.0470	0.0401
		Total	0.0740	0.0690

Table 8.5.1: Use of Cardiac Stimulants by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
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	0.0182	0.0338
		Private	0.0020	0.0019
		Total	0.0202	0.0357
C01C A04	Dopamine	Public	0.0373	0.0381
		Private	0.0022	0.0014
		Total	0.0395	0.0395
C01C A06	Phenylephrine	Public	0.0009	0.0034
		Private	0.0018	0.0015
		Total	0.0027	0.0049
C01C A07	Dobutamine	Public	0.0098	0.0111
		Private	0.0009	0.0012
		Total	0.0107	0.0123
C01C A09	Metaraminol	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
C01C A24	Epinephrine	Public	0.1566	0.1571
		Private	0.0243	0.0246
		Total	0.1808	0.1816
C01C A26	Ephedrine	Public	0.0005	0.0087
		Private	0.0022	0.0015
		Total	0.0027	0.0102
C01C E	**Phosphodiesterase inhibitors**			
C01C E02	Milrinone	Public	<0.0001	<0.0001
		Private	0.0002	0.0004
		Total	0.0002	0.0004
C01C X	**Other cardiac stimulants**			
C01C X08	Levosimendan	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

Table 8.6.1: Use of Vasodilators in Cardiac diseases by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C01D A	**Organic nitrates**			
C01D A02	Glyceryl trinitrate	Public	0.1942	0.1438
		Private	0.0933	0.0436
		Total	0.2875	0.1874
C01D A08	Isosorbide dinitrate	Public	0.9821	1.0396
		Private	0.0455	0.0809
		Total	1.0276	1.1204
C01D A14	Isosorbide mononitrate	Public	0.1155	0.1987
		Private	0.3158	0.2629
		Total	0.4313	0.4615
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 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C01E A	**Prostaglandins**			
C01E A01	Alprostadil	Public	<0.0001	0.0026
		Private	0.0025	0.0017
		Total	0.0026	0.0043
C01E B	**Other cardiac preparations**			
C01E B10	Adenosine	Public	0.0006	0.0008
		Private	0.0001	0.0002
		Total	0.0007	0.0010
C01E B15	Trimetazidine	Public	4.4451	0.9455
		Private	0.7361	0.2945
		Total	5.1812	1.2401
C01E B17	Ivabradine	Public	-	0.0005
		Private	0.0028	0.0040
		Total	0.0028	0.0045

Table 8.7.1: Use of Diuretics by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C03A A	**Thiazides, plain**			
C03A A03	Hydrochlorothiazide	Public	9.8619	10.7069
		Private	1.3329	0.2609
		Total	11.1948	10.9678
C03A A04	Chlorothiazide	Public	0.0219	0.0327
		Private	0.0142	<0.0001
		Total	0.0361	0.0327
C03B A	**Sulfonamides, plain**			
C03B A04	Chlortalidone	Public	-	-
		Private	0.0126	<0.0001
		Total	0.0126	<0.0001

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C03B A08	Metolazone	Public	<0.0001	0.0005
		Private	-	0.0004
		Total	<0.0001	0.0009
C03B A11	Indapamide	Public	0.0194	0.0237
		Private	1.8839	0.1180
		Total	1.9032	0.1417
C03C A	**Sulfonamides, plain**			
C03C A01	Furosemide	Public	3.5828	4.9055
		Private	0.5704	0.8310
		Total	4.1532	5.7365
C03C A02	Bumetanide	Public	0.0083	0.0033
		Private	0.0085	0.1089
		Total	0.0169	0.1122
C03D A	**Aldosterone antagonists**			
C03D A01	Spironolactone	Public	0.2255	0.2376
		Private	0.3202	0.0589
		Total	0.5457	0.2966
C03D A04	Eplerenone	Public	<0.0001	<0.0001
		Private	-	0.0002
		Total	<0.0001	0.0003
C03D B	**Other potassium-sparing agents**			
C03D B01	Amiloride	Public	-	0.0623
		Private	0.0092	0.0013
		Total	0.0092	0.0636
C03E A	**Low-ceiling diuretics and potassium-sparing agents**			
C03E A01	Hydrochlorothiazide and potassium-sparing agents	Public	0.9291	0.8063
		Private	0.1308	0.0925
		Total	1.0599	0.8988

Table 8.8.1: Use of Peripheral Vasodilators by Drugs Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C04A C01	Nicotinic acid	Public	-	-
		Private	-	0.0005
		Total	-	0.0005
C04A D03	Pentoxifylline	Public	0.0305	0.0338
		Private	0.0210	0.0118
		Total	0.0515	0.0457
C04A E01	Ergoloid mesylates	Public	-	-
		Private	0.0013	0.0008
		Total	0.0013	0.0008
C04A X02	Phenoxybenzamine	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

Table 8.9.1: Use of Beta Blocking Agents by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C07A A	**Beta blocking agents, non-selective**			
C07A A05	Propranolol	Public	0.2446	0.2398
		Private	0.2401	0.1060
		Total	0.4847	0.3458
C07A A07	Sotalol	Public	0.0010	0.0015
		Private	0.0062	0.0076
		Total	0.0072	0.0091
C07A B	**Beta blocking agents, selective**			
C07A B02	Metoprolol	Public	9.5960	9.8837
		Private	0.4085	0.1315
		Total	10.0045	10.0152
C07A B03	Atenolol	Public	7.5123	7.9586
		Private	1.4322	1.2175
		Total	8.9445	9.1761
C07A B04	Acebutolol	Public	-	-
		Private	0.0003	<0.0001
		Total	0.0003	<0.0001
C07A B05	Betaxolol	Public	0.0006	0.0013
		Private	0.0118	0.0051
		Total	0.0124	0.0064
C07A B07	Bisoprolol	Public	0.0773	0.1419
		Private	0.1934	0.1391
		Total	0.2707	0.2811
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	0.0004
		Total	<0.0001	0.0004
C07A G	**Alpha and beta blocking agents**			
C07A G01	Labetalol	Public	0.0881	0.0106
		Private	0.3005	0.5728
		Total	0.3886	0.5834
C07A G02	Carvedilol	Public	0.1192	0.1488
		Private	0.1453	0.0913
		Total	0.2644	0.2401
C07B B	**Beta blocking agents, selective, and thiazides**			
C07B B07	Bisoprolol and thiazides	Public	-	-
		Private	0.0061	0.0032
		Total	0.0061	0.0032
C07C B	**Beta blocking agents, selective, and other diuretics**			
C07C B02	Metoprolol and other diuretics	Public	-	-
		Private	0.0002	-
		Total	0.0002	-
C07C B03	Atenolol and other diuretics	Public	-	-
		Private	0.0965	0.0228
		Total	0.0965	0.0228

Table 8.10.1: Use of Calcium Channel Blockers Agents by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C08C A	**Dihydropyridine derivatives**			
C08C A01	Amlodipine	Public	7.4473	25.6883
		Private	8.7885	9.1230
		Total	16.2358	34.8113
C08C A02	Felodipine	Public	1.3953	1.6894
		Private	0.3583	0.2263
		Total	1.7536	1.9157
C08C A03	Isradipine	Public	-	-
		Private	0.0021	0.0002
		Total	0.0021	0.0002
C08C A04	Nicardipine	Public	-	<0.0001
		Private	0.0033	0.0003
		Total	0.0033	0.0003
C08C A05	Nifedipine	Public	11.485	10.0186
		Private	1.1568	1.7471
		Total	12.6417	11.7657
C08C A06	Nimodipine	Public	0.0008	0.0015
		Private	0.0003	0.0005
		Total	0.0011	0.0020
C08C A09	Lacidipine	Public	-	-
		Private	0.0012	0.0017
		Total	0.0012	0.0017
C08C A13	Lercanidipine	Public	-	0.0011
		Private	0.0730	0.0319
		Total	0.0730	0.0330
C08D A	**Phenylalkylamine derivatives**			
C08D A01	Verapamil	Public	0.0250	0.0238
		Private	0.0137	0.0149
		Total	0.0386	0.0386
C08D B	**Benzothiazepine derivatives**			
C08D B01	Diltiazem	Public	0.1781	0.1895
		Private	0.0520	0.0588
		Total	0.2302	0.2483

Table 8.11.1: Use of ACE Inhibitors Agents by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C09A	**ACE INHIBITORS, PLAIN**			
C09A A01	Captopril	Public	3.2357	3.1559
		Private	0.0267	0.0848
		Total	3.2624	3.2407
C09A A02	Enalapril	Public	3.7143	4.9205
		Private	0.4149	0.3401
		Total	4.1293	5.2606

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C09A A03	Lisinopril	Public	0.0008	<0.0001
		Private	0.3468	0.1500
		Total	0.3475	0.1500
C09A A04	Perindopril	Public	9.4613	14.2719
		Private	0.3239	0.3346
		Total	9.7852	14.6065
C09A A05	Ramipril	Public	0.2770	0.4032
		Private	0.3622	0.1397
		Total	0.6392	0.5428
C09A A09	Fosinopril	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
C09A A16	Imidapril	Public	0.0003	0.0011
		Private	0.0076	0.0006
		Total	0.0079	0.0017
C09B	**ACE Inhibitors, Combinations**			
C09B A04	Perindopril and diuretics	Public	0.0003	0.0184
		Private	0.0868	0.0567
		Total	0.0871	0.0751

Table 8.12.1: Use of Angiotensin II Antagonists by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C09C	**Angiotensin II Antagonists, Plain**			
C09C A01	Losartan	Public	0.3657	0.5448
		Private	0.4214	0.3115
		Total	0.7872	0.8563
C09C A03	Valsartan	Public	0.2006	0.3147
		Private	0.1519	0.1233
		Total	0.3525	0.4380
C09C A04	Irbesartan	Public	0.5077	0.7907
		Private	0.2002	0.1406
		Total	0.7079	0.9312
C09C A06	Candesartan	Public	<0.0001	0.0047
		Private	0.1257	0.0239
		Total	0.1257	0.0286
C09C A07	Telmisartan	Public	0.6537	1.0212
		Private	0.2649	0.1592
		Total	0.9187	1.1804
C09C A08	Olmesartan medoxomil	Public	-	-
		Private	0.1022	0.0695
		Total	0.1022	0.0695
C09D	**Angiotensin II Antagonists, Combinations**			
C09D A01	Losartan and diuretics	Public	0.0598	0.7297
		Private	0.3661	0.3802
		Total	0.4259	1.1099
C09D A03	Valsartan and diuretics	Public	0.5326	0.8766
		Private	0.2841	0.2687
		Total	0.8167	1.1453

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C09D A04	Irbesartan and diuretics	Public	0.7524	0.9707
		Private	0.1477	0.1406
		Total	0.9000	1.1113
C09D A06	Candesartan and diuretics	Public	-	0.0019
		Private	0.0569	0.0513
		Total	0.0569	0.0532
C09D A07	Telmisartan and diuretics	Public	0.0435	0.1243
		Private	0.2421	0.8617
		Total	0.2856	0.9860
C09D A08	Olmesartan medoxomil and diuretics	Public	-	-
		Private	0.0009	0.0017
		Total	0.0009	0.0017
C09D B01	Valsartan and amlodipine	Public	0.0043	0.0806
		Private	0.1746	5.7898
		Total	0.1789	5.8704

References:

1. National Health and Morbidity Survey 2011. *http://www.moh.gov.my/english.php/pages/view/115* (accessed Nov, 2013).
2. Fong, A.Y.Y.; Yan, B.P.; Better late or never too late? Management of ST-elevation myocardial infarction initially treated with fibrinolysis in Asia. Eur Heart J Suppl2012,14 (Suppl A), A39-40.
3. Wiviott, S.D.; Braunwald, E.; McCabe, C.H. et al. Prasugrel versus clopidogrel in patients with acute coronary syndromes. *N Engl J Med*.2007,357,2001-15.
4. Montalescot, G.; Cohen, M.; Salette, G.; et al. Impact of anticoagulation levels on outcomes in patients undergoing elective percutaneous coronary intervention: insights from the STEEPLE trial. *Eur Heart J* 2008,29,462-71.
5. Steg, P.G.; Jolly, S.S.; Mehta, S.R.; et al. *Low-dose vs standard-dose unfractionated heparin for percutaneous coronary intervention in acute coronary syndromes treated with fondaparinux: the FUTURA/OASIS-8 randomized trial.* JAMA 2010,304,1339-49.
6. Brener, S.J.; Moliterno, D.J.; Lincoff, A.M.; et al. *Relationship between activated clotting time and ischemic or hemorrhagic complications: analysis of 4 recent randomized clinical trials of percutaneous coronary intervention*. Circulation 2004,110,994-8.
7. Sakshaug, S (ed), *Drug Consumption in Norway 2007-2011* (Legemiddelforbruket i Norge 2007-2011), Oslo, Norwegian Institute of Public Health, March 2012.
8. Australian Government, Department of Health and Aging. Statistics on Medicine Use 2009. http://www.pbs.gov.au/statistics/asm/2009/asm-2009.pdf (accessed January 7, 2014).
9. Australian Government, Department of Health and Aging. Statistics on Medicine Use 2010. http://www.pbs.gov.au/statistics/asm/2010/australian-statistics-on-medicine-2010.pdf (accessed January 7, 2014).
10. Packer, M.; Bristow, M.R.; Cohn, J.N.; et al. The effect of carvedilol on morbidity and mortality in patients with chronic heart failure. *N Engl J Med* 1996,334,1349-55.
11. Ogawa, T.; Yasui, K.; Tomizawa, T.; Sugishita, Y.Safety and efficacy of amlodipine. A new once-daily calcium antagonist in nonhypertensive patients with coronary artery disease. *Jpn Heart J.* 1993,34,557-65.
12. Derosa, G.; Maffioli, P. Drug safety evaluation of amlodipine. *Expert Opin Drug Saf.* 2011,10,795-804.
13. The ALLHAT officers and coordinators for the ALLHAT Collaborative Research Group: Major outcomes in high-risk hypertensivepatients randomized to angiotensin-converting enzyme inhibitor or calcium channel blocker vs. diuretic: The antihypertensive and lipid-lowering treatment to prevent heart attack trial (ALLHAT). *JAMA* 2002,28.

CHAPTER 9 : USE OF ANTIHYPERTENSIVES

Azahari R.[1], Khoo E.M.[2], Bavanandan S.[3], Sani Y.[4]

1. Institut Jantung Negara, Kuala Lumpur 2. University Malaya Medical Centre, Selangor 3. Hospital Kuala Lumpur, Kuala Lumpur 4. Heart Centre, Sarawak General Hospital, Sarawak

In 2010, the total utilisation of antihypertensives had increased by 22.4% from 100.8388 DDD/1000 population/day in 2009 to 123.0747 DDD/1000 population/day in 2010. There were increased utilisations of agents acting on the renin-angiotensin system (RAS) by 37.3%, followed by calcium channel blockers (CCB) by 55.1%. However, beta blockers usage was decreased by 14.1%.

In 2009, the most commonly used antihypertensives were CCB (31.247 DDD/1000 population/day), agents acting on the RAS [23.8189 DDD/1000 population/day (ACEi and ACEi - combinations: 18.2739 DDD/1000 population/day; ARBs and ARB-combinations: 5.5451 DDD/1000 population/day)], beta blockers (24.0768 DDD/1000 population/day), and diuretics (18.9259 DDD/1000 population/day). In 2010, the ranking remained unchanged with CCB utilisation of 48.4702 DDD/1000 population/year, agents acting on RAS [32.7017 DDD/1000 population/day (ACEi and ACEi -combinations: 23.88 DDD/1000 population/day; ARB and ARB-combinations: 8.8194 DDD/1000 population/day)], beta blockers (20.6715 DDD/1000 population/day) and diuretics (18.2526 DDD/1000 population/day). The popular use of CCBs and agents acting on the RAS is in accordance with the Malaysian Clinical Practice Guidelines on Management of Hypertension (3rd Edition)[1].

Among the ACEi, perindopril alone and in combination with diuretics is most commonly used. Its use increased markedly by 48.8% from 9.8715 DDD/1000 population/day in 2009 to 14.6871 DDD/1000 population/day in 2010. The increase is mainly seen in the public sector. Enalapril is the next commonest used ACEi with a 25.9% rise in utilisation from 4.1411 in 2009 to 5.2118 in 2010. The greater utilisation of perindopril is probably related to its once-daily dosing as opposed to enalapril.

Among ARBs, the commonest used was telmisartan alone and in combination with diuretics which has increased slightly from 1.1994 DDD/1000/population/day in 2009 to 1.264 DDD/1000 population/day in 2010. The increase is mainly seen in the public sector. In private sector, the use of valsartan in combination with amlodipine was rise dramatically from 0.1722 DDD/1000/population/day in 2009 to 0.2076 DDD/1000/population/day.

There was a distinct difference in trends in utilisation of CCBs in public and private sectors. In the public sector there was a huge rise by 245% in the use of amlodipine (7.4473 to 25.6883 DDD/1000 population/day). This is probably related to amendment in drug listing in the Ministry of Health Malaysia in 2009 where amlodipine changed from category class A to class B. This allowed medical officers to prescribe amlodipine without countersignature from a specialist. In the private sector the usage of amlodipine is increased by 3.8% from 8.7885 to 9.123 DDD/1000 population/day. In the public sector, use of nifedipine decreased slight by 12.8% (11.485 to 10.0186 DDD/1000 population/day) whereas utilisation remained similar in the private sector (1.1568 and 1.7471 DDD/1000 population/day in 2009 and 2010 respectively). Use of the other CCBs remained relatively unchanged.

The most commonly used beta blockers were atenolol and metoprolol. Atenolol use had increased by 2.6% from 8.9445to 9.1761 DDD/1000 population/day in 2009 and 2010 respectively. The use of metoprolol had remained relatively unchanged at 10.0 DDD/1000 population/day in both public and private sectors combined.

In analysing the use of diuretics as antihypertensive agents, high ceiling diuretics have been excluded. Use of diuretics alone was 13.6975 DDD/1000 population/day in 2009 and 11.4478 DDD/1000 population/day in 2010. 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 14.7559 in 2009 and 12.3483 DDD/1000 population/day in 2010. The main diuretic used was hydrochlorothiazide (HCTZ), with 10.9678 DDD/1000 population/day in 2010, followed by indapamide at 0.142 DDD/1000 population/day in the same year.

The four most commonly prescribed antihypertensive agents in 2010 were amlodipine (34.8113 DDD/1000 population/day, perindopril (14.6065 DDD/1000 population/day), followed by nifedipine (11.7657 DDD/1000 population/day) and hydrochlorothiazide (10.9678 DDD/1000 population/day) These 4 drugs accounted for 58.6% of the total utilisation of antihypertensives.

Overall 84.4% of all antihypertensives were utilised by the public sector in 2010. The most popular drugs used in the public sector were amlodipine (25.6883DDD /1000 population/day), perindopril (14.2719 DDD /1000 population/day), hydrochlorothiazide (10.7069 DDD /1000 population/day).The most popular drugs in the private sector were amlodipine (9.123 DDD/1000 population/day), and nifedipine (1.7471 DDD/1000 population/day).

Compared to Australia[2] and Nordic countries[3] the use

of antihypertensives in Malaysia is low. In Finland[4] and Norway[5], drugs acting on the RAS were the most commonly prescribed agents rather than CCBS. Another difference seen is the use of fixed-dose combinations. In Malaysia in 2010 for example, the use of fixed-dose combination ARB/diuretic was 4.7044DDD/100 population/day as compared to 36.900 DDD/1000 population/day in Norway[5]. This may be due to cost considerations.

Table 9.1: Use of Anti-Hypertensives by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
C02	Antihypertensives	2.7174	2.9298
C02A	Antiadrenergic agents, centrally acting	0.3830	0.3281
C02C	Antiadrenergic agents, peripherally acting	2.3209	2.5874
C02D	Arteriolar smooth muscle, agents acting on	0.0132	0.0137
C02K	Other antihypertensives	0.0004	0.0005
C03	Diuretics	18.9259	18.2526
C03A	Low-ceiling diuretics, thiazides	11.2308	11.0005
C03B	Low-ceiling diuretics, excl. Thiazides	1.9151	0.1437
C03C	High-ceiling diuretics	4.1700	5.9043
C03D	Potassium-sparing agents	0.5516	0.3036
C03E	Diuretics and potassium-sparing agents in combination	1.0584	0.9005
C04	Peripheral vasodilators	0.0528	0.0489
C07	Beta blocking agents	24.0768	20.6715
C08	Calcium channel blockers	31.2470	48.4702
C09	Agents acting on the renin-angiotensin system	23.8189	32.7017
C09A	Ace inhibitors, plain	18.1876	23.7994
C09B	Ace inhibitors, combinations	0.0863	0.0806
C09C	Angiotensin II antagonists, plain	2.9559	3.8305
C09D	Angiotensin II antagonists, combinations	2.5892	4.9889
C09X	Other agents acting on the renin-angiotensin system	-	0.0023

Table 9.2: Use of Anti-Hypertensives by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C02A	**Antiadrenergic Agents, Centrally Acting**			
C02A B01	Methyldopa (levorotatory)	Public	0.3388	0.2943
		Private	0.0183	0.0066
		Total	0.3571	0.3009
C02A C01	Clonidine	Public	-	-
		Private	-	-
		Total	-	-
C02A C05	Moxonidine	Public	0.0003	0.0016
		Private	0.0256	0.0256
		Total	0.0258	0.0272
C02C A	**Alpha-adrenoreceptor antagonists**			
C02C A01	Prazosin	Public	1.7879	2.1579
		Private	0.0273	0.0432
		Total	1.8152	2.2010
C02C A04	Doxazosin	Public	0.2910	0.3016
		Private	0.2147	0.0848
		Total	0.5057	0.3864

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C02D	**Arteriolar smooth muscle, agents acting on**			
C02D A01	Diazoxide	Public	-	0.0002
		Private	-	-
		Total	-	0.0002
C02D B01	Dihydralazine	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
C02D B02	Hydralazine	Public	0.0003	0.0005
		Private	<0.0001	<0.0001
		Total	0.0003	0.0005
C02D C01	Minoxidil	Public	0.0046	0.0018
		Private	<0.0001	<0.0001
		Total	0.0047	0.0018
C02D D01	Nitroprusside	Public	<0.0001	<0.0001
		Private	0.0082	0.0111
		Total	0.0082	0.0111
C02K	**Other Antihypertensives**			
C02K X01	Bosentan	Public	<0.0001	<0.0001
		Private	0.0004	0.0004
		Total	0.0005	0.0004
C03A	**Low-ceiling diuretics, thiazides**			
C03A A03	Hydrochlorothiazide	Public	9.8615	10.7069
		Private	1.3329	0.2609
		Total	11.1948	10.9678
C03A A04	Chlorothiazide	Public	0.0219	0.0327
		Private	0.0142	<0.0001
		Total	0.0361	0.0327
C03B	**Low-ceiling diuretics, excl. Thiazides**			
C03B A04	Chlortalidone	Public	-	-
		Private	0.0126	<0.0001
		Total	0.0126	<0.0001
C03B A08	Metolazone	Public	<0.0001	0.0006
		Private	-	0.0004
		Total	<0.0001	0.0010
C03B A11	Indapamide	Public	0.0194	0.0237
		Private	1.8831	0.1190
		Total	1.9025	0.1427
C03C	**High-Ceiling Diuretics**			
C03C A01	Furosemide	Public	3.5828	4.9055
		Private	0.5704	0.8310
		Total	4.1532	5.7365
C03C A02	Bumetanide	Public	0.0084	0.0036
		Private	0.0085	0.1642
		Total	0.0169	0.1678
C03D	**Potassium-Sparing Agents**			
C03D A01	Spironolactone	Public	0.2274	0.2398
		Private	0.3149	0.0623
		Total	0.5423	0.3020

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C03D A04	Eplerenone	Public	<0.0001	<0.0001
		Private	-	0.0002
		Total	<0.0001	0.0003
C03D B01	Amiloride	Public	-	0.0623
		Private	0.0092	0.0013
		Total	0.0092	0.0013
C03E	**Diuretics and potassium-sparing agents in combination**			
C03E A01	Hydrochlorothiazide and potassium-sparing agents	Public	0.9291	0.8063
		Private	0.1308	0.0925
		Total	1.0599	0.8988
C07A	**Beta blocking agents**			
C07A A05	Propranolol	Public	0.2457	0.2409
		Private	0.2381	0.0523
		Total	0.4838	0.2931
C07A A07	Sotalol	Public	0.0010	0.0016
		Private	0.0059	0.0076
		Total	0.0072	0.0096
C07A B02	Metoprolol	Public	9.5960	9.8837
		Private	0.4085	0.1315
		Total	10.0045	10.0152
C07A B03	Atenolol	Public	7.5123	7.9586
		Private	1.4322	1.2175
		Total	8.9445	9.1761
C07A B04	Acebutolol	Public	-	-
		Private	0.0003	<0.0001
		Total	0.0003	<0.0001
C07A B05	Betaxolol	Public	0.0006	0.0013
		Private	0.0118	0.0051
		Total	0.0124	0.0064
C07A B07	Bisoprolol	Public	0.0781	0.1534
		Private	0.1898	0.1473
		Total	0.2679	0.3007
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	0.0004
		Total	<0.0001	0.0004
C07A G01	Labetalol	Public	0.0881	0.0106
		Private	0.3005	0.5728
		Total	0.3886	0.5834
C07A G02	Carvedilol	Public	1.8754	0.1601
		Private	1.9897	0.0997
		Total	3.8650	0.2598
C07B B07	Bisoprolol and thiazides	Public	-	-
		Private	0.0061	0.0036
		Total	0.0061	0.0036

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C07C	**Beta blocking agents and other diuretics**			
C07C B02	Metoprolol and other diuretics	Public	-	-
		Private	0.0002	-
		Total	0.0002	-
C07C B03	Atenolol and other diuretics	Public	-	-
		Private	0.0965	0.0228
		Total	0.0965	0.0228
C08C	**Selective calcium channel blockers with mainly vascular effects**			
C08C A01	Amlodipine	Public	7.4473	25.6883
		Private	8.7885	9.1230
		Total	16.2358	34.8113
C08C A02	Felodipine	Public	1.3953	1.6894
		Private	0.3583	0.2263
		Total	1.7536	1.9157
C08C A03	Isradipine	Public	-	-
		Private	0.0022	0.0002
		Total	0.0022	0.0002
C08C A04	Nicardipine	Public	-	<0.0001
		Private	0.0033	0.0003
		Total	0.0033	0.0003
C08C A05	Nifedipine	Public	11.4850	10.0186
		Private	1.1568	1.7471
		Total	12.6417	11.7657
C08C A06	Nimodipine	Public	0.0008	0.0016
		Private	0.0003	0.0005
		Total	0.0011	0.0021
C08C A09	Lacidipine	Public	-	-
		Private	0.0028	0.0018
		Total	0.0028	0.0018
C08C A13	Lercanidipine	Public	-	0.0011
		Private	0.0724	0.0367
		Total	0.0724	0.0378
C08D	**Selective calcium channel blockers with direct cardiac effects**			
C08D A01	Verapamil	Public	0.0251	0.0240
		Private	0.0135	0.0176
		Total	0.3870	0.0416
C08D B01	Diltiazem	Public	0.4131	0.1906
		Private	0.0822	0.1032
		Total	0.4954	0.2938
C09A	**ACE Inhibitors, Plain**			
C09A A01	Captopril	Public	3.2421	3.1630
		Private	0.0264	0.0873
		Total	3.2685	3.2503
C09A A02	Enalapril	Public	3.7286	5.0896
		Private	0.4125	0.1221
		Total	4.1411	5.2118

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C09A A03	Lisinopril	Public	0.0008	<0.0001
		Private	0.3458	0.1519
		Total	0.3465	0.1519
C09A A04	Perindopril	Public	9.4613	14.2719
		Private	0.3239	0.3346
		Total	9.7852	14.6065
C09A A05	Ramipril	Public	0.2787	0.4282
		Private	0.3509	0.1490
		Total	0.6296	0.5772
C09A A09	Fosinopril	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
C09A A16	Imidapril	Public	0.0088	0.0011
		Private	0.0078	0.0006
		Total	0.0166	0.0017
C09B	**ACE inhibitors, combinations**			
C09B A04	Perindopril and diuretics	Public	0.0003	0.0184
		Private	0.0860	0.0616
		Total	0.0863	0.0806
C09C	**Angiotensin II antagonists, plain**			
C09C A01	Losartan	Public	0.3682	0.5850
		Private	0.3885	0.4302
		Total	0.7567	1.0151
C09C A03	Valsartan	Public	0.2020	0.3366
		Private	0.1461	0.1298
		Total	0.3481	0.4664
C09C A04	Irbesartan	Public	0.5109	0.8255
		Private	0.1963	0.1507
		Total	0.1963	0.1507
C09C A06	Candesartan	Public	<0.0001	0.0047
		Private	0.1247	0.0263
		Total	0.1247	0.0310
C09C A07	Telmisartan	Public	0.6568	1.1001
		Private	0.2611	0.1684
		Total	0.9179	0.1684
C09C A08	Olmesartan medoxomil	Public	-	-
		Private	0.1012	0.0733
		Total	0.1012	0.0733
C09D	**Angiotensin II antagonists, combinations**			
C09D A01	Losartan and diuretics	Public	0.0602	0.7542
		Private	0.3089	0.4650
		Total	0.3690	1.2192
C09D A03	Valsartan and diuretics	Public	0.5330	0.8874
		Private	0.2785	0.3133
		Total	0.8115	1.2009

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C09D A04	Irbesartan and diuretics	Public	0.7524	0.9763
		Private	0.1424	0.1547
		Total	0.8948	1.1310
C09D A06	Candesartan and diuretics	Public	-	0.0019
		Private	0.0547	0.0540
		Total	0.0547	0.0559
C09D A07	Telmisartan and diuretics	Public	0.0439	0.1347
		Private	0.2376	0.9610
		Total	0.2815	1.0956
C09D A08	Olmesartan medoxomil and diuretics	Public	-	-
		Private	0.0011	0.0018
		Total	0.0011	0.0018
C09D B01	Valsartan and amlodipine	Public	0.0043	0.0771
		Private	0.1722	0.2076
		Total	0.1765	0.2847
C09X A02	Aliskiren	Public	-	<0.0001
		Private	-	0.0023
		Total	-	0.0023

References:

1. *Clinical Practice Guidelines on Management of Hypertension* (3rd Edition), Ministry of Health Malaysia 2008.
2. *Australian Statistics in Medicine* 2010. Australian Government Department of Health and Aging 2010, Printing Office: Australia 2012.
3. *Medicines Consumption in the Nordic Countries* 2004-2008. Nordic Medical Statistical Committee 2009, Copenhagen 2009.
4. *Finnish Statistics on Medicine* 2010 .Finnish Medicines Agency Social Insurance Institution, Printing Office: Helsinki 2011.
5. Sakshaug, S (ed), *Drug Consumption in Norway* 2008-2012, Norwegian Institute of Public Health, Printing Office: Oslo 2013.

CHAPTER 10 : USE OF LIPID MODIFYING DRUGS

Wan Azman W.A.[1], Yusoff M.R.[2], Kasim S.[3], Kong S.H.[4], Haarathi C.[5], Nirmala J.[6], Sim K.H.[7]

1.Department of Medicine, University Malaya Medical Centre, 2. Department of Medicine, Hospital Kuala Lumpur, 3. Department of Medicine, Universiti Teknologi MARA, Sungai Buloh 4. UKM Medical Centre, Kuala Lumpur 5. Pharmaceutical Services Division, Ministry of Health 6. Hospital Kuala Lumpur, 7. National Heart Association of Malaysia

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 – 66 years, Canada – 68 years). Majority of patients were managed medically, with low rates of cardiac interventions, the latter depends largely on availability of cardiac catheterisation laboratory 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 2011, the prevalence of hypertension in Malaysia for adults ≥ 18 years has increased from 32.2% in 2006 to 32.7% in 2011. For hypercholesterolemia, 35.1% (6.2 million) of adults 18 years and above have elevated cholesterol. Of these, 8.4% are known to have hypercholesterolemia however 26.6% are previously undiagnosed with hypercholesterolemia[3]. The high prevalence of cardiovascular risk factors indicate the need for 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 dyslipidemia. 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[4-9]. The treatment target and practice guideline regarding the use of statins in various cardiovascular presentations have been well documented[10,11,12]. The lower the low-density lipoprotein (LDL), the better the outcome[13,14]. However the 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk (ASCVD) in adults provides a new perspective on the LDL-C and/or non HDL-C treatment goals. The guideline focus on the appropriate intensity of statin therapy to reduce ASCVD risk in those most likely to benefit[15].

A good standard of practice with regards to ACS pharmacotherapy among Malaysian patients has been noted. About 91.0% of our ACS patients were given statin upon discharge[2,16]. The most prescribed statin in Malaysia was simvastatin (57.6%). Eighty percent (80.4%) of its use accounts from the public sector. Its widespread availability across the country makes simvastatin the number one used statin in Malaysia. The second most commonly used statin was lovastatin which accounts for 27.2% of the overall statins used in the year 2010. There has been an increase in the overall usage of atorvastatin compared to 2008 contributed mainly by a 2 fold increase in the private sector. As for rosuvastatin, the usage has decreased in the public and the private sector by 25%. The use of pravastatin has also declined (35.2%) compared to 2008.

The fibrate group remains the second most commonly used lipid modifying agent. Compared to 2008, the overall usage has reduced by 16.1%. Gemfibrozil is still the most commonly used fibrate (73.9%), however there is an increasing trend in the use of fenofibrate (17.7%) in the public sector.

Ezetimibe, a cholesterol absorption inhibitor, usage has remained the same. There is an increase of its use in the public sector (45.8%). Overall, the use of combination therapy with simvastatin and ezetimibe has decreased by 16.8%. The combination drug of atorvastatin and amlodipine has had a significant utilization, accounting for 20.5% of the total lipid modifying agents used in 2010.

Referring to utilization pattern of lipid modifying agents in other countries, the Nordic countries especially Finland has shown an increase in the use of lipid modifying agents by 18% from 2008 to 2010. Simvastatin remains the dominant statin in these countries possibly due to its cheaper cost when compared to atorvastatin. The other lipid lowering agents (fibrates, bile acid sequestrants, nicotinic acid) represents a small proportion of agents used in a stable trend[17,18]. In Australia, the top three statins used in the public sector remains to be atorvastatin, rosuvastatin and simvastatin in descending order. Statin is the most prescribed lipid modifying agent followed by combination

therapy and ezetimibe monotherapy. The usage of ezetimibe monotherapy has increase 12.2%, much smaller when compared to Finland[19].

Despite the younger age of ACS in Malaysia, and with more than 90.0% of them having cardiovascular risk factors1, our utilisation of lipid modifying agents compared to the developed countries is much lower. For example, Australia had a statin usage of 137.820 DDD/1000 population/day in 2010 compared to 15.130 DDD/1000 population/day in Malaysia[19]. Despite this disparity, Malaysia is showing an increasing trend in statin usage of 25.6% from 2009 to 2010.

There is a huge gap to fill as this data shows that we are still under utilising statin therapy at a population level. 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 health care cost in the future.

Table 10.1: Use of Lipid Modifying Medicines by Drug Class, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
C10A A	HMG CoA reductase inhibitors	21.735	29.0697
C10A B	Fibrates	0.9370	1.1251
C10A C	Bile acid sequestrants	<0.0001	0.0001
C10A D	Nicotinic acid and derivatives	<0.0001	<0.0001
C10A X	Other lipid modifying agents	0.1513	0.1296
C10B A	HMG CoA reductase inhibitors in combination with other lipid modifying agents	0.1268	0.1939
C10B X	HMG CoA reductase inhibitors, other combinations	0.0262	4.2624

Table 10.2: Use of Lipid Modifying Medicines by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C10A A	**HMG CoA reductase inhibitors**			
C10A A01	Simvastatin	Public	10.3117	13.4621
		Private	2.5831	3.2758
		Total	12.8947	16.7379
C10A A02	Lovastatin	Public	4.6067	7.6777
		Private	0.2697	0.2381
		Total	4.8764	7.9158
C10A A03	Pravastatin	Public	0.0799	0.1205
		Private	0.0479	0.0143
		Total	0.1278	0.1348
C10A A04	Fluvastatin	Public	0.0004	-
		Private	0.0279	0.0088
		Total	0.0283	0.0088
C10A A05	Atorvastatin	Public	0.8444	1.3177
		Private	2.0328	2.6271
		Total	2.8772	3.9448
C10A A07	Rosuvastatin	Public	0.0916	0.0481
		Private	0.8394	0.3274
		Total	0.9311	0.3754
C10A B	**Fibrates**			
C10A B04	Gemfibrozil	Public	0.6521	0.8127
		Private	0.0086	0.0191
		Total	0.6607	0.8318

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C10A B05	Fenofibrate	Public	0.0187	0.1178
		Private	0.2511	0.1720
		Total	0.2698	0.2898
C10A B08	Ciprofibrate	Public	0.0003	0.0002
		Private	0.0062	0.0033
		Total	0.0065	0.0035
C10A C	**Bile acid sequestrants**			
C10A C01	Colestyramine	Public	-	0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0001
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	0.0622	0.0766
		Private	0.0891	0.0530
		Total	0.1513	0.1296
C10B A	**HMG CoA reductase inhibitors in combination with other lipid modifying agents**			
C10B A02	Simvastatin and ezetimibe	Public	0.0099	0.0576
		Private	0.1169	0.1363
		Total	0.1268	0.1939
C10B X	**HMG CoA reductase inhibitors, other combinations**			
C10B X03	Atorvastatin and amlodipine	Public	0.0016	3.3129
		Private	0.0246	0.9495
		Total	0.0262	4.2624

References:

1. Number of discharges and deaths in government hospitals. Health Informatics Centre, Planning and Development Division, Ministry of Health, July 2010.
2. Wan Ahmad, W.A., Zamhari, R., Ismail, O., et al. Malaysian National Cardiovascular Disease Database (NCVD) – Acute Coronary Syndrome (ACS) Registry: How are we different? *CVD Prevention and Control Journal* 2011. DOI:10.1016/j.cvdpc.2011.04.004.
3. Institute for Public Health (IPH) 2011. *National Health and Morbidity Survey* 2011 (NHMS 2011). Vol. II: Non-Communicable Diseases; 2011. ISBN 978-967-3887-68-2.
4. Heart Protection Study Collaborative Group: MRC/BHF Heart Protection Study of cholesterol lowering with simvastatin in 20 536 high-risk individuals: a randomized placebo- controlled trial. *Lancet* 2002, 360, 7–22.
5. Sever, P.S., Dahlof, B., Poulter, N.R., et al for the ASCOT Investigators: Prevention of coronary and stroke events with atorvastatin in hypertensive patients who have average or lower-than-average cholesterol concentrations, in the Anglo-Scandinavian cardiac outcomes trial-lipid lowering arm (ASCOT-LLA): a multicentre randomized controlled trial. *Lancet* 2003, 361, 1149–1158.
6. Pedersen, T.R., Faergeman, O, Kastelein, J.J.P., et al. High-dose atorvastatin vs usual-dose simvastatin for secondary prevention after myocardial infarction: the IDEAL Study: a randomized controlled trial. *JAMA* 2005, 294, 2437–2445.
7. Cannon, C.P., Braunwald, E., McCabe, C.H., et al. Intensive versus moderate lipid lowering with statins after acute coronary syndromes. *N. Engl. J. Med.* 2004, 350, 1495–1504.
8. LaRosa, J.C., Grundy, S.M., Waters, D.D.; et al. Intensive lipid lowering with atorvastatin in patients with stable coronary disease. *N. Engl. J. Med.* 2005, 352, 1425–1435

9. Sacks, F.M., Pfeffer, M.A.; Moye, L.A., et al. The effect of pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels: Cholesterol and Recurrent Events Trial investigators. *N. Engl. J. Med.* 1996, 335, 1001–1009.

10. Grundy, S.M., Cleement, J.I., Merz, C.N.; et al. Implications of recent clinical trials for the National Cholesterol Education Program Adult Treatment Panel III guidelines. *J. Am. Coll. Cardiol.* 2004, 44(3), 720-732.

11. Smith, S.C. Jr., Allen, J., Blair, S.N., et al. ACC/AHA guidelines for secondary prevention for patients with coronary and other atherosclerotic vascular disease: 2006 update: endorsed by the National Heart, Lung and Blood Institute. *Circulation* 2006, 113(19), 2363-2372.

12. Clinical Practice Guidelines: Management of Dyslipidemia 2011. 4th edition. Ministry of Health, June 2011.

13. Van der Harst, P., Voors, A.A., et al. Intensive versus moderate lipid lowering with statins after acute coronary syndromes. *N. Engl. J. Med.* 2004, 351, 714-717.

14. Waters, D.D., Guyton, J.R., Herrington, D.M., et al. Treating to New Targets (TNT) Study: does lowering low-density lipoprotein cholesterol levels below currently recommended guidelines yield incremental clinical benefit? *Am. J. Cardiol.* 2004, 93, 154-158.

15. Stone, N.J., Robinson, J., Lichtenstein, A.H., et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol.* 2013; DOI:10.1016/j.jacc.2013.11.002.

16. Wan Ahmad, W.A., Ramesh, S.V., Zambahari, R. Malaysia-ACute CORonary syndromes Descriptive study (ACCORD): Evaluation of the compliance with existing guidelines in patients with Acute Coronary Sydrome. *Singapore Med. J.* 2011, 52(7), 508-511.

17. *Finnish Statistics on Medicines 2010*. Finnish Medicines Agency Fimea & Social Insurance Institution, Helsinki 2011.

18. Sakshaug, S. Drug Consumption in Norway 2008-2012 (Legemiddelforbruket i Norge 2008-2012), Norwegian Institute of Public Health, Oslo, *legemiddelstatistikk* 2013:1

19. *Australian Statistics on Medicines* 2010. *Australian Government Department of Health and Ageing*. Commonwealth of Australia 2012.

CHAPTER 11 :USE OF DERMATOLOGICALS

Azura M.A.[1], Suganthi T. [1,] Chan L.C.[2], Choon S.E.[3], Chang S.Y.[4], Roshidah B.[5]

1. Hospital Kuala Lumpur, Kuala Lumpur 2. Hospital Pulau Pinang, Pulau Pinang 3. Hospital Sultanah Aminah, Johor Bahru 4. Hospital Raja Permaisuri Bainun , Ipoh 5. Hospital Melaka, Melaka.

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. The utilization of topical antifungals except selenium sulfide had dropped by 60.0% from 2009 to 2010. Topical azoles were the most commonly prescribed antifungal. Single agent topical azoles were preferred by the public sector, whereas fixed dose combinations of azole with corticosteroids were favoured by the private sector in both 2009 and 2010[4]. Similarly the utilization of systemic antifungals such as griseofulvin, itraconazole, ketoconazole and terbinafine has dropped by 50.0%. The most commonly prescribed systemic antifungal was ketoconazole followed by griseofulvin, fluconazole, itraconazole and terbinafine. The reduction in the usage of both topical and systemic antifungal was an interesting observation. The overall usage of oral ketoconazole had declined by almost 50.0% possibly due to heightened awareness of its potential hepatotoxicity[5]. This reduction in ketoconazole use may explain the increase use of selenium compound, an alternative treatment of pityriasis versicolor.

There was no data available on the usage of tar-based preparation, despite its wide use in the public sector. This finding was also observed in the previous report. As with the previous year, it was not possible to analyse the use of topical corticosteroids for psoriasis, as the information on its use for individual dermatological conditions was unavailable. Dithranol, although effective, had the potential to irritate and stain the skin, thus out of favour in both the private and public sectors[6]. The total utilization of calcipotriol had dropped by 30.0% from 2009 to 2010, mainly due to reduced usage in the private sector. There was an overall increased usage of calcipotriol combination, due to marked increased usage in the public sector by 14 fold. It was not possible to determine the utilisation pattern of systemic antipsoriatic agents, as this survey did not document the indications for treatment. Methotrexate and cyclosporin, two conventional systemic anti-psoriatic agents, were also used in other non-dermatological conditions. Acitretin use for the treatment of psoriasis continued to decrease over the past four years.

The overall usage of topical methoxsalen had increased by 150% from 2009 to 2010. However, the overall use of oral methoxsalen has decreased by 65.0% from 2009 to 2010. This was because PUVA therapy as a treatment option for psoriasis had gone out of favour in the private sector[7].

There was an overall reduction of 64.0% in the usage of topical antibiotic from 2009 to 2010. There was a dramatic reduction in the use of topical fucidic acid in the private sector. The two commonly used topical antibiotics were fusidic acid and neomycin. The two least favoured topical antibiotics were chloramphenicol and amikacin.

The usage of silver sulfadiazine has reduced from 2009 to 2010, probably due to the awareness of its sensitizing effects. There was also a marked reduction in the usage of topical acyclovir from 2009 to 2010. The usage of imiquimod, an effective treatment for genital wart[8], remained low, probably due to its high cost.

There was an overall increase in the usage of topical steroid from 2009 to 2010. There was a 2.7 fold increase in the usage of topical steroid in the public sector. However, there was a marked reduction in the usage in the private sector. The two most frequently prescribed topical corticosteroids were betamethasone and hydrocortisone, whilst the least prescribed topical corticosteroid was flucinonide. The overall usage of very potent topical corticosteroid, such as clobetasol had dropped by three folds. When the frequency of the usage of individual topical corticosteroids in 2009 and 2010 was analyzed, very potent corticosteroid (clobetasol) accounted for 13% of overall topical corticosteroids usage in the private sector versus 1% in the public sector.

Fixed dose combination of betamethasone and antibiotic was the preferred combination in both the public and private sectors. The use of topical steroid and antibiotic combination was high in the private sector, compared to the public sector. However the overall usage of this combination had dropped. Combination of betamethasone and salicylic acid was mainly utilized in the private sector as compared to the public sector in both years.

Fusidic acid remained the preferred choice in both topical and medicated dressing. However its overall usage was low in both sectors.

Topical treatment for acne vulgaris includes benzoyl peroxide, retinoid, topical antibiotic and azelaic acid[9,10]. The preference of topical anti-acne medications differed between the public and private sectors. In the absence of

data on benzoyl peroxide, the most common anti-acne preparation in the public sector was retinoids (82.9%), followed by azelaic acid (15%) and topical antibiotic (2.1%). In contrast, topical antibiotic especially clindamycin (70%) was the most popular anti-acne preparation in the private sector, followed by retinoids (25%) and azelaic acid (5%). In the private sector, both tretinoin and adapalene were equally used. However in the public sector, because of its relatively low cost, more tretinoin was prescribed as compared to adapalene.

There was an overall reduction in the use of oral isotretinoin, a drug with teratogenic potential and strict pharmacovigilance requirements[9]. Its restricted prescription by registered prescribers only may explain the apparent higher utilization in the public sector.

Wart and anti-corn preparations are not used in the public sector as they are treated with physical modalities. The utilization of topical calcineurin inhibitors such as tacrolimus and pimecrolimus were higher in the private sector due to its high cost.

Non-availability of Minoxidil and Finasteride in the public sector explains its non-utilization in the public sector. Low usage of hydroquinone in the public sector was also due to non-availability. In conclusion, we observed a contrasting pattern of usage of topical anti-acne preparations in the public and private sectors. We also noticed an overall decline in the usage of both topical and systemic antifungal medications in both sectors. Low usage of oral isotretinoin in the private sector may reflect a lack of compliance with pharmacovigilance requirement.

In summary, the ten commonest topical dermatological preparations used in 2009 and 2010 are shown in Figure 11.1.

Figure 11.1: Ten commonest topical dermatological preparations used in 2009 and 2010

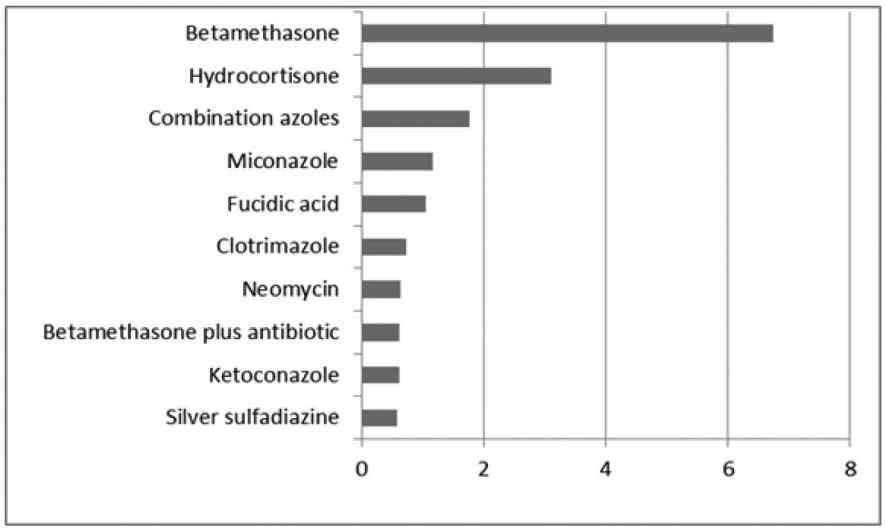


Table 11.1: Use of dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D01A A	**Antibiotics**				
D01A A01	Nystatin	g/ml/cc	Public	0.1008	0.0003
			Private	-	0.0019
			Total	0.1008	0.0022
D01A C	**Imidazole and triazole derivatives**				
D01A C01	Clotrimazole	g/ml/cc	Public	0.1356	0.1046
			Private	0.4043	0.0887
			Total	0.5399	0.1932
D01A C02	Miconazole	g/ml/cc	Public	0.5031	0.3463
			Private	0.2486	0.0713
			Total	0.7517	0.4177

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D01A C03	Econazole	g/ml/cc	Public	-	-
			Private	0.0482	0.1580
			Total	0.0482	0.1580
D01A C05	Isoconazole	g/ml/cc	Public	-	0.0006
			Private	0.0006	0.0005
			Total	0.0006	0.0010
D01A C07	Tioconazole	g/ml/cc	Public	0.0005	0.0010
			Private	0.0039	0.0076
			Total	0.0044	0.0086
D01A C08	Ketoconazole	g/ml/cc	Public	0.0727	0.0506
			Private	0.4060	0.0859
			Total	0.4787	0.1365
D01A C15	Fluconazole	g/ml/cc	Public	-	-
			Private	0.0032	<0.0001
			Total	0.0032	<0.0001
D01A C20	Combinations	g/ml/cc	Public	0.0003	0.0002
			Private	1.2433	0.5206
			Total	1.2436	0.5208
D01A E	**Other antifungals for topical use**				
D01A E13	Selenium sulfide	g/ml/cc	Public	0.0235	0.0129
			Private	0.0806	0.0002
			Total	0.1040	0.0131
D01A E15	Terbinafine	g/ml/cc	Public	-	0.0003
			Private	0.0656	0.0110
			Total	0.0656	0.0113
D01A E16	Amorolfine	g/ml/cc	Public	0.0002	0.0003
			Private	<0.0001	<0.0001
			Total	0.0002	0.0004
D01A E22	Naftifine	g/ml/cc	Public	-	-
			Private	-	0.0001
			Total	-	0.0001

Table 11.2: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
D01B A	**Antifungals for systemic use**			
D01B A01	Griseofulvin	Public	0.1015	0.1159
		Private	0.1145	0.0895
		Total	0.2160	0.2054
D01B A02	Terbinafine	Public	0.0049	0.0022
		Private	0.0277	0.0065
		Total	0.0326	0.0087

Table 11.3: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D05A D	**Psoralens for topical use**				
D05A D02	Methoxsalen	g/ml/cc	Public	0.0006	0.0015
			Private	-	-
			Total	0.0006	0.0015

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D05A X	**Other antipsoriatics for topical use**				
D05A X02	Calcipotriol	g/ml/cc	Public	0.0397	0.0302
			Private	0.0060	0.0017
			Total	0.0457	0.0319
D05A X52	Calcipotriol, combinations	g/ml/cc	Public	0.0003	0.0041
			Private	0.0075	0.0080
			Total	0.0078	0.0121

Table 11.4: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
D05B A	**Psoralens for systemic use**			
D05B A02	Methoxsalen	Public	0.0011	0.0012
		Private	0.0027	<0.0001
		Total	0.0038	0.0013
D05B B	**Retinoids for treatment of psoriasis**			
D05B B02	Acitretin	Public	0.0064	0.0058
		Private	0.0016	0.0001
		Total	0.0081	0.0059

Table 11.5: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D06A X	**Other antibiotics for topical use**				
D06A X01	Fusidic acid	g/ml/cc	Public	0.0441	0.0848
			Private	0.7504	0.1835
			Total	0.7945	0.2683
D06A X02	Chloramphenicol	g/ml/cc	Public	-	-
			Private	-	0.0005
			Total	-	0.0005
D06A X04	Neomycin	g/ml/cc	Public	0.3371	0.1258
			Private	0.1745	0.0114
			Total	0.5116	0.1372
D06A X07	Gentamicin	g/ml/cc	Public	0.0197	0.0634
			Private	0.1375	0.0140
			Total	0.1572	0.0774
D06A X09	Mupirocin	g/ml/cc	Public	0.0153	0.0192
			Private	0.0689	0.0558
			Total	0.0842	0.0750
D06A X12	Amikacin	g/ml/cc	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001

Table 11.6: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D06B A	**Sulfonamides**				
D06B A01	Silver sulfadiazine	g/ml/cc	Public	0.2120	0.0045
			Private	0.2509	0.1171
			Total	0.4629	0.1217

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D06B B	**Antivirals**				
D06B B02	Tromantadine	g/ml/cc	Public	-	-
			Private	0.0011	<0.0001
			Total	0.0011	<0.0001
D06B B03	Aciclovir	g/ml/cc	Public	0.0011	0.0022
			Private	0.0911	0.0130
			Total	0.0923	0.0152
D06B B04	Podophyllotoxin	g/ml/cc	Public	0.0002	0.0039
			Private	0.0025	<0.0001
			Total	0.0027	0.0039
D06B B10	Imiquimod	g/ml/cc	Public	-	0.0006
			Private	0.0002	0.0002
			Total	0.0002	0.0008
D06B X	**Other chemotherapeutics**				
D06B X01	Metronidazole	g/ml/cc	Public	-	-
			Private	0.0090	0.0129
			Total	0.0090	0.0129

Table 11.7: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D07A A	**Corticosteroids, weak (group I)**				
D07A A02	Hydrocortisone	g/ml/cc	Public	0.8849	1.5320
			Private	0.4539	0.2438
			Total	1.3388	1.7758
D07A A03	Prednisolone	g/ml/cc	Public	-	-
			Private	0.0015	-
			Total	0.0015	-
D07A B	**Corticosteroids, moderately potent (group II)**				
D07A B01	Clobetasone	g/ml/cc	Public	0.0676	0.0703
			Private	0.0126	0.0360
			Total	0.0802	0.1062
D07A B09	Triamcinolone	g/ml/cc	Public	-	-
			Private	0.0014	0.0002
			Total	0.0014	0.0002
D07A C	**Corticosteroids, potent (group III)**				
D07A C01	Betamethasone	g/ml/cc	Public	1.0963	3.7292
			Private	1.6206	0.3021
			Total	2.7169	4.0313
D07A C04	Fluocinolone acetonide	g/ml/cc	Public	-	-
			Private	0.0008	<0.0001
			Total	0.0008	<0.0001
D07A C08	Fluocinonide	g/ml/cc	Public	-	<0.0001
			Private	-	-
			Total	-	<0.0001
D07A C13	Mometasone	g/ml/cc	Public	0.0176	0.0331
			Private	0.1295	0.1617
			Total	0.1471	0.1948

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D07A C16	Hydrocortisone aceponate	g/ml/cc	Public	-	0.0019
			Private	0.0081	0.0104
			Total	0.0081	0.0122
D07A C17	Fluticasone	g/ml/cc	Public	-	-
			Private	0.0036	0.0084
			Total	0.0036	0.0084
D07A D	**Corticosteroids, very potent (group IV)**				
D07A D01	Clobetasol	g/ml/cc	Public	0.0280	0.0354
			Private	0.3826	0.0974
			Total	0.4106	0.1328

Table 11.8: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D07C A	**Corticosteroids, weak, combinations with antibiotics**				
D07C A01	Hydrocortisone and antibiotics	g/ml/cc	Public	0.0402	<0.0001
			Private	0.0110	0.0064
			Total	0.0512	0.0064
D07C B	**Corticosteroids, moderately potent, combinations with antibiotics**				
D07C B01	Triamcinolone and antibiotics	g/ml/cc	Public	-	-
			Private	0.0009	0.0005
			Total	0.0009	0.0005
D07C C	**Corticosteroids, potent, combinations with antibiotics**				
D07C C01	Betamethasone and antibiotics	g/ml/cc	Public	0.0016	0.0224
			Private	0.4330	0.1647
			Total	0.4346	0.1871
D07C C02	fluocinolone acetonide and antibiotics	g/ml/cc	Public	-	<0.0001
			Private	0.0052	0.0024
			Total	0.0052	0.0024

Table 11.9: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D07X A	**Corticosteroids, weak, other combinations**				
D07X A01	Hydrocortisone	g/ml/cc	Public	-	-
			Private	0.0147	0.0005
			Total	0.0147	0.0005
D07X C	**Corticosteroids, potent, other combinations**				
D07X C01	Betamethasone	g/ml/cc	Public	0.0005	0.0008
			Private	0.0988	0.0304
			Total	0.0993	0.0312

Table 11.10: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D09A A	**Medicated dressings with antiinfectives**				
D09A A02	Fusidic acid	g/ml/cc	Public	0.0001	0.0002
			Private	0.0147	0.0005
			Total	0.0147	0.0005

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D07X C	**Corticosteroids, potent, other combinations**				
D07X C01	Betamethasone	g/ml/cc	Public	0.0005	0.0008
			Private	0.0988	0.0304
			Total	0.0993	0.0312

Table 11.11: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D10A A	**Corticosteroids, combinations for treatment of acne**				
D10A A02	Methylprednisolone	g/ml/cc	Public	-	-
			Private	0.0050	<0.0001
			Total	0.0050	<0.0001
D10A D	**Retinoids for topical use in acne**				
D10A D01	Tretinoin	g/ml/cc	Public	0.0205	0.0233
			Private	0.0161	0.0137
			Total	0.0366	0.0370
D10A D03	Adapalene	g/ml/cc	Public	0.0022	0.0045
			Private	0.0264	0.0126
			Total	0.0285	0.0171
D10A D04	Isotretinoin	g/ml/cc	Public	-	-
			Private	0.0022	-
			Total	0.0022	-
D10A D51	Tretinoin, combinations	g/ml/cc	Public	-	-
			Private	0.0015	0.0002
			Total	0.0015	0.0002
D10A F	**Antiinfectives for treatment of acne**				
D10A F01	Clindamycin	g/ml/cc	Public	-	0.0011
			Private	0.1038	0.0631
			Total	0.1038	0.0642
D10A F02	Erythromycin	g/ml/cc	Public	-	0.0002
			Private	0.0200	0.0087
			Total	0.0200	0.0088
D10A F52	Erythromycin, combinations	g/ml/cc	Public	-	-
			Private	0.0002	0.0002
			Total	0.0002	0.0002
D10A X	**Other anti-acne preparations for topical use**				
D10A X03	Azelaic acid	g/ml/cc	Public	0.0081	0.0011
			Private	0.0072	0.0020
			Total	0.0153	0.0031

Table 11.12: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
D10B A	**Retinoids for treatment of acne**			
D10B A01	Isotretinoin	Public	0.0052	0.0074
		Private	0.0049	0.0010
		Total	0.0101	0.0084

Table 11.13: Use of Dermatological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
D11A C	**Medicated shampoos**				
D11A C03	Selenium compounds	g/ml/cc	Public	0.0586	0.4303
			Private	0.0687	0.0181
			Total	0.1274	0.4484
D11A F	**Wart and anti-corn preparations**				
D11A F00	Wart and anti-corn preparations	g/ml/cc	Public	-	-
			Private	0.0020	0.0006
			Total	0.0020	0.0006
D11A H	**Agents for dermatitis, excluding corticosteroids**				
D11A H01	Tacrolimus	g/ml/cc	Public	0.0003	0.0006
			Private	0.0051	0.0061
			Total	0.0054	0.0067
D11A H02	Pimecrolimus	g/ml/cc	Public	<0.0001	0.0003
			Private	0.0001	0.0003
			Total	0.0001	0.0005
D11A X	**Other dermatologicals**				
D11A X01	Minoxidil	g/ml/cc	Public	-	-
			Private	0.0076	0.0073
			Total	0.0076	0.0073
D11A X10	Finasteride	mg	Public	<0.0001	-
			Private	0.0019	0.0008
			Total	0.0020	0.0008
D11A X11	Hydroquinone	g/ml/cc	Public	-	0.0008
			Private	0.0038	0.0052
			Total	0.0038	0.0060

Table 11.14: Use of Antifungal in Dermatology by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
J02A B	**Imidazole derivatives**				
J02A B02	Ketoconazole	g	Public	0.0069	0.0127
			Private	0.2996	0.1439
			Total	0.3065	0.1566
J02A C	**Triazole derivatives**				
J02A C01	Fluconazole	g	Public	0.0140	0.0181
			Private	0.0569	0.0418
			Total	0.0708	0.0599
J02A C02	Itraconazole	g	Public	0.0262	0.0202
			Private	0.0169	0.0143
			Total	0.0431	0.0345
J02A C03	Voriconazole	g	Public	0.0004	0.0011
			Private	<0.0001	0.0001
			Total	0.0004	0.0012

References :

1. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. *Australian Statistics on Medicine 2010 16th Edition;* Australian Government Department of Health and Ageing Printing Office: Commonwealth of Australia 2012.
3. *Consumption in the Nordic Countries 2004-2008;* Nordic Medico Statistical Committee, Medicines Printing Office: Copenhagen 2009.
4. Greenberg, H.L.; Shwayder, T.A.; Bieszk, N. et al. Clotrimazole/ Betamethasone Diproprionate: A review of cost and complications in the treatment of common cutaneous fungal infections. *Pediatric Dermatology 2002,*19(1),78-81.
5. García, R.; Duque.; Castellsague.; Pérez-Gutthann.; Stricker. A cohort study on the risk of acute liver injury among users of ketoconazole and other antifungal drugs. *British Journal of Clinical Pharmacology 1999,48(6),847–852.*
6. Yawalkar, N.;Management of Psoriasis; Karger; *Switzerland, 2009;* pp 162.
7. Kunnamo, I.;Evidence-based Medicine Guidelines; *Wiley; West Sussex, 2005;* pp 441.
8. Tyring, S.; Conant, M.; Marini, M. et al. Imiquimod: An international updates on therapeutic uses in dermatology. *Int J Dermatol 2002,*41,810-816.
9. Stein, R.H.; Lebwohl, M. *Acne Therapy: Clinical Pearls.* Seminars In Cutaneous Medicine and Surgery 2001,20(3),184-189.
10. Thielitz, A.; Abdel-Naser, M.B.; Fluhr, J.W. et al. Topical retinoids in acne –an evidence-based overview. *J Dtsch Dermatol Ges* 2008,6(12),1023-1031.

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

Ravindran J.[1], Maisarah A.H.[1], Nik Mohd Nasri N.I.[2], Wan Hamilton W.H.[3], Zaridah S.[4]

1. Kuala Lumpur Hospital, Kuala Lumpur 2. Malaysian Islamic Science University, Negeri Sembilan 3. Serdang Hospital, Selangor, 4. Tunku Fauziah Hospital, Perlis.

This chapter reviews the trends in drug usage in Obstetrics & Gynaecology (O&G) for the years 2009 to 2010. The initiation of a number of health clinics named as 1Malaysia Clinics in 2010 contributed to a change in prescribing patterns in O&G drugs as the policy for these clinics allowed the prescription of some gynaecologicals and hormonal contraceptives by assistant medical officers and community nurses.

The use of gynaecological anti-infectives and antiseptics showed a marked increase in 2009 and 2010 as compared with 2008. Usage of other gynaecologicals (oxytocics, prostaglandins, prolactin inhibitors and atosiban) was slightly reduced in 2009 but increased up to 10 fold in 2010, whereas sex hormones and modulators of the genital system showed a marked increase in 2009 as compared to 2008. The use then doubled in 2010.

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 universal prophylaxis antibiotics usage in Obstetrics and Gynaecology was classified under anti-infective groups and some of the imidazole derivatives such as miconazole, econazole and metronidazole were also 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 in 2008 but usage has shown marked increase (almost 200 times) in 2010. This may be due to the opening of 1Malaysia Clinic as alluded to earlier and cheaper cost as compared to the alternatives.

The utilization of oxytoxics dropped from in 2009 as compared to 2008 but increased in 2010. Methylergometrine was still used in private hospitals with marked reducing trends in the period studied. However in public hospitals, it was not used at all for both years. On the contrary, the public hospitals utilised ergometrine more than the private. The utilization of oxytocin and syntometrine is not yet captured in this survey although the recommendation was made in 2008 MSOM. Future drug utilisation reviews should capture the use of oxytocin and syntometrine as these oxytocics are more relevant to current evidence based protocols.

Carboprost had doubled its utilization in this survey. Although carboprost is an expensive uterotonic drug, it is utilized because it is one of the first line prostaglandins in the protocol for the management of primary post partum haemorrhage.

Preterm labour and births still remain a significant health issue in Malaysian obstetric practice. The suppression of preterm labour is the still the main strategy used to prevent preterm births. The use of tocolytic agents such as nifedipine, salbutamol and terbutalinefor the indication of preterm labour remain outside the scope of this chapter as the main indication for the use of these drugs is other than for an obstetric indication. It is hoped that the use of the main drug for this indication i.e. nifedipine will be captured in future years. The use of atosiban which is the only registered drug for the indication of suppression of preterm labour remains very low in both years in both the private and public sectors.

Bromocriptine use continues to show the decline which was evident over 2007-2008 in both sectors. Bromocriptine was still the prevalent prolactin inhibitor used in Malaysia compared to cabergoline. There was a minimal increase in cabergoline use in the public sector in 2010 compared to 2009. It was not possible to separate the use of prolactin inhibitors for the indications of suppression of lactation and hyperprolactinemia in this survey. It had been previously recommended that there should be a reversal towards favouring cabergoline instead of bromocriptine due to the worries of cardiovascular complications and the worries of the risk of the concurrent use of anti-hypertensives with bromocriptine, especially in pre-eclamptic mothers. This change in prescribing pattern was not yet evident in the current survey.

Hormonal contraceptives for systemic use continued its sharp increase compared to the previous years. The increase was contributed mainly by the increase in the usage of fixed combination oestrogens and progestogens such as levonorgesterel and oestrogen in the public sector. This may have been due to a policy to use contraception as a strategy to reduce maternal mortality in the effort to meet MDG 5 targets. No significant increase in the use of other contraceptives was noted.

Emergency contraceptive use showed a decline in 2009 before increasing to previous levels in 2010. This was mainly contributed by the increase in the use of levonorgesterel in

the private sector. The use of emergency contraception in the public sector is restricted mainly to its use in the one stop crisis centers.

In general, the use of progestogens for menstrual dysfunction has shown an increase over the survey period. It has been observed that the private sector usage of medroxyprogesterone was more than the usage of public sector in 2009 and 2010. The private sector used more dydrogesterone for menstrual dysfunction. This might be related with cost implication.

Table 12.1: Use of Gynecological, Sex Hormones and Hormonal Contraceptives, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
G01	Gynecological antiinfectives and antiseptics	1.1283	3.1626
G02	Other gynecologicals	0.0669	0.5009
G03	Sex hormones and modulators of the genital system	11.9883	22.3942

Table 12.2.1: Use of Gynecological, Sex Hormones and Hormonal Contraceptives by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
G01A	Antiinfectives And Antiseptics, Excl. Combinations With Corticosteroids	1.1283	3.1627
G01A A	Antibiotics	0.7451	2.9783
G01A F	Imidazole Derivatives	0.3832	0.1844
G02A	Oxytocics	0.0432	0.4820
G02A B	Ergot Alkaloids	0.0014	0.4342
G02A D	Prostaglandins	0.0418	0.0478
G02C	Other Gynecologicals	0.0237	0.0188
G02C B	Prolactine Inhibitors	0.0236	0.0188
G02C X	Other Gynecologicals	<0.0001	<0.0001
G03A	Hormonal Contraceptives For Systemic Use	7.2439	9.9654
G03A A	Progestogens And Estrogens, Fixed Combinations	1.3810	5.7617
G03A B	Progestogens And Estrogens, Sequential Preparations	0.0049	0.0074
G03A C	Progestogens	5.8483	4.1816
G03A D	Emergency Contraceptives	0.0096	0.0148
G03B	Androgens	0.0134	0.0645
G03B A	3-Oxoandrosten (4) Derivatives	0.0117	0.0641
G03B B	5-Androstanon (3) Derivatives	0.0017	0.0004
G03C	Estrogens	2.8020	10.9735
G03C A	Natural And Semisynthetic Estrogens, Plain	2.7273	10.9424
G03C B	Synthetic Estrogens, Plain	-	0.0010
G03C X	Other Estrogens	0.0747	0.0301
G03D	Progestogens	0.9285	1.0123
G03D A	Pregnen (4) Derivatives	0.2261	0.2680
G03D B	Pregnadien Derivatives	0.4509	0.0973
G03D C	Estren Derivatives	0.2515	0.6470
G03F	Progestogens And Estrogens In Combination	0.0371	0.0849
G03F A	Progestogens And Estrogens, Fixed Combinations	0.0059	0.0107
G03F B	Progestogens And Estrogens, Sequential Preparations	0.0312	0.0742
G03G	Gonadotropins And Other Ovulation Stimulants	0.7723	0.2049
G03G A	Gonadotropins	0.0175	0.0306
G03G B	Ovulation Stimulants, Synthetic	0.7548	0.1743
G03H	Antiandrogens	0.0122	0.0284

ATC	DRUG CLASS	2009	2010
G03H A	Antiandrogens, Plain	0.0075	0.0054
G03H B	Antiandrogens And Estrogens	0.0047	0.0231
G03X	Other Sex Hormones And Modulators Of The Genital System	0.1789	0.0604
G03X A	Antigonadotropins And Similar Agents	0.0573	0.0088
G03X C	Selective Estrogen Receptor Modulators	0.1216	0.0517

Table 12.2.2: Use of Gynecological, Sex Hormones and Hormonal Contraceptives by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G01A A	**Antibiotics**			
G01A A01	Nystatin	Public	<0.0001	2.9242
		Private	0.7294	0.0537
		Total	0.7295	2.9779
G01A A03	Amphotericin B	Public	-	-
		Private	0.0012	0.0002
		Total	0.0012	0.0002
G01A A10	Clindamycin	Public	-	-
		Private	0.0144	0.0002
		Total	0.0144	0.0002
G01A F	**Imidazole derivatives**			
G01A F01	Metronidazole	Public	-	-
		Private	-	0.0015
		Total	-	0.0015
G01A F02	Clotrimazole	Public	0.0776	0.1445
		Private	0.3014	0.0372
		Total	0.3790	0.1817
G01A F05	Econazole	Public	-	-
		Private	0.0032	0.0008
		Total	0.0032	0.0008
G01A F08	Tioconazole	Public	<0.0001	<0.0001
		Private	0.0007	0.0003
		Total	0.0008	0.0003
G01A F15	Butoconazole	Public	-	-
		Private	0.0003	<0.0001
		Total	0.0003	<0.0001
G02A B	**Ergot alkaloids**			
G02A B01	Methylergometrine	Public	-	-
		Private	0.0008	0.0002
		Total	0.0008	0.0002
G02A B03	Ergometrine	Public	0.0006	0.4339
		Private	<0.0001	<0.0001
		Total	0.0006	0.4339
G02A D	**Prostaglandins**			
G02A D02	Dinoprostone	Public	0.0360	0.0368
		Private	0.0037	0.0021
		Total	0.0397	0.0388

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G02A D03	Gemeprost	Public	0.0018	0.0088
		Private	<0.0001	<0.0001
		Total	0.0009	0.0088
G02A D04	Carboprost	Public	0.0001	0.0002
		Private	<0.0001	<0.0001
		Total	0.0002	0.0002
G02C B	**Prolactine inhibitors**			
G02C B01	Bromocriptine	Public	0.0175	0.0151
		Private	0.0035	0.0010
		Total	0.0210	0.0162
G02C B03	Cabergoline	Public	0.0019	0.0021
		Private	0.0007	0.0006
		Total	0.0026	0.0027
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	0.1596	4.3375
		Private	0.3402	0.2362
		Total	0.4998	4.5737
G03A A09	Desogestrel and estrogen	Public	0.0437	0.2439
		Private	0.5328	0.6985
		Total	0.5765	0.9424
G03A A10	Gestodene and estrogen	Public	-	<0.0001
		Private	0.0858	0.0733
		Total	0.0858	0.0733
G03A A12	Drospirenone and estrogen	Public	-	0.0018
		Private	0.2190	0.1705
		Total	0.2190	0.1723
G03A B	**Progestogens and estrogens, sequential preparations**			
G03A B03	Levonorgestrel and estrogen	Public	-	-
		Private	0.0049	0.0074
		Total	0.0049	0.0074
G03A C	**Progestogens**			
G03A C01	Norethisterone	Public	0.2760	0.2519
		Private	0.8134	0.0849
		Total	1.0894	0.3368
G03A C03	Levonorgestrel	Public	-	0.0010
		Private	-	-
		Total	-	0.0010
G03A C06	Medroxyprogesterone	Public	0.3110	1.3989
		Private	4.2829	2.2598
		Total	4.5939	3.6587
G03A C08	Etonogestrel	Public	0.0252	0.0150
		Private	0.1398	0.1248
		Total	0.1649	0.1398

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G03A C09	Desogestrel	Public	-	0.0453
		Private	-	-
		Total	-	0.0453
G03A D	**Emergency contraceptives**			
G03A D01	Levonorgestrel	Public	<0.0001	<0.0001
		Private	0.0096	0.0148
		Total	0.0096	0.0148
G03B A	**3-oxoandrosten (4) derivatives**			
G03B A03	Testosterone	Public	0.0045	0.0118
		Private	0.0072	0.0524
		Total	0.0117	0.0641
G03B B	**5-androstanon (3) derivatives**			
G03B B01	Mesterolone	Public	-	-
		Private	0.0017	0.0004
		Total	0.0017	0.0004
G03C A	**Natural and semisynthetic estrogens, plain**			
G03C A01	Ethinylestradiol	Public	-	0.0903
		Private	-	-
		Total	-	0.0903
G03C A03	Estradiol	Public	0.0182	0.0818
		Private	0.0264	0.1018
		Total	0.0446	0.1836
G03C A57	Conjugated estrogens	Public	0.1121	3.6998
		Private	2.5707	6.9687
		Total	2.6828	10.6685
G03C B	**Synthetic estrogens, plain**			
G03C B02	Diethylstilbestrol	Public	-	0.0010
		Private	-	-
		Total	-	0.0010
G03C X	**Other estrogens**			
G03C X01	Tibolone	Public	0.0512	0.0240
		Private	0.0235	0.0061
		Total	0.0747	0.0301
G03D A	**Pregnen (4) derivatives**			
G03D A02	Medroxyprogesterone	Public	0.1802	0.2412
		Private	0.0166	0.0171
		Total	0.1968	0.2583
G03D A03	Hydroxyprogesterone	Public	-	0.0004
		Private	0.0266	0.0054
		Total	0.0266	0.0058
G03D A04	Progesterone	Public	0.0002	0.0005
		Private	0.0024	0.0034
		Total	0.0026	0.0039
G03D B	**Pregnadien derivatives**			
G03D B01	Dydrogesterone	Public	0.0615	0.0538
		Private	0.3883	0.0361
		Total	0.4498	0.0899

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G03D B02	Megestrol	Public	-	-
		Private	0.0012	0.0074
		Total	0.0012	0.0074
G03D C	**Estren derivatives**			
G03D C01	Allylestrenol	Public	-	-
		Private	0.0338	-
		Total	0.0338	-
G03D C02	Norethisterone	Public	0.0048	0.0005
		Private	0.2129	0.6465
		Total	0.2176	0.6470
G03F A	**Progestogens and estrogens, fixed combinations**			
G03F A01	Norethisterone and estrogen	Public	-	-
		Private	0.0017	-
		Total	0.0017	-
G03F A12	Medroxyprogesterone and estrogen	Public	0.0011	0.0044
		Private	0.0002	<0.0001
		Total	0.0013	0.0045
G03F A14	Dydrogesterone and estrogen	Public	0.0008	0.0029
		Private	0.0001	0.0009
		Total	0.0010	0.0038
G03F A17	Drospirenone and estrogen	Public	-	0.0009
		Private	0.0019	0.0015
		Total	0.0019	0.0024
G03F B	**Progestogens and estrogens, sequential preparations**			
G03F B01	Norgestrel and estrogen	Public	0.0067	0.0387
		Private	0.0093	0.0221
		Total	0.0160	0.0608
G03F B05	Norethisterone and estrogen	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
G03F B08	Dydrogesterone and estrogen	Public	0.0050	0.0128
		Private	0.0022	0.0006
		Total	0.0072	0.0134
G03F B09	Levonorgestrel and estrogen	Public	-	-
		Private	0.0081	-
		Total	0.0081	-
G03G A	**Gonadotropins**			
G03G A01	Chorionic gonadotrophin	Public	0.0021	0.0139
		Private	0.0130	0.0027
		Total	0.0151	0.0166
G03G A02	Human menopausal gonadotrophin	Public	-	-
		Private	<0.0001	0.0003
		Total	<0.0001	0.0003
G03G A04	Urofollitropin	Public	-	0.0100
		Private	0.0003	<0.0001
		Total	0.0003	0.0100

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G03G A05	Follitropin alfa	Public	0.0002	0.0024
		Private	0.0004	0.0007
		Total	0.0005	0.0031
G03G A06	Follitropin beta	Public	0.0013	0.0004
		Private	0.0002	0.0002
		Total	0.0015	0.0006
G03G A08	Choriogonadotropin alfa	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
G03G B	**Ovulation stimulants, synthetic**			
G03G B02	Clomifene	Public	0.1129	0.0649
		Private	0.6420	0.1094
		Total	0.7548	0.1743
G03H A	**Antiandrogens, plain**			
G03H A01	Cyproterone	Public	0.0069	0.0049
		Private	0.0006	0.0005
		Total	0.0075	0.0054
G03H B	**Antiandrogens and estrogens**			
G03H B01	Cyproterone and estrogen	Public	0.0016	0.0125
		Private	0.0031	0.0106
		Total	0.0047	0.0231
G03X A	**Antigonadotropins and similar agents**			
G03X A01	Danazol	Public	0.0116	0.0061
		Private	0.0214	0.0016
		Total	0.0330	0.0077
G03X A02	Gestrinone	Public	<0.0001	0.0003
		Private	0.0243	0.0008
		Total	0.0243	0.0011
G03X C	**Selective estrogen receptor modulators**			
G03X C01	Raloxifene	Public	0.0938	0.0458
		Private	0.0278	0.0059
		Total	0.1216	0.0517

References:

1. *Malaysian Statistics on Medicines 2008*; Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. Ravichandran Jeganathan (Eds). *Preliminary Report of National Obstetrics Registry, July-December 2009*. National Obstetrics Registry: Kuala Lumpur, 2011.
3. Ravichandran Jeganathan (Eds). *Preliminary Report of National Obstetrics Registry, Jan-December 2010*. National Obstetrics Registry: Kuala Lumpur, 2011.
4. Pharmaceutical Services Division, Ministry of Health, Malaysia. *Penggunaan Ubat-ubat Off-label untuk Indikasi O&G di Fasiliti KKM*. KKM-55/BPF/103/001/09 Jld12, (44). March 18, 2011.
5. *Australian Statistics on Medicine 2010*. Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2010
6. The Women's Health Initiative Study Group. Risks and Benefits of Estrogen Plus Progestin in Healthy Postmenopausal Women. *JAMA* 2002, 288 (3), 321-333.

CHAPTER 13: USE OF UROLOGICALS

Rohan Malek J.[1], Selvalingam S.[2], Lei C.M.[3], Hazimah H.[4]

1. Selayang Hospital, Selangor, 2. Tuanku Mizan Military Hospital, Kuala Lumpur, 3. Normah Medical Specialist Centre, Kuching, 4. Pharmaceutical Services Division, Ministry of Health.

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

Drugs used in overactive bladder

Tolterodine, oxybutynin, propiverine and solifenacin are recommended for use in overactive bladder[1]. Flavoxate (Urispas) is an old antimuscarinic agent and is usually not available in most public urological centres. It is the oldest drug in the group and has questionable efficacy as it has only level 2 evidence for its use in the treatment of overactive bladder[2]. It has been removed from the latest guideline[1]. However, it is still available in the private sector. Therefore, its use was higher in the private than the public sector. There was an increasing trend in the use of flavoxate in the private sector from 2008 to 2010[3] and this could be due to its prescription by non-urologists.

Oxybutynin is still available in the public centres due to lower cost. However, it has worse side effects compared to the other drugs and therefore its use has decreased (0.0023 DDD/1000 population/day in 2008[3] to 0.0015 DDD/1000 population/day in 2010). This decrease may be due to the availability of other antimuscarinic agents with less side effects in the public sector. Tolterodine extended-release as a single dose therapy was introduced in the public and private sector in 2009. This explains the increasing use of tolterodine in the public sector from 2008 (0.0467 DDD/1000 population/day)[3] to 2009 (0.0781 DDD/1000 population/day) and in the private sector (0.0206 DDD/1000 population/day in 2008[3] to 0.0296 DDD/1000 population/day in 2009). However, its use decreased in 2010 in both public and private sectors which could be due to the availability of solifenacin in 2010. Similar trend was noticed in the use of propiverine in the public and private sectors. Tolterodine use in Malaysia was higher than Australia[4] because it was subsidised by the government. Since propiverine is given three times a day, it is less popular than tolterodine in both public and private sectors.

The use of solifenacin was higher in the private sector in 2010 when it was introduced. This is because solifenacin only entered the Ministry of Health Drug Formulary in July 2013 while in 2010, its use in the public sector needed special approval from the Director General of Health. In the private sector, the use of solifenacin (0.0022 DDD/1000 population/day) almost equalled that of tolterodine (0.0024 DDD/1000 population/day). Solifenacin is also prescribed as daily dose and has less side effects, making it an attractive option to tolterodine. Trospium was not available in the public sector, however, has been used in the private sector in 2010. Its use was still low (0.0004 DDD/1000 population/day), considering it is the newest drug introduced.

Drugs used in erectile dysfunction and premature ejaculation

Sildenafil, tadalafil and vardenafil are the three selective phosphodiesterase type-5 (PDE5) inhibitors used in the treatment of erectile dysfunction. PDE5 inhibitors were more commonly prescribed in the private sector because the drugs were still not available in the public sector in 2010. Among the three, sildenafil was still the most popular in both private and public sectors. This is probably because it is the first PDE5 inhibitor available in Malaysia. Tadalafil was second probably because it is a longer acting drug (duration is 36 hours) compared to vardenafil (duration is five hours). There has been a decrease in the use of sildenafil, tadalafil and vardenafil in both private and public sectors from the year 2009 to 2010. The overall decrease of all these three drugs in 2010 could be due to patients turning to cheaper alternatives such as traditional treatment or counterfeit drugs. In comparison, in Australia, the most popular PDE5 inhibitor was tadalafil (0.38 DDD/1000 population/day), followed by sildenafil (0.356 DDD/1000 population/day) and vardenafil (0.061 DDD/1000 population/day). The use of all these three drugs in Australia remained higher than in Malaysia[4]. There has been no change in the use of alprostadil from 2008 to 2010[3]. Its use remained very low (<0.0001 DDD/1000 population/day).

Dapoxetine has been used in Malaysia from 2010 in the treatment of premature ejaculation. It is an SSRI agent with less side effects. Since it is newly introduced, its use in the public and private sectors remained low (<0.0001 DDD/1000 population/day).

Alpha-adrenoceptor antagonists

1-blockers are often considered the first-line drug treatment of moderate-to-severe male lower urinary tract symptoms. All α-blockers have similar efficacy and only vary in their side effect profile. The most frequent side effects of α-blockers are asthenia, dizziness and (orthostatic) hypotension[5].

In the year 2010, there was a decrease in the use of alpha blockers: alfuzoxin XL, doxazosin XL and terazosin, both in the public and private sectors, as compared to the year 2009. The trend of use was same in both sectors. Doxazosin XL remains the most popular drug, followed by terazosin and alfuzosin XL. The use of doxazosin in the private sector decreased from 2009 (0.2202 DDD/1000 population/day) to 2010 (0.069 DDD/1000 population/day). Similar trend was seen for alfuzosin which use was 0.0509 DDD/1000

population/day in 2009 but decreased to 0.0149 DDD/1000 population/day in 2010. Tamsulosin was introduced in 2010 and since it is a new drug, its use in the public and private centres was relatively low (0.0011 DDD/1000 population/day for each sector). However, in Australia, tamsulosin was a preferred drug[4] due to its increase prostate selectivity. Alfuzosin dan doxazosin were not available in Australia.

5-alpha reductase inhibitors

The two 5-alpha reductase inhibitors used were finasteride (5α-reductase type 2 inhibitor) and dutasteride (5α-reductase types 1 and 2 inhibitor). Between the two in 2010, finasteride was the favoured drug in the public sector. This could be due to the prescribing practice and the wider availability of this drug in most of the public hospitals. The use of finasteride has been steadily decreasing in the private sector from 0.0223 DDD/1000 population/day in 2007[3] to 0.0087 DDD/1000 population/day in 2010. There was a steep increase in the use of dutasteride from 0.0551 in 2008[3] to 0.1399 in 2009 in the public sector and from 0.0185 DDD/1000 population/day in 2008[3] to 0.0399 DDD/1000 population/day in 2009 in the private sector. This increase may be due to the increased publicity for dutasteride as a dual 5α-reductase inhibitor. However, there was a decreasing trend in the use of dutasteride in the public and private sectors between 2009 and 2010. This may be because finasteride was the more preferred option in the public hospitals due to its lower cost. The use of finasteride and dutasteride in the public sector in the year 2010 was almost similar to the year 2009. The use of finasteride in Australia in 2010 (0.17 DDD/1000 population/day)[4] exceeded the use in both public and private sectors in Malaysia. The use of dutasteride in Australia in 2010 (0.041 DDD/1000 population/day) was lower than the use of dutasteride in the public sector in Malaysia. Finasteride was the preferred drug in Australia in 2010[4].

Gonadotropin releasing hormone analogues

Long-acting luteinising hormone releasing hormone (LHRH) agonists have been used in the treatment of advanced prostate cancer[6] and are currently the main forms of androgen deprivation treatment in the public and private sectors. The use of buserelin was low in the public and private sectors because it is not commonly used in the treatment of metastatic prostate cancer. In 2010, the most commonly used LHRH analogue in the public sector was goserelin (0.0231 DDD/1000 population/day), followed by leuprorelin (0.0135 DDD/1000 population/day). In the private sector, the most common LHRH analogue in 2010 was leuprorelin (0.014 DDD/1000 population/day), followed by goserelin (0.0068 DDD/1000 population/day). Lucrin® three-monthly injection became available in 2010, making it a more attactive option in the private sector. The use of leuprorelin increased between 2008[3] and 2009 in both public and private sectors. However, there was a drop in its use in 2010. The use of goserelin reduced in the public sector in 2009, however, showed an increase in 2010. Overall, the use of LHRH analogues were higher in the public sector and this may be because more cancer patients are seen in the public sector. Also there is an overall drop in the use of LHRH analogues in 2010 in both the public and private sectors and this may be due to the stage migration of prostate cancer where less patients with metastatic prostate cancer are being diagnosed. The use of LHRH analogues in Australia was very much higher for leuprorelin (0.819 DDD/1000 population/day) and goserelin (0.589 DDD/1000 population/day) because of the higher incidence of prostate cancer in Australia[7] and also because these drugs were reimbursed through the Pharmaceutical Benefit Scheme[4].

Anti-androgens

The anti-androgens are indicated for metastatic prostate cancer. It is used during the initiation of LHRH analogue to prevent the 'flare phenomenon' or added to either surgical or pharmacological castration for complete androgen blockade. Cyproterone is the oldest drug[6]. Cyproterone use is more popular in the public sector. However, there was a decline in its use in both public and private sectors in 2010. The most popular anti-androgen in 2010 in both public and private sectors was bicatulamide (0.008 DDD/1000 population/day). Bicatulamide is the preferred anti-androgen because it is non-steroidal and has less side effects[6]. Overall, there has been a decreasing trend in the use of anti-androgens in 2009 and 2010, possibly due to stage migration of prostate cancer and less metastatic prostate cancer diagnosis. The use of bicatulamide in Australia in 2010 was much higher (0.125 DDD/1000 population/day)[4] than in Malaysia (0.0091 DDD/1000 population/day). Bicatulamide was still the most popular anti-androgen in Australia[4].

Testosterone

Testosterone replacement therapy is recommended in male hypogonadism for patients with a decline in muscle mass and strength, reduced bone mineral density at the lumbar spine, and decreased libido and erection[8]. In the public sector, the use of testosterone supplement reached its peak in 2008 (0.0196 DDD/1000 population/day)[3], then decline to 0.0045 DDD/1000 population/day) in 2009 and increased again to 0.0118 DDD/1000 population/day in 2010. As in the private sector, there was a steep increase in the use of testosterone supplement in 2010 (0.0524 DDD/1000 population/day) compared to 0.0072 DDD/1000 population/day in 2009. This could be due to the rise in men's health clinics as well as better awareness among patients who visit the private sectors. Therefore, it is not surprising that the overall use of testosterone replacement therapy was much higher in the private sector than the public sector. The cost of testosterone treatment is high[9,10] and this may be a limiting factor to its use in the public sector. The use in Australia in 2010 was much higher

(0.766 DDD/1000 population/day) and this drug was reimbursed through the Pharmaceutical Benefit Scheme.[4]

BCG Vaccine

Intravesicle BCG is given as maintenance therapy for at least two years after giving an induction therapy of six weekly installations. There was a sharp increase in the use of BCG vaccine in the public sector in 2010 (0.5679 DDD/1000 population/day) compared to 2009 (0.0002 DDD/1000 population/day) and this may be due to an increased diagnosis of high risk urothelial bladder cancer and the increased awareness on the benefits of BCG intravesical treatment among healthcare providers. The use of BCG vaccine in the private sector remained low.

Table 13.1: Use of Drugs for Urological Disorders in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
G04	Urologicals	0.8771	0.7277
C02C	Antiadrenergic agents, peripherally acting	0.5093	0.3457
G03	Sex hormones and modulators of the genital system	0.0192	0.0695
L02	Endocrine therapy	0.1554	0.0689
L03	Immunostimulants	0.0007	0.5713

Table 13.2.1: Use of Urologicals by Drug Class in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
G04B	Other urologicals, incl. Antispasmodics	0.0441	0.0481
G04C	Drugs used in benign prostatic hypertrophy	0.8331	0.6796

Table 13.2.2: Use of Urologicals by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G04B D	**Urinary antispasmodics**			
G04B D02	Flavoxate	Public	<0.0001	0.0003
		Private	0.0216	0.0404
		Total	0.0216	0.0407
G04B D04	Oxybutynin	Public	0.0010	0.0015
		Private	<0.0001	<0.0001
		Total	0.0010	0.0015
G04B D06	Propiverine	Public	0.0003	0.0001
		Private	0.0040	0.0002
		Total	0.0043	0.0004
G04B D07	Tolterodine	Public	0.0781	0.0313
		Private	0.0296	0.0024
		Total	0.1077	0.0337
G04B D08	Solifenacin	Public	-	<0.0001
		Private	-	0.0022
		Total	-	0.0023
G04B D09	Trospium	Public	-	-
		Private	-	0.0004
		Total	-	0.0004
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	0.0041	0.0014
		Private	0.0096	0.0023
		Total	0.0137	0.0037

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G04B E08	Tadalafil	Public	0.0002	0.0001
		Private	0.0041	0.0016
		Total	0.0043	0.0018
G04B E09	Vardenafil	Public	0.0002	<0.0001
		Private	0.0033	0.0013
		Total	0.0035	0.0014
G04B X	**Other urologicals**			
G04B X14	Dapoxetine	Public	-	<0.0001
		Private	-	<0.0001
		Total	-	<0.0001
G04C A	**Alpha-adrenoreceptor antagonists**			
G04C A01	Alfuzosin	Public	0.1451	0.1377
		Private	0.0509	0.0149
		Total	0.1960	0.1526
G04C A02	Tamsulosin	Public	-	0.0011
		Private	-	0.0011
		Total	-	0.0022
G04C A03	Terazosin	Public	0.2390	0.2378
		Private	0.0500	0.0194
		Total	0.2890	0.2572
G04C B	**Testosterone-5-alpha reductase inhibitors**			
G04C B01	Finasteride	Public	0.1518	0.1563
		Private	0.0164	0.0087
		Total	0.1682	0.1649
G04C B02	Dutasteride	Public	0.1399	0.0963
		Private	0.0399	0.0086
		Total	0.1799	0.1048

Table 13.3.1: Use of Other Drugs for Urological Disorders by Drug Class and Agents in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
C02C	**Antiadrenergic agents, peripherally acting**			
C02C A04	Doxazosin	Public	0.2890	0.2767
		Private	0.2202	0.0690
		Total	0.5093	0.3457
G03	**Sex hormones and modulators of the genital system**			
G03B A	**3-oxoandrosten (4) derivatives**			
G03B A03	Testosterone	Public	0.0045	0.0118
		Private	0.0072	0.0524
		Total	0.0117	0.0641
G03H A	**Antiandrogens, plain**			
G03H A01	Cyproterone	Public	0.0069	0.0049
		Private	0.0006	0.0005
		Total	0.0075	0.0054
L02	**Endocrine therapy**			
L02A E	**Gonadotropin releasing hormone analogues**			

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
L02A E01	Buserelin	Public	-	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
L02A E02	Leuprorelin	Public	0.0841	0.0135
		Private	0.0317	0.0140
		Total	0.1157	0.0275
L02A E03	Goserelin	Public	0.0133	0.0231
		Private	0.0136	0.0068
		Total	0.0269	0.0299
L02A E04	Triptorelin	Public	0.0017	0.0014
		Private	<0.0001	<0.0001
		Total	0.0018	0.0014
L02B B	**Anti-androgens**			
L02B B01	Flutamide	Public	0.0007	0.0010
		Private	<0.0001	<0.0001
		Total	0.0007	0.0010
L02B B03	Bicalutamide	Public	0.0088	0.0080
		Private	0.0013	0.0012
		Total	0.0101	0.0091
L03A X	Other immunostimulants			
L03A X03	BCG vaccine	Public	0.0002	0.5679
		Private	0.0004	0.0034
		Total	0.0007	0.5713

References:

1. Lucas, M.G.; Bosch, J.L.H.R.; Cruz, F.R.; Madden, T.B.; Nambiar, A.; Neisius,A.; Pickard, R.S.; de Ridder, D.J.M.K.; Tubaro, A.; Turner, W.H. European Association of Urology Home Page. Guidelines on Urinary Incontinence. http://www.uroweb.org/gls/pdf/18_Urinary_Incontinence_LR.pdf (accessed November 27, 2013).
2. *European Association of Urology (EAU) Guidelines;* edition presented at the 25th EAUAnnual Congress; Barcelona, 2010.
3. *Malaysian Statistics on Medicine 2008*; Pharmaceutical Services Division and Clinical Research Centre, Ministry of Health Malaysia: Kuala Lumpur, 2013.
4. *Australian Statistics on Medicines 2010*; 16th Edition; Australian Government Department of Health and Ageing, Commonwealth of Australia, 2010.
5. Oelke, M.; Bachmann, A.; Descazeaud, A.; Emberton, M.; Gravas, S.; Michel, M.C.; N'Dow, J.; Nordling, J.; de la Rosette, J.J. European Association of Urology Home Page. Guidelines on the Management of Male Lower Urinary Tract Symptoms (LUTS), incl. Benign Prostatic Obstruction (BPO). http://www.uroweb.org/gls/pdf/12_Male_LUTS_LR%20May%209th%202012.pdf (accessed November 10, 2013).
6. Heidenreich, A.; Bastian, P.J.; Bellmunt, J.; Bolla, M.; Joniau, S.; Mason, M.D.; Matveev, V.; Mottet, N.; van der Kwast, T.H.; Wiegel, T.; Zattoni, F. *European Association of Urology*. Guidelines on Prostate Cancer. http://www.uroweb.org/gls/pdf/08%20 Prostate%20Cancer_LR%20II.pdf (accessed November 10, 2013).
7. Cancer incidence projections: Australia, 2011 to 2020; Cancer Series no. 66. Cat. No. CAN 62; Australian Institute of Health and Welfare: Canberra, 2012.
8. Dohle, G.R.; Arver, S.; Bettocchi, C.; Kliesch, S.; Punab, M.; de Ronde, W. *European Association of Urology*. Guidelines on Male Hypogonadism. http://www.uroweb.org/gls/pdf/16_Male_Hypogonadism_LR%20II.pdf (accessed November 12, 2013)
9. Private Sector Medicine *Wholesale Price Survey 2009*; Pharmaceutical Services Division, Ministry of Health Malaysia.
10. Private Sector Medicine *Wholesale Price Survey 2010*; Third Edition; Pharmaceutical Services Division, Ministry of Health Malaysia, October 2010.

CHAPTER 14: USE OF DRUGS FOR ENDOCRINE DISORDERS

Zanariah H.[1], Hong Y.H.J.[1], Chan Y.Y.[2], Lin S.N.[3],

1. Putrajaya Hospital, Putrajaya, 2. Teluk Intan Hospital, Perak, 3.Tengku Ampuan Rahimah Klang Hospital, Selangor.

In Malaysia, the total consumption for endocrine-related drugs for 2010 decreased by 35.2% when compared to 2009 (to DDD/1000 populations/day). Thyroid-related drugs were still the most utilised endocrine drugs (98.2%), followed by pituitary-hypothalamic hormones and analogues (1.6%), and drugs for calcium homeostasis (0.2%). Similar to 2009, there was much higher utilisation of endocrine-related drugs in Malaysia as compared to Australia for 2010.

Drugs for thyroid disorders consist of thyroid hormones and anti-thyroid drugs. Levothyroxine (T4) was the mainstay for the treatment of hypothyroidism 2.9414 DDD/1000 population/day in 2009 and increased by 19.0% in 2010. The use of levothyroxine was 8-folds higher in Australia (16.275 DDD/1000 population/day) in the same year. 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. Similar to 2008 and 2009, liothyronine (T3) sodium was hardly used in Malaysia in 2010.

In 2010, there was a reduction of 76.2% in anti-thyroid drug utilization (0.9429 DDD/1000 population/day) compared to 2009 and this was higher than Australia (0.621 DDD/1000 population/day). This is probably because more patients are opting for the radio-iodine ablation therapy. Among the anti-thyroid drugs in Malaysia, carbimazole (88.45%) was the most utilised, followed by propylthiouracil (11.55%) that may reflected the preference for once daily dosing of carbimazole. Also, carbimazole is the drug of choice in paediatric and adolescent patients. The use of PTU has continued to reduce in year 2009 and 2010, with a reduction of 93.7% in 2010. This is in keeping with the prescribing restrictions both in adults and paediatric patients. Similar to the previous years, iodine therapy is almost never been used (<0.0001).

Drug utilisation of pituitary-hypothalamic hormones and analogues were generally low in Malaysia at 0.7357 DDD/1000 population/day. However, a drastic increment of 74.3% was seen as compared to 2009. The difference is strongly suggestive of the increase in awareness and diagnosis of pituitary-hypothalamic endocrine disorders. The usage of somatropin and somatropin agonists increases by 7.6 folds when compared to year 2009, this may likely be contributed by the increase of paediatric endocrine services in Malaysia.

Regards to drugs for calcium homeostasis, the usage of calcitonin (salmon synthetic), 0.0033 was 26.7% lower than previous year. The reduction in calcitonin usage mainly occurs in the private sector while its usage was increased predominantly and significantly in the public sector from <0.0001 to 0.0018 DDD/1000 population/day. The total usage of teriparatide was 0.0016 DDD/1000 population/day which increased by 45.5% compared to year 2009. The usage of teriperatide in private sector was 3-fold higher as compared to public 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 Drugs for Endocrine Disorders, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
H01	Pituitary and hypothalamic hormones and analogues	0.1893	0.7357
H03	Thyroid therapy	6.9021	4.4443
H04	Pancreatic hormones	0.0001	0.0006
H05	Calcium homeostasis	0.0079	0.0078

Table 14.2: Use of Pituitary and Hypothalamic Hormones and Analogues by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
H01A	Anterior pituitary lobe hormones and analogues	0.0009	0.0072
H01A A	ACTH	<0.0001	0.0002
H01A C	Somatropin and somatropin agonists	0.0009	0.0068
H01A X	Other anterior pituitary lobe hormones and analogues	-	0.0002
H01B	Posterior pituitary lobe hormones	0.1848	0.7278
H01B A	Vasopressin and analogues	0.0752	0.0662

ATC	DRUG CLASS	2009	2010
H01C	Hypothalamic hormones	0.0036	0.0007
H01C B	Somatostatin and analogues	0.0036	0.0006
H01C C	Anti-gonadotropin-releasing hormones	<0.0001	<0.0001
H03A	Thyroid preparations	2.9414	3.5014
H03A A	Thyroid hormones	2.9414	3.5014
H03B	Antithyroid preparations	3.9607	0.9429
H03B A	Thiouracils	1.7310	0.1089
H03B B	Sulfur-containing imidazole derivatives	2.2298	0.8340
H03C	Iodine therapy	-	<0.0001
H03C A	Iodine therapy	-	<0.0001
H04A	Glycogenolytic hormones	0.0001	0.0006
H04A A	Glycogenolytic hormones	0.0001	0.0006
H05A	Parathyroid hormones and analogues	0.0011	0.0016
H05A A	Parathyroid hormones and analogues	0.0011	0.0016
H05B	Anti-parathyroid agents	0.0068	0.0062
H05B A	Calcitonin preparations	0.0045	0.0033
H05B X	Other anti-parathyroid agents	0.0022	0.0029

Table 14.3.1: Use of Thyroid Therapy by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
H03A	Thyroid preparations	2.9414	3.5014
H03A A	Thyroid hormones	2.9414	3.5014
H03B	Antithyroid preparations	3.9607	0.9429
H03B A	Thiouracils	1.7310	0.1089
H03B B	Sulfur-containing imidazole derivatives	2.2298	0.8340
H03C	Iodine therapy	-	<0.0001
H03C A	Iodine therapy	-	<0.0001

Table 14.3.2: Use of Thyroid Therapy by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
H03A A	**Thyroid hormones**			
H03A A01	Levothyroxine sodium	Public	2.3223	2.2185
		Private	0.6191	1.2829
		Total	2.9414	3.5014
H03A A02	Liothyronine sodium	Public	-	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
H03B A	**Thiouracils**			
H03B A02	Propylthiouracil	Public	1.0682	0.0788
		Private	0.6627	0.0301
		Total	1.7310	0.1089
H03B B	**Sulfur-containing imidazole derivatives**			
H03B B01	Carbimazole	Public	1.1999	0.6650
		Private	1.0299	0.1689
		Total	2.2298	0.8340
H03C A	**Iodine therapy**			
H03C AXX	Fake INN for H03C A	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001

Table 14.4.1: Use of Pancreatic Hormones by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	2009	2010
H04A	Glycogenolytic hormones	0.0001	0.0006
H04A A	Glycogenolytic hormones	0.0001	0.0006

Table 14.4.2: Use of Pancreatic Hormones by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
H04A A	**Glycogenolytic hormones**			
H04A A01	Glucagon	Public	0.0001	0.0006
		Private	<0.0001	<0.0001
		Total	0.0001	0.0006

Table 14.5.1: Use of Pancreatic Hormones by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
H05A	Parathyroid hormones and analogues	0.0011	0.0016
H05A A	Parathyroid hormones and analogues	0.0011	0.0016
H05B	Anti-parathyroid agents	0.0068	0.0062
H05B A	Calcitonin preparations	0.0045	0.0033
H05B X	Other anti-parathyroid agents	0.0022	0.0029

Table 14.5.2: Use of Pancreatic Hormones by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
H05A A	**Parathyroid hormones and analogues**			
H05A A02	Teriparatide	Public	-	0.0004
		Private	0.0011	0.0012
		Total	0.0011	0.0016
H05B A	**Calcitonin preparations**			
H05B A01	Calcitonin (salmon synthetic)	Public	<0.0001	0.0018
		Private	0.0044	0.0015
		Total	0.0045	0.0033
H05B X	**Other anti-parathyroid agents**			
H05B X02	Paricalcitol	Public	0.0008	0.0016
		Private	0.0014	0.0012
		Total	0.0022	0.0029

References:

1. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. *Australian Statistics on Medicines 2008 14th Edition;* Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2009.
3. *Guidelines for ATC Classification and DDD Assignment 2012;* WHO Collaborating Centre for Drug Statistics Methodology Printing Office: Oslo December 2012.

CHAPTER 15: USE OF ANTIINFECTIVES

Sim L.H.[1], Leong K.N.[2], Norhayati N.H.S[3], Sameerah S.A.R.[4], Rahela A.K.[1], Yuzlina M.Y.[5]

1. Sungai Buloh Hospital, Selangor, 2. Pulau Pinang Hospital, Pulau Pinang, 3. Melaka Hospital, Melaka, 4. National Pharmaceutical Control Bureau, Ministry of Health, 5. Hospital Putrajaya, Wilayah Persekutuan Putrajaya.

Anti-infectives remain the largest group of drugs used in Malaysian health facilities apart from antidiabetics, antihypertensives and lipid lowering agents. This chapter covers the various trends of usage of anti-infectives starting with antibacterials, then antituberculous medications, antimalarials, antivirals and lastly antimycotics.

In 2010, anti-bacterial use increased by 16% compared to 2009. Among the antibacterials, penicillins constituted 44.8% of total antibacterial usage in 2009 and this increased to 55.5% in 2010. Amoxicillin was the most widely used penicillin in 2009 and 2010. The public sector contributed 38.8% of usage of amoxicillin in 2010. According to the National Care Medical Survey 2010, about 29.6% of prescriptions containing antibiotics were issued for respiratory tract infection in the primary sector. Amoxicillin was prescribed in 35% of cases. This supports the recommendations of the National Antibiotic Guidelines of 2008 of using narrow spectrum penicillins for suspected community acquired pneumonia. Nonetheless it also reveals the common practise at primary care settings of giving antibiotics to treat respiratory tract infections which are mainly viral in origin. Inappropriate use of antibiotics leads to increases in antimicrobial resistance among bacteria (Musher 2003).

Cephalosporins constituted 18.4% of total antibacterial use in 2009 and 7.2% of total antibacterial use in 2010. 3rd generation (44.4%) was the most widely used group of cephalosporins in 2009 whilst 2nd generation (53.3%) was the highest in 2010. Among 2nd generation cephalosporins, cefuroxime constituted 71.5% to 95.6% usage. There was a marked increase in the usage of cefaclor (6.5 fold) from 2009 to 2010 and this phenomena was predominantly observed in private sector. Ceftriaxone and cefixime were the most common 3rd generation cephalosporins used in 2009 and 2010. Cefixime was used only in private sectors. However, usage of both these drugs dropped tremendously in 2010 (83.6% for ceftriaxone and 99.3% for cefixime). The restrcitive use of 3rd generation of cephalosporins is encouraged to minimise the rate of ESBL infection.

Antimicrobial Stewardship Programmes promote de-escalation of antibiotics by initially promoting the use of broad spectrum antibiotics such as carbapenems in very ill patients upfront and then deescalating of a narrow spectrum once cultures are available to minimize the emergence of resistance organisms. In Malaysia, usage of carbapenem increased tremendously in 2010 (9.5 fold) and this was mainly contributed to by meropenem usage in the public sector (33 folds). More efforts are needed to promote the judicious use of carbapenems to curb the emergence of Carbapenem Resistant Enterobactericeae (CRE). CRE has been increasing in Malaysia from 1 case in 2010 to 28 cases in 2011 (Medical Development Division, MOH 2013).

Acinetobacter baumanie multiresistant organism (MRO) became more prevalent in Malaysia in 2010. This is evident by the increase in usage of polymyxins (polymyxin B and colistin) in 2010 compared to 2009. Since Acinetobacter MRO is only sensitive to limited antibiotics like polymyxins and tigecycline, the appropriate use of polymyxins need to be emphasized to minimise the emergence of any resistance towards these antibiotics.

Under the tetracyclines, there was an increase in 2009 in the DDD/1000 population/day compared to 2007 and 2008 to 1.805 from 1.100 and 1.155 respectively. This increase was mainly contributed by doxycycline usage in private sector. Leptospirosis became a notifiable disease around that time due to increased reports of mortalities within the country. This likely triggered an increase in doxycycline usage. Its usage may also be a reflection of the trend of patients seeking treatment of acne in the private sector.

In the sulphonamides and trimethoprim group, there was a substantial increase in trimethoprim but a corresponding drop in the usage of sulfamethoxazole-trimethoprim in the private sector in 2010 compared to 2009. In view that most of the usage of this antibiotic is for treatment for urinary tract infections, the drop in the combination drug is likely due to a simplification of therapy to avoid the side effects of the sulphur component of sulfamethoxazole.

Among the macrolides, there was a doubling in the use of erythromycin in 2010 compared to the years before in the public sector. Apart from its anti-infective properties, erythromycin is also being increasingly used as a motility agent in critically ill patients in ICU. A more substantial increase was seen in the usage of azithromycin from 0.091 in 2007 and 2008 to 0.536 and 1.518 in 2009 and 2010 respectively in the private sector. This constitutes a jump of almost 6 fold and 16 fold in those years. While some of the increase can be explained by the increased awareness of the need to cover for atypical infections in community acquired pneumonias (the national antibiotic guidelines

were published at the end of 2008), there is also a possibility that the increase in 2010 purchasing was done due to marketing forces as Azithromycin was losing its patent in the subsequent year. It is also interesting to note that the usage of azithromycin in the private sector exceeded 10 times its usage in the public sector. Taking into consideration the increasing resistance of Streptococcal pneumonia towards azithromycin in the country, this liberal usage in the private sector is of concern.

For aminoglycosides, there was generally an increase in the usage of gentamicin, amikacin and netilmicin in the public sector in both 2009 and 2010 compared to the years before. This is a reflection of the increase in multi-resistant hospital acquired infections as the bulk of aminoglycosides are used in the intensive care units and mainly for patients who have resistant organisms that are only susceptible to this group of drugs.

Going on to the fluoroquinolones group, ofloxacin usage in the public sector in 2010 saw a drop while there was a corresponding increase in the usage of levofloxacin in that year. This reflects a switch in usage of ofloxacin to levofloxacin as an alternative agent for tuberculosis and also would reflect the increase in the number of drug resistant TB cases where levofloxacin is a useful agent. An increase in the use of ciprofloxacin in the public sector and moxifloxacin in the private sector in 2010 is again a cause for concern since it has been repeatedly reported as contributing to the general increase in antibiotic resistance among bacteria. This alarming trend is further emphasised when comparing quinolone usage which was many fold higher in the private practise compared to the public sector.

Among the other antibacterials, there has been a decrease in the usage of vancomycin in the public sector while the usage of linezolid has increased especially in 2010. This shows a general trend among doctors of being increasingly wary of vancomycin and its associated toxicities and the increased availability of alternative agents for its use against methicillin resistant Staphylococcus aureus.

As for tuberculosis (TB), the incidence in Malaysia has increased from 81.4 in 2010 to 83.5 per 100,000 populations in 2011[1]. The rate of MDR-TB cultures had also increased from 0.3% in 2005 to 1.3% in 2011. Hence, the utilization of antimycobacterials also increased. The Fixed-Dose Combinations (FDCs) are preferred to ensure patient's compliance and acceptability and success in treatment[1,2]. However, the usage of FDCs is still lower compared to individual drugs in both the public and the private hospitals.

Malaria elimination is now a goal of many countries in Southeast Asia and the Western Pacific, and large reductions in prevalence have been achieved. Malaysia has had one of the most successful malaria control programs in the region, and aims to be malaria-free by 2020[3]. The incidence of malaria in Malaysia has reduced from 0.5 per 1000 population in 2000 to 0.2 per 1000 population since 2008[4]. Since 2010, there were no locally acquired malaria cases reported in 3 states and 2 Federal Territories in Malaysia. However, the incidence of malaria was still high in the East Malaysia ie up to 0.8 per 1000 population[4]. A total of 4.4% of all malaria cases were notified in Sabah, with this percentage increasing slightly over the years from a median of 3.98% from 1992–2001 to 5.20% from 2002–2011 ($p = 0.049$)[5]. On the other hand, thenumber of imported cases is on the rise in West Malaysia[4]. This pattern can explain the marked increment in the antimalarial usage from 2009 to 2010.

Malaysia remains a low prevalence country for HIV. A modest increase in the use of all anti-retroviral agents is seen from 2009 to 2010. The public sector remains the center of treatment for the majority of HIV positive patients requiring HAART. Usage of fixed dose formulation of antiretrovirals continue to increase in view of the ease of delivery of medications to patients. Protease inhibitors use is much lower compared to other agents due to their status as second line drugs and higher cost. Nevirapine usage remains static while there is a trend towards more efavirenz based HAART.

Agents for treatment of both hepatitis B and C (entecavir, telbivudine, adefovir and ribavirin) also showed modest increases. On the other hand there was a reduction in oseltamivir usage. In light of the significant increment in anti-bacterial use, perhaps health care practitioners are still over-treating upper respiratory tract viral infections with antibacterials.

With regards to antimycotics, there was a 3-fold increase in the utilization of amphotericin B in the public hospital in 2010 when compared to 2009. However, on the whole the NMUS data showed a gradual reduction in the use of systemic antimycotics. A bigger reduction is seen in the private compared to the public hospital. The reason behind this is difficult to be determined as systemic fungal infection is not a notifiable disease.

It is the writing committee's recommendation that more detailed studies are carried out into the usage of particular antibiotics mainly those that are on the increase and those with significant public health effects. Public health campaigns to discourage inappropriate usage of antibiotics would go a long way toward reducing the threat of mutltiresistance among microorganisms.

Table 15.1: Use of Anti-Infectives, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2009	2010	2009	2010
J01	Antibacterials for systemic use	13.2719	15.4895	4.8442	5.6536
J02	Antimycotics for systemic use	0.4240	0.2590	0.1548	0.0945
J04	Antimycobacterials	0.7105	0.9198	0.2593	0.3357
J05	Antivirals for systemic use	0.3852	0.6742	0.1406	0.2461
J06	Immune sera and immunoglobulins	0.0004	0.0009	0.0001	0.0003
J07	Vaccines	8.3266	2.0086	3.0392	0.7332
P01B	Antimalarials	0.0994	0.3029	0.0363	0.1105

Table 15.2.1: Use of Anti-Bacterials by Drug Class, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2009	2010	2009	2010
J01A	Tetracyclines	1.8052	1.3327	0.6589	0.4864
J01B	Amphenicols	0.0037	0.0261	0.0014	0.0095
J01C	Beta-lactam antibacterials, penicillins	5.9455	8.5922	2.1700	3.1361
J01D	Other beta-lactam antibacterials	2.4589	1.2758	0.8975	0.4657
J01E	Sulfonamides and trimethoprim	0.3733	0.2204	0.1362	0.0804
J01F	Macrolides, lincosamides and streptogramins	1.8317	3.2402	0.6686	1.1827
J01G	Aminoglycoside antibacterials	0.2660	0.2107	0.0971	0.0769
J01M	Quinolone antibacterials	0.4856	0.4398	0.1772	0.1605
J01X	Other antibacterials	0.1021	0.1515	0.0373	0.0553

Table 15.2.2: Use of Anti-Bacterials by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01A A	**Tetracyclines**					
J01A A02	Doxycycline	Public	0.1962	0.2095	0.0716	0.0765
		Private	1.5129	1.0037	0.5522	0.3664
		Total	1.7091	1.2132	0.6238	0.4428
J01A A06	Oxytetracycline	Public	<0.0001	-	<0.0001	-
		Private	-	-	-	-
		Total	<0.0001	-	<0.0001	-
J01A A07	Tetracycline	Public	0.0194	0.0268	0.0071	0.0098
		Private	0.0705	0.0912	0.0257	0.0333
		Total	0.0899	0.1179	0.0328	0.0430
J01A A08	Minocycline	Public	0.0003	0.0003	0.0001	0.0001
		Private	0.0057	0.0011	0.0021	0.0004
		Total	0.0061	0.0013	0.0022	0.0005
J01A A12	Tigecycline	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0001	0.0002	<0.0001	<0.0001
		Total	0.0002	0.0002	<0.0001	<0.0001
J01B A	**Amphenicols**					
J01B A01	Chloramphenicol	Public	0.0033	0.0261	0.0012	0.0095
		Private	0.0004	<0.0001	0.0001	<0.0001
		Total	0.0037	0.0261	0.0014	0.0095

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01C A	**Penicillins with extended spectrum**					
J01C A01	Ampicillin	Public	0.1964	0.1673	0.0717	0.0611
		Private	0.0302	0.0637	0.0110	0.0233
		Total	0.2266	0.2310	0.0827	0.0843
J01C A04	Amoxicillin	Public	1.1781	1.2397	0.4300	0.4525
		Private	1.7121	1.9577	0.6249	0.7146
		Total	2.8902	3.1974	1.0549	1.1670
J01C A06	Bacampicillin	Public	0.1764	0.1401	0.0644	0.0511
		Private	0.0628	0.0537	0.0229	0.0196
		Total	0.2392	0.1938	0.0873	0.0707
J01C A12	Piperacillin	Public	<0.0001	0.0003	<0.0001	0.0001
		Private	-	-	-	-
		Total	<0.0001	0.0003	<0.0001	0.0001
J01C E	**Beta-lactamase sensitive penicillins**					
J01C E01	Benzylpenicillin	Public	0.1535	0.1798	0.0560	0.0656
		Private	0.0005	0.0004	0.0002	0.0002
		Total	0.1541	0.1803	0.0562	0.0658
J01C E02	Phenoxymethylpenicillin	Public	0.1773	1.1044	0.0647	0.4031
		Private	0.0163	0.0196	0.0060	0.0071
		Total	0.1936	1.1240	0.0707	0.4102
J01C E08	Benzathine benzylpenicillin	Public	0.0011	0.0006	0.0004	0.0002
		Private	0.0007	<0.0001	0.0003	<0.0001
		Total	0.0019	0.0006	0.0007	0.0002
J01C E09	Procaine benzylpenicillin	Public	0.0243	0.0195	0.0089	0.0071
		Private	-	<0.0001	-	<0.0001
		Total	0.0243	0.0196	0.0089	0.0071
J01C F	**Beta-lactamase resistant penicillins**					
J01C F02	Cloxacillin	Public	0.9550	0.9950	0.3486	0.3632
		Private	0.4352	1.1189	0.1588	0.4084
		Total	1.3901	2.1139	0.5074	0.7716
J01C F05	Flucloxacillin	Public	<0.0001	-	<0.0001	-
		Private	0.0807	0.0012	0.0294	0.0004
		Total	0.0807	0.0012	0.0294	0.0004
J01C G	**Beta-lactamase inhibitors**					
J01C G01	Sulbactam	Public	-	0.0012	-	0.0004
		Private	-	<0.0001	-	<0.0001
		Total	-	0.0012	-	0.0005
J01C R	**Combinations of penicillins, incl. beta-lactamase inhibitors**					
J01C R01	Ampicillin and enzyme inhibitor	Public	0.0086	1.1801	0.0031	0.4308
		Private	0.0100	0.0069	0.0036	0.0025
		Total	0.0186	1.1870	0.0068	0.4333
J01C R02	Amoxicillin	Public	0.1229	0.0222	0.0449	0.0081
		Private	0.5628	0.2679	0.2054	0.0978
		Total	0.6857	0.2901	0.2503	0.1059

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01C R04	Sultamicillin	Public	0.0103	0.0116	0.0038	0.0042
		Private	0.0268	0.0164	0.0098	0.0060
		Total	0.0371	0.0280	0.0135	0.0102
J01C R05	Piperacillin and enzyme inhibitor	Public	0.0026	0.0216	0.0009	0.0079
		Private	0.0009	0.0022	0.0003	0.0008
		Total	0.0035	0.0238	0.0013	0.0087
J01D B	**First-generation cephalosporins**					
J01D B01	Cefalexin	Public	0.1979	0.0879	0.0722	0.0321
		Private	0.4756	0.2770	0.1736	0.1011
		Total	0.6734	0.3648	0.2458	0.1332
J01D B04	Cefazolin	Public	0.0003	0.0035	0.0001	0.0013
		Private	0.0011	0.0016	0.0004	0.0006
		Total	0.0015	0.0051	0.0005	0.0019
J01D B05	Cefadroxil	Public	-	-	-	-
		Private	0.0578	0.0435	0.0211	0.0159
		Total	0.0578	0.0435	0.0211	0.0159
J01D B09	Cefradine	Public	-	-	-	-
		Private	-	0.0002	-	<0.0001
		Total	-	0.0002	-	<0.0001
J01D C	**Second-generation cephalosporins**					
J01D C02	Cefuroxime	Public	0.2047	0.2122	0.0747	0.0775
		Private	0.3873	0.2160	0.1414	0.0788
		Total	0.5920	0.4282	0.2161	0.1563
J01D C04	Cefaclor	Public	0.0014	-	0.0005	-
		Private	0.0248	0.1706	0.0090	0.0623
		Total	0.0261	0.1706	0.0095	0.0623
J01D C10	Cefprozil	Public	-	-	-	-
		Private	0.0006	-	0.0002	-
		Total	0.0006	-	0.0002	-
J01D D	**Third-generation cephalosporins**					
J01D D01	Cefotaxime	Public	0.0036	0.0029	0.0013	0.0011
		Private	0.0004	0.0004	0.0002	0.0002
		Total	0.0041	0.0034	0.0015	0.0012
J01D D02	Ceftazidime	Public	0.0079	0.0087	0.0029	0.0032
		Private	0.0015	0.0013	0.0005	0.0005
		Total	0.0094	0.0101	0.0034	0.0037
J01D D04	Ceftriaxone	Public	0.0284	0.0330	0.0104	0.0121
		Private	0.2513	0.0127	0.0917	0.0046
		Total	0.2796	0.0458	0.1021	0.0167
J01D D08	Cefixime	Public	-	-	-	-
		Private	0.7581	0.0050	0.2767	0.0018
		Total	0.7581	0.0050	0.2767	0.0018
J01D D12	Cefoperazone	Public	0.0074	0.0085	0.0027	0.0031
		Private	0.0003	0.0002	0.0001	<0.0001
		Total	0.0077	0.0087	0.0028	0.0032

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01D D14	Ceftibuten	Public	-	-	-	-
		Private	0.0225	0.0222	0.0082	0.0081
		Total	0.0225	0.0222	0.0082	0.0081
J01D D15	Cefdinir	Public	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
J01D D62	Cefoperazone, combinations	Public	0.0007	0.0019	0.0003	0.0007
		Private	0.0028	0.0037	0.0010	0.0014
		Total	0.0036	0.0057	0.0013	0.0021
J01D E	**Fourth-generation cephalosporins**					
J01D E01	Cefepime	Public	0.0055	0.0085	0.002	0.0031
		Private	0.0007	0.0009	0.0003	0.0003
		Total	0.0062	0.0094	0.0023	0.0034
J01D H	**Carbapenems**					
J01D H02	Meropenem	Public	0.0041	0.1344	0.0015	0.0491
		Private	0.0031	0.0036	0.0011	0.0013
		Total	0.0072	0.1380	0.0026	0.0504
J01D H03	Ertapenem	Public	0.0005	0.0015	0.0002	0.0006
		Private	0.0017	0.0043	0.0006	0.0016
		Total	0.0022	0.0059	0.0008	0.0021
J01D H51	Imipenem and enzyme inhibitor	Public	0.0055	0.0048	0.0020	0.0018
		Private	0.0013	0.0043	0.0005	0.0016
		Total	0.0068	0.0092	0.0025	0.0033
J01E A	**Trimethoprim and derivatives**					
J01E A01	Trimethoprim	Public	0.0020	0.0062	0.0007	0.0023
		Private	0.0026	0.0403	0.0010	0.0147
		Total	0.0047	0.0465	0.0017	0.0170
J01E C	**Intermediate-acting sulfonamides**					
J01E C01	Sulfamethoxazole	Public	-	<0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	<0.0001	-	<0.0001
J01E E	**Combinations of sulfonamides and trimethoprim, incl. Derivatives**					
J01E E01	Sulfamethoxazole and trimethoprim	Public	0.2004	0.1679	0.0732	0.0613
		Private	0.1554	0.0059	0.0567	0.0022
		Total	0.3558	0.1738	0.1299	0.0634
J01E E02	Sulfadiazine and trimethoprim	Public	-	<0.0001	-	<0.0001
		Private	0.0128	-	0.0047	-
		Total	0.0128	<0.0001	0.0047	<0.0001
J01F A	**Macrolides**					
J01F A01	Erythromycin	Public	0.4048	1.2132	0.1477	0.4428
		Private	0.4661	0.2142	0.1701	0.0782
		Total	0.8708	1.4274	0.3179	0.5210
J01F A02	Spiramycin	Public	-	-	-	-
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01F A05	Oleandomycin	Public	-	-	-	-
		Private	-	0.0002	-	<0.0001
		Total	-	0.0002	-	<0.0001
J01F A06	Roxithromycin	Public	-	-	-	-
		Private	0.0939	0.0513	0.0343	0.0187
		Total	0.0939	0.0513	0.0343	0.0187
J01F A09	Clarithromycin	Public	0.0093	0.0225	0.0034	0.0082
		Private	0.2453	0.1642	0.0896	0.0599
		Total	0.2547	0.1867	0.0930	0.0682
J01F A10	Azithromycin	Public	0.0578	0.0407	0.0211	0.0148
		Private	0.5357	1.5175	0.1955	0.5539
		Total	0.5934	1.5582	0.2166	0.5687
J01F F	**Lincosamides**					
J01F F01	Clindamycin	Public	0.0019	0.0040	0.0007	0.0015
		Private	0.0160	0.0092	0.0059	0.0034
		Total	0.0179	0.0133	0.0065	0.0048
J01F F02	Lincomycin	Public	-	-	-	-
		Private	0.0009	0.0031	0.0003	0.0011
		Total	0.0009	0.0031	0.0003	0.0011
J01G A	**Streptomycins**					
J01G A01	Streptomycin	Public	0.1606	0.1014	0.0586	0.0370
		Private	0.0001	0.0002	<0.0001	<0.0001
		Total	0.1607	0.1016	0.0587	0.0371
J01G B	**Other aminoglycosides**					
J01G B03	Gentamicin	Public	0.0796	0.0788	0.0290	0.0288
		Private	0.0019	0.0009	0.0007	0.0003
		Total	0.0814	0.0798	0.0297	0.0291
J01G B04	Kanamycin	Public	0.0005	0.0001	0.0002	<0.0001
		Private	0.0002	0.0002	<0.0001	<0.0001
		Total	0.0007	0.0003	0.0003	0.0001
J01G B06	Amikacin	Public	0.0201	0.0266	0.0074	0.0097
		Private	0.0004	0.0004	0.0001	0.0001
		Total	0.0205	0.0270	0.0075	0.0099
J01G B07	Netilmicin	Public	0.0020	0.0013	0.0007	0.0005
		Private	0.0007	0.0007	0.0002	0.0003
		Total	0.0027	0.0020	0.0010	0.0007
J01M A	**Fluoroquinolones**					
J01M A01	Ofloxacin	Public	0.0117	0.0091	0.0043	0.0033
		Private	0.1075	0.0337	0.0392	0.0123
		Total	0.1192	0.0428	0.0435	0.0156
J01M A02	Ciprofloxacin	Public	0.0315	0.0856	0.0115	0.0312
		Private	0.2011	0.1713	0.0734	0.0625
		Total	0.2326	0.2569	0.0849	0.0938
J01M A03	Pefloxacin	Public	0.0004	0.0003	0.0001	0.0001
		Private	-	0.0005	-	0.0002
		Total	0.0004	0.0009	0.0001	0.0003

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01M A06	Norfloxacin	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0753	0.0367	0.0275	0.0134
		Total	0.0753	0.0367	0.0275	0.0134
J01M A12	Levofloxacin	Public	0.0006	0.0053	0.0002	0.0019
		Private	0.0245	0.0357	0.0090	0.0130
		Total	0.0252	0.0410	0.0092	0.0150
J01M A14	Moxifloxacin	Public	0.0001	0.0001	<0.0001	<0.0001
		Private	0.0290	0.0554	0.0106	0.0202
		Total	0.0291	0.0555	0.0106	0.0202
J01M A17	Prulifloxacin	Public	-	-	-	-
		Private	0.0002	-	<0.0001	-
		Total	0.0002	-	<0.0001	-
J01M B	**Other quinolones**					
J01M B04	Pipemidic acid	Public	-	-	-	-
		Private	0.0036	0.0061	0.0013	0.0022
		Total	0.0036	0.0061	0.0013	0.0022
J01X A	**Glycopeptide antibacterials**					
J01X A01	Vancomycin	Public	0.0034	0.0001	0.0013	<0.0001
		Private	0.0008	0.0007	0.0003	0.0003
		Total	0.0043	0.0008	0.0016	0.0003
J01X A02	Teicoplanin	Public	0.0001	0.0002	<0.0001	<0.0001
		Private	0.0002	0.0002	<0.0001	<0.0001
		Total	0.0003	0.0004	0.0001	0.0001
J01X B	**Polymyxins**					
J01X B01	Colistin	Public	<0.0001	0.0003	<0.0001	0.0001
		Private	-	<0.0001	-	<0.0001
		Total	<0.0001	0.0003	<0.0001	0.0001
J01X B02	Polymyxin B	Public	<0.0001	0.0003	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	0.0003	<0.0001	0.0001
J01X C	**Steroid antibacterials**					
J01X C01	Fusidic acid	Public	0.0086	0.0490	0.0031	0.0179
		Private	0.0027	0.0012	0.0010	0.0005
		Total	0.0113	0.0502	0.0041	0.0183
J01X D	**Imidazole derivatives**					
J01X D01	Metronidazole	Public	0.0442	0.0394	0.0161	0.0144
		Private	0.0230	0.0484	0.0084	0.0177
		Total	0.0672	0.0878	0.0245	0.0321
J01X E	**Nitrofuran derivatives**					
J01X E01	Nitrofurantoin	Public	0.0022	0.0021	0.0008	0.0008
		Private	0.0031	0.0010	0.0011	0.0004
		Total	0.0054	0.0031	0.0020	0.0011
J01X X	**Other antibacterials**					
J01X X01	Fosfomycin	Public	-	-	-	-
		Private	0.0112	0.0009	0.0041	0.0003
		Total	0.0112	0.0009	0.0041	0.0003

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J01X X08	Linezolid	Public	0.0019	0.0064	0.0007	0.0024
		Private	0.0003	0.0011	<0.0001	0.0004
		Total	0.0022	0.0076	0.0008	0.0028
J01X X09	Daptomycin	Public	-	<0.0001	-	<0.0001
		Private	<0.0001	0.0001	<0.0001	<0.0001
		Total	<0.0001	0.0001	<0.0001	<0.0001

Table 15.3.1: Use of Anti-Mycotics by Drug Class, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2009	2010	2009	2010
J02A A	Antibiotics	0.0023	0.0066	0.0008	0.0024
J02A B	Imidazole derivatives	0.3065	0.1566	0.1119	0.0571
J02A C	Triazole derivatives	0.1144	0.0955	0.0418	0.0349
J02A X	Other antimycotics for systemic use	0.0008	0.0003	0.0003	0.0001

Table 15.3.2: Use of Anti-Mycotics by Drug Class and Agents, , in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J02A A	**Antibiotics**					
J02A A01	Amphotericin B	Public	0.0022	0.0064	0.0008	0.0024
		Private	0.0001	0.0001	<0.0001	<0.0001
		Total	0.0023	0.0066	0.0008	0.0024
J02A B	**Imidazole derivatives**					
J02A B02	Ketoconazole	Public	0.0069	0.0127	0.0025	0.0046
		Private	0.2996	0.1439	0.1094	0.0525
		Total	0.3065	0.1566	0.1119	0.0571
J02A C	**Triazole derivatives**					
J02A C01	Fluconazole	Public	0.0140	0.0181	0.0051	0.0066
		Private	0.0569	0.0418	0.0208	0.0152
		Total	0.0708	0.0599	0.0258	0.0218
J02A C02	Itraconazole	Public	0.0262	0.0202	0.0096	0.0074
		Private	0.0169	0.0143	0.0062	0.0052
		Total	0.0431	0.0345	0.0157	0.0126
J02A C03	Voriconazole	Public	0.0004	0.0011	0.0001	0.0004
		Private	<0.0001	0.0001	<0.0001	<0.0001
		Total	0.0004	0.0012	0.0002	0.0004
J02A X	**Other antimycotics for systemic use**					
J02A X01	Flucytosine	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	-	-	-	-
		Total	<0.0001	<0.0001	<0.0001	<0.0001
J02A X04	Caspofungin	Public	0.0002	0.0002	<0.0001	<0.0001
		Private	0.0006	<0.0001	0.0002	<0.0001
		Total	0.0007	0.0002	0.0003	<0.0001
J02A X06	Anidulafungin	Public	-	<0.0001	-	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001

Table 15.4.1: Use of Anti-Mycobacterials by Drug Class, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J04A B	**Antibiotics**					
J04A B01	Cycloserine	Public	0.0010	0.0015	0.0004	0.0005
		Private	-	-	-	-
		Total	0.0010	0.0015	0.0004	0.0005
J04A B02	Rifampicin	Public	0.2172	0.1981	0.0793	0.0723
		Private	0.0160	0.0181	0.0058	0.0066
		Total	0.2332	0.2162	0.0851	0.0789
J04A B04	Rifabutin	Public	-	<0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	<0.0001	-	<0.0001
J04A C	**Hydrazides**					
J04A C01	Isoniazid	Public	0.2407	0.4085	0.0879	0.1491
		Private	0.0113	0.0123	0.0041	0.0045
		Total	0.2521	0.4208	0.092	0.1536
J04A D	**Thiocarbamide derivatives**					
J04A D03	Ethionamide	Public	0.0011	0.0016	0.0004	0.0006
		Private	<0.0001	-	<0.0001	-
		Total	0.0011	0.0016	0.0004	0.0006
J04A K	**Other drugs for treatment of tuberculosis**					
J04A K01	Pyrazinamide	Public	0.1000	0.0880	0.0365	0.0321
		Private	0.0063	0.0045	0.0023	0.0016
		Total	0.1062	0.0925	0.0388	0.0338
J04A K02	Ethambutol	Public	0.0681	0.0812	0.0249	0.0297
		Private	0.0084	0.0333	0.0031	0.0122
		Total	0.0765	0.1145	0.0279	0.0418
J04A M	**Combinations of drugs for treatment of tuberculosis**					
J04A M02	Rifampicin and isoniazid	Public	-	<0.0001	-	<0.0001
		Private	0.0055	0.0019	0.0020	0.0007
		Total	0.0055	0.0020	0.0020	0.0007
J04A M05	Rifampicin, pyrazinamide and isoniazid	Public	-	<0.0001	-	<0.0001
		Private	0.0023	0.0003	0.0008	0.0001
		Total	0.0023	0.0003	0.0008	0.0001
J04A M06	Rifampicin, pyrazinamide, ethambutol & isoniazid	Public	0.0003	0.0003	0.0001	0.0001
		Private	0.0022	0.0002	0.0008	<0.0001
		Total	0.0025	0.0005	0.0009	0.0002
J04B A	**Drugs for treatment of lepra**					
J04B A01	Clofazimine	Public	0.0016	0.0022	0.0006	0.0008
		Private	-	<0.0001	-	<0.0001
		Total	0.0016	0.0023	0.0006	0.0008
J04B A02	Dapsone	Public	0.0281	0.0660	0.0102	0.0241
		Private	0.0004	0.0014	0.0001	0.0005
		Total	0.0285	0.0673	0.0104	0.0246

Table 15.5.1: Use of Anti-Malarials by Drug Class, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2009	2010	2009	2010
P01A	Agents against amoebiasis and other protozoal diseases	0.2854	0.3133	0.1042	0.1144
P01B A	Aminoquinolines	0.0842	0.2814	0.0307	0.1027
P01B B	Biguanides	<0.0001	<0.0001	<0.0001	<0.0001
P01B C	Methanolquinolines	0.0067	0.0009	0.0025	0.0003
P01B D	Diaminopyrimidines	0.0085	0.0203	0.0031	0.0074
P01B E	Artemisinin and derivatives, plain	<0.0001	0.0002	<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 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
P01A B	**Nitroimidazole derivatives**					
P01A B01	Metronidazole	Public	0.0941	0.1049	0.0343	0.0383
		Private	0.1896	0.2081	0.0692	0.0760
		Total	0.2837	0.3131	0.1035	0.1143
P01A B02	Tinidazole	Public	-	-	-	-
		Private	0.0017	0.0002	0.0006	<0.0001
		Total	0.0017	0.0002	0.0006	<0.0001
P01B A	**Aminoquinolines**					
P01B A01	Chloroquine	Public	0.0037	0.0207	0.0014	0.0076
		Private	0.0005	0.0011	0.0002	0.0004
		Total	0.0043	0.0218	0.0016	0.0079
P01B A02	Hydroxychloroquine	Public	0.0469	0.2204	0.0171	0.0804
		Private	0.0069	0.0033	0.0025	0.0012
		Total	0.0537	0.2237	0.0196	0.0817
P01B A03	Primaquine	Public	0.0255	0.0359	0.0093	0.0131
		Private	0.0007	<0.0001	0.0003	<0.0001
		Total	0.0262	0.0359	0.0096	0.0131
P01B B	**Biguanides**					
P01B B51	Proguanil, combinations	Public	-	-	-	-
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001
P01B C	**Methanolquinolines**					
P01B C01	Quinine	Public	0.0063	0.0008	0.0023	0.0003
		Private	0.0004	0.0001	0.0001	<0.0001
		Total	0.0067	0.0009	0.0024	0.0003
P01B C02	Mefloquine	Public	-	<0.0001	-	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001
P01B D	**Diaminopyrimidines**					
P01B D01	Pyrimethamine	Public	<0.0001	0.0106	<0.0001	0.0039
		Private	-	-	-	-
		Total	<0.0001	0.0106	<0.0001	0.0039

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
P01B D51	Pyrimethamine, combinations	Public	0.0081	0.0096	0.0029	0.0035
		Private	0.0003	<0.0001	0.0001	<0.0001
		Total	0.0084	0.0097	0.0031	0.0035
P01B E	**Artemisinin and derivatives, plain**					
P01B E03	Artesunate	Public	<0.0001	0.0002	<0.0001	<0.0001
		Private	-	-	-	-
		Total	<0.0001	0.0002	<0.0001	<0.0001

Table 15.6.1: Use of Anti-Virals by Drug Class in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
		2009	2010	2009	2010
J05A B	Nucleosides and nucleotides excl. reverse transcriptase inhibitors	0.0261	0.0453	0.0095	0.0166
J05A D	Phosphonic acid derivatives	-	<0.0001	-	<0.0001
J05A E	Protease inhibitors	0.0025	0.0033	0.0009	0.0012
J05A F	Nucleoside and nucleotide reverse transcriptase inhibitors	0.2459	0.4428	0.0898	0.1616
J05A G	Non-nucleoside reverse transcriptase inhibitors	0.0634	0.0974	0.0232	0.0355
J05A H	Neuraminidase inhibitors	0.0035	0.0039	0.0013	0.0014
J05A R	Antivirals for treatment of HIV infections, combinations	0.0438	0.0815	0.0160	0.0297
J05A X	Other antivirals	-	<0.0001	-	<0.0001

Table 15.6.2: Use of Anti-Virals by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J05A B	**Nucleosides and nucleotides excl. reverse transcriptase inhibitors**					
J05A B01	Aciclovir	Public	0.0087	0.0122	0.0032	0.0045
		Private	0.0159	0.0313	0.0058	0.0114
		Total	0.0247	0.0435	0.0090	0.0159
J05A B04	Ribavirin	Public	-	0.0001	-	<0.0001
		Private	0.0004	<0.0001	0.0001	<0.0001
		Total	0.0004	0.0002	0.0001	<0.0001
J05A B06	Ganciclovir	Public	0.0001	0.0004	<0.0001	0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0001	0.0004	<0.0001	0.0002
J05A B11	Valaciclovir	Public	<0.0001	0.0006	<0.0001	0.0002
		Private	0.0009	0.0005	0.0003	0.0002
		Total	0.0009	0.0011	0.0003	0.0004
J05A B14	Valganciclovir	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001
J05A D	**Phosphonic acid derivatives**					
J05A D01	Foscarnet	Public	-	<0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	<0.0001	-	<0.0001

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J05A E	**Protease inhibitors**					
J05A E02	Indinavir	Public	0.0011	0.0011	0.0004	0.0004
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0012	0.0011	0.0004	0.0004
J05A E03	Ritonavir	Public	0.0006	0.0017	0.0002	0.0006
		Private	-	-	-	-
		Total	0.0006	0.0017	0.0002	0.0006
J05A E06	Lopinavir	Public	0.0007	0.0004	0.0003	0.0001
		Private	-	-	-	-
		Total	0.0007	0.0004	0.0003	0.0001
J05A E08	Atazanavir	Public	-	0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	0.0001	-	<0.0001
J05A E10	Darunavir	Public	-	<0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	<0.0001	-	<0.0001
J05A F	**Nucleoside and nucleotide reverse transcriptase inhibitors**					
J05A F01	Zidovudine	Public	0.1571	0.1839	0.0573	0.0671
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.1571	0.1839	0.0573	0.0671
J05A F02	Didanosine	Public	0.0032	0.0089	0.0012	0.0032
		Private	0.0002	<0.0001	<0.0001	<0.0001
		Total	0.0035	0.0089	0.0013	0.0032
J05A F04	Stavudine	Public	0.0114	0.0178	0.0042	0.0065
		Private	0.0003	-	<0.0001	-
		Total	0.0117	0.0178	0.0043	0.0065
J05A F05	Lamivudine	Public	0.0407	0.1905	0.0149	0.0695
		Private	0.0116	0.0007	0.0042	0.0002
		Total	0.0523	0.1912	0.0191	0.0698
J05A F06	Abacavir	Public	0.0002	0.0004	<0.0001	0.0001
		Private	-	<0.0001	-	<0.0001
		Total	0.0002	0.0004	<0.0001	0.0001
J05A F07	Tenofovir disoproxil	Public	0.0012	0.0014	0.0004	0.0005
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	0.0012	0.0015	0.0005	0.0005
J05A F08	Adefovir dipivoxil	Public	0.0056	0.0096	0.0021	0.0035
		Private	0.0014	0.0009	0.0005	0.0003
		Total	0.0070	0.0105	0.0026	0.0038
J05A F09	Emtricitabine	Public	-	0.0097	-	0.0035
		Private	-	0.0002	-	<0.0001
		Total	-	0.0098	-	0.0036
J05A F10	Entecavir	Public	0.0050	0.0086	0.0018	0.0032
		Private	0.0074	0.0075	0.0027	0.0027
		Total	0.0124	0.0161	0.0045	0.0059

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 POPULATION/DAY		DDD/POPULATION/YEAR	
			2009	2010	2009	2010
J05A F11	Telbivudine	Public	<0.0001	0.0022	<0.0001	0.0008
		Private	0.0005	0.0004	0.0002	0.0001
		Total	0.0005	0.0026	0.0002	0.0009
J05A G	**Non-nucleoside reverse transcriptase inhibitors**					
J05A G01	Nevirapine	Public	0.0141	0.0145	0.0052	0.0053
		Private	0.0002	<0.0001	<0.0001	<0.0001
		Total	0.0144	0.0145	0.0053	0.0053
J05A G03	Efavirenz	Public	0.0475	0.0826	0.0173	0.0301
		Private	0.0015	0.0003	0.0006	0.0001
		Total	0.0490	0.0829	0.0179	0.0303
J05A H	**Neuraminidase inhibitors**					
J05A H01	Zanamivir	Public	-	-	-	-
		Private	<0.0001	<0.0001	<0.0001	<0.0001
		Total	<0.0001	<0.0001	<0.0001	<0.0001
J05A H02	Oseltamivir	Public	0.0002	<0.0001	<0.0001	<0.0001
		Private	0.0033	0.0039	0.0012	0.0014
		Total	0.0035	0.0039	0.0013	0.0014
J05A R	**Antivirals for treatment of HIV infections, combinations**					
J05A R01	Zidovudine and lamivudine	Public	0.0395	0.0548	0.0144	0.0200
		Private	0.0014	0.0010	0.0005	0.0003
		Total	0.0409	0.0557	0.0149	0.0203
J05A R03	Tenofovir disoproxil and emtricitabine	Public	-	0.0010	-	0.0004
		Private	-	<0.0001	-	<0.0001
		Total	-	0.001	-	0.0004
J05A R07	Stavudine, lamivudine and nevirapine	Public	0.0029	0.0248	0.0010	0.0090
		Private	-	-	-	-
		Total	0.0029	0.0248	0.0010	0.0090
J05A X	**Other antivirals**					
J05A X08	Raltegravir	Public	-	<0.0001	-	<0.0001
		Private	-	-	-	-
		Total	-	<0.0001	-	<0.0001

References:

1. *Clinical Practice Guidelines on Management of Tuberculosis (3rd ed)*. Ministry of Health Malaysia:Putrajaya, Malaysia, 2012.
2. *Treatment of tuberculosis Guidelines*. Fourth ed.: World Health Organization:Geneva, 2010.
3. *World Malaria Report 2011*;World Health Organization: Geneva, 2011.
4. Rundi, C. Malaria Elimination in Malaysia. Third annual APMEN technical and business meeting, 9–12 May 2011; Kota Kinabalu, Malaysia, 2011.
5. Available:http://apmen.org/apmen-iii-meeting-proceedings/(Accessed 3 May, 2012)
6. William, T.; Rahman, H.A.; Jelip, J.; Ibrahim, M.Y.; Menon, J.; Grigg, M.J.; Yeo, T.W.; Anstey, N.M.; Barber B.E. Increasing incidence of Plasmodium knowlesi malaria following control of *P. falciparum* and P. vivax Malaria in Sabah, Malaysia. PLoS Negl Tro0p Dis. 2013, 7, 2026.

CHAPTER 16: USE OF ANTINEOPLASTICS AGENTS, INCLUDING ENDOCRINE THERAPY AND IMMUNOSTIMULANTS

Hafizah Z.A .[1], Myat S.K.[2], Wan Nazuha W.R. [3], Lim Y.S. [4]

1. National Cancer Institute, Putrajaya, 2. Sultan Ismail Hospital, Johor, 3. Kuala Lumpur Hospital, Kuala Lumpur, 4. Ampang Hospital, Selangor.

In 2007, cancer was the third common cause of death at 11.26 percent in Ministry of Health Malaysia Hospitals after Heart Disease and Diseases of Pulmonary Circulation and Septicaemia[1]. Nearly 70,000 new cancer cases were diagnosed among Malaysians in Peninsular Malaysia between 2003 and 2005, according to a report released in early 2008 on the incidence of the disease in West Malaysia. The most frequent cancer during this period was breast cancer (18 percent) followed by large bowel cancer (11.9 percent) and lung cancer (7.4 percent)[2].

Systemic therapy for cancer had evolved from the use of chemotherapy drugs to targeted therapies with less toxicity. New agents are being incorporated into routine practice both in private and public sectors. This report will describe the total utilisation of antineoplastic agents, endocrine therapy and immnostimulants for 2009 and 2010.

For 2009, in the public sector, the 10 antineoplastic agents with the highest overall usage in solid tumours were the 5-flurouracil, capecitabine, cyclophosphamide, methotrexate, gemcitabine, carboplatin, imatinib, etoposide, doxorubicin and cisplatin. For 2010 the top 10 agents were 5-flurouracil, cyclophosphamide, capecitabine, methotrexate, imatinib, gemcitabine, carboplatin, etoposide, doxorubicin and paclitaxel. In private sector for both years, capecitabine was on the top of the list as it was is more convenient for the patients.

There was an increment by six fold from 2009 to 2010 for imatinib usage which could be explained by the introduction of MYPAP (Malaysia Patient Assisted Programme) for gastrointestinal stromal tumour.

Since the introduction of free EGFR test in public sector, the usage of gefitinib and erlotinib which is a targeted treatment for lung cancer has increased compared to private sector. After pemetrexed was registered in Malaysia in 2006 for non-squamous lung cancer, there has been a steady increase both in public and private sector.

Private sector used more lapatinib if compared to trastuzumab in view of cheaper price and convenient in administration (lapatinib is in oral form) in HER2 positive breast cancer. It is also in the top 10 list for both years in term of usage in private sector. Trastuzumab usage had increased significantly in 2010 by 16 fold in public sector after it was approved for use in adjuvant setting for 1 year (17 cycles).

Bevacizumab was another type of targeted therapy that was gaining popularity in both public and private centre since it's registration in Malaysia in 2005. Most significant increase had been observed in public sector in which it is being prescribed as a treatment for metastatic colorectal cancer.

Temozolomide is an alkylating agent used in post-operative setting in patients diagnosed with Glioblastoma Multiforme concurrent with radiotherapy and as single agent. Its usage had increased significantly in public sector, although in private sector remained the same.

According to the different drug classes, for antimetabolites, fluorouracil was the most used agent followed by capecitabine. This could be explained by the fact that fluorouracil was used in many types of cancer which included breast, colorectal and head & neck. As for capecitabine, it was used more frequently in breast and colorectal cancer as an oral alternative of fluorouracil and in patients who did not tolerate fluorouracil.

The most used alkylating agent was cyclophosphamide as it was commonly used in breast cancer patients either in adjuvant or metastatic setting[3]. Breast cancer was also the commonest cancer in Malaysia.

In the platinum group, there was a drastic increase in the usage for carboplatin in private sector in which it was ranked as number 10 in 2009 but jumped to 2nd place in 2010.

ENDOCRINE THERAPY

Comparing 2009 to 2010, there was a reduction in the usage of tamoxifen in the private sector as opposed to public sector, in which the figure remained the same. However there was an increment in the usage of aromatase inhibitors in particular exemestane in both sectors.

There was no significant increment in the usage of goserelin which was used in prostate cancer. As for anti-androgen, bicalutamide was used more commonly as compared to flutamide.

IMMUNOSTIMULANTS

Similar as previous years, filgrastim remained the most frequently used colony stimulating factor.

ANTIEMETICS

Antiemetics were routinely used as a premedication for nearly all chemotherapy. Granisetron or ondansetron were commonly used for high dose platinum or cyclophosphamide chemotherapy. Granisetron usage had increased by 50 percent as opposed to ondansetron which had reduced by 50 percent.

Table 16.1: Use of Anti-Neoplastic Agents by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS & AGENTS	DOSE & DURATION	AVERAGE DOSE PER TREATMENT CYCLE	UNIT	SECTOR	2009		2010	
						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	5.6474	44527	16.2682	130582
					Private	0.6344	5002	0.5353	4297
					Total	6.2818	49528	16.8035	134878
L01A A02	Chlorambucil	10mg d1-14	140	mg	Public	0.0027	200	0.0049	365
					Private	0.0004	28	0.0002	11
					Total	0.0031	228	0.0050	376
L01A A03	Melphalan	30mg/m2	50	mg	Public	0.0027	550	0.0023	485
					Private	0.0003	67	0.0011	221
					Total	0.0030	617	0.0034	706
L01A A06	Ifosfamide	1500mg/m2 x 5/7	12900	mg	Public	0.0011	1	0.0012	1
					Private	0.0001	<1	0.0001	<1
					Total	0.0012	1	0.0013	1
L01A B	**Alkyl sulfonates**								
L01A B01	Busulfan	0.8mg/kg QID x 4/7	800	mg	Public	0.0028	36	0.0080	104
					Private	<0.0001	<1	0.0006	8
					Total	0.0028	36	0.0086	112
L01A C	**Ethylene imines**								
L01A C01	Thiotepa	45mg/m2 weekly	80	mg	Public	0.0001	7	0.0001	13
					Private	-	-	0.0001	13
					Total	0.0001	7	0.0002	27
L01A D	**Nitrosoureas**								
L01A D01	Carmustine	300mg/m2 x1/7	500	mg	Public	0.0006	13	0.0014	30
					Private	0.0006	12	0.0007	14
					Total	0.0012	25	0.0021	44
L01A D02	Lomustine	110mg/m2 d1	190	mg	Public	0.0002	9	0.0005	29
					Private	<0.0001	2	-	-
					Total	0.0002	11	0.0005	29
L01A X	**Other alkylating agents**								
L01A X03	Temozolomide	75mg/m2 d1-5 x 6 weeks	3900	mg	Public	0.0016	4	0.0208	56
					Private	0.0035	9	0.0037	10
					Total	0.0051	13	0.0245	66
L01A X04	Dacarbazine	375mg/m2 D1+15	1300	mg	Public	0.0545	430	0.0446	358
					Private	0.0113	89	0.0104	84
					Total	0.0658	519	0.0550	442

ATC	DRUG CLASS & AGENTS	DOSE & DURATION	AVERAGE DOSE PER TREATMENT CYCLE	UNIT	SECTOR	2009		2010	
						TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE	TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE
L01B A	**Folic acid analogues**								
L01B A01	Methotrexate	2000mg/m2	3500	mg	Public	3.9077	11444	1.3787	4110
					Private	0.4204	1231	0.0287	86
					Total	4.3281	12675	1.4075	4196
L01B A04	Pemetrexed	500mg/m2	860	mg	Public	0.0005	6	0.0141	171
					Private	0.0099	118	0.0229	278
					Total	0.0104	124	0.0370	448
L01B B	**Purine analogues**								
L01B B02	Mercaptopurine	100mg/m2 d1-5	860	mg	Public	0.5695	6787	0.4546	5516
					Private	0.0090	107	0.0299	363
					Total	0.5785	6894	0.4845	5879
L01B B03	Tioguanine	100mg/m2 d1-5	860	mg	Public	0.0266	317	0.0436	530
					Private	0.0002	2	0.0001	1
					Total	0.0268	319	0.0437	530
L01B B04	Cladribine	0.2mg/kg d1-5	60	mg	Public	<0.0001	1	<0.0001	5
					Private	-	-	-	-
					Total	<0.0001	1	<0.0001	5
L01B B05	Fludarabine	25mg/m2 d1-5	215	mg	Public	0.0016	78	0.0032	157
					Private	0.0004	20	0.0004	21
					Total	0.0021	98	0.0037	177
L01B C	**Pyrimidine analogues**								
L01B C01	Cytarabine	1500mg/m2 b BD x 4/7	20640	mg	Public	1.2131	602	1.8807	951
					Private	0.2020	100	0.2557	129
					Total	1.4151	703	2.1364	1080
L01B C02	Fluorouracil	1000mg/m2	2000	mg	Public	22.8154	116926	24.4317	127470
					Private	0.7285	3734	0.5218	2723
					Total	23.5439	120660	24.9535	130193
L01B C03	Tegafur	300mg/m2 x 21days rest 7days	10836	mg	Public	-	-	-	-
					Private	0.0148	14	0.0620	60
					Total	0.0148	14	0.0620	60
L01B C05	Gemcitabine	1000mg/m2 d1+ 8	3440	mg	Public	0.8312	2477	1.0703	3247
					Private	0.3087	920	0.4180	1268
					Total	1.1399	3396	1.4883	4515
L01B C06	Capecitabine	2500mg/d d1-14	35000	mg	Public	7.7276	2263	12.9109	3849
					Private	5.9778	1751	4.2478	1266
					Total	13.7054	4014	17.1587	5116
L01B C08	Decitabine	20mg/m2/d x 5days	172	mg	Public	-	-	-	-
					Private	0.0001	5	<0.0001	3
					Total	0.0001	5	<0.0001	3
L01B C53	Tegafur, combinations	100mg tds x 28 days	8400	mg	Public	-	-	<0.0001	<1
					Private	1.2458	1520	0.0151	19
					Total	1.2458	1520	0.0151	19

ATC	DRUG CLASS & AGENTS	DOSE & DURATION	AVERAGE DOSE PER TREATMENT CYCLE	UNIT	SECTOR	2009		2010	
						TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE	TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE
L01C A01	Vinblastine	10mg d1+15	20	mg	Public	0.0013	685	0.0013	675
					Private	0.0004	215	0.0002	126
					Total	0.0018	900	0.0015	801
L01C A02	Vincristine	2mg d1+8	4	mg	Public	0.0013	3245	0.0015	3976
					Private	0.0001	271	0.0001	327
					Total	0.0014	3516	0.0016	4304
L01C A04	Vinorelbine	30mg/m2 d1+8	100	mg	Public	0.0009	88	0.0031	319
					Private	0.0060	616	0.0057	597
					Total	0.0069	704	0.0088	916
L01C B	**Podophyllotoxin derivatives**								
L01C B01	Etoposide	100mg/m2 d1-5	860	mg	Public	0.1445	1723	0.2120	2573
					Private	0.0159	189	0.0650	789
					Total	0.1604	1912	0.2771	3362
L01C B02	Teniposide	100mg/m2	860	mg	Public	-	-	-	-
					Private	-	-	<0.0001	<1
					Total	-	-	<0.0001	<1
L01C D	**Taxanes**								
L01C D01	Paclitaxel	175mg/m2	300	mg	Public	0.0548	1873	0.1167	4058
					Private	0.0288	982	0.0396	1379
					Total	0.0836	2855	0.1563	5437
L01C D02	Docetaxel	75mg/m2	130	mg	Public	0.0150	1185	0.0565	4536
					Private	0.0146	1152	0.0175	1404
					Total	0.0296	2337	0.0740	5940
L01D A	**Actinomycines**								
L01D A01	Dactinomycin	15mcg/kg	1	mcg	Public	0.0001	615	0.0001	1286
					Private	<0.0001	8	<0.0001	28
					Total	0.0001	622	0.0001	1314
L01D B	**Anthracyclines and related substances**								
L01D B01	Doxorubicin	50mg/m2	90	mg	Public	0.1320	15038	0.1178	13657
					Private	0.0230	2616	0.0201	2325
					Total	0.1550	17654	0.1379	15983
L01D B02	Daunorubicin	45mg/m2 d1-3	230	mg	Public	0.0041	184	0.0084	379
					Private	0.0006	29	0.0023	103
					Total	0.0048	213	0.0106	482
L01D B03	Epirubicin	75mg/m2	130	mg	Public	0.0935	7373	0.0900	7228
					Private	0.0083	653	0.0232	1864
					Total	0.1018	8026	0.1133	9092
L01D B06	Idarubicin	12mg/m2 d1-3	105	mg	Public	0.0010	101	0.0031	309
					Private	0.0001	14	0.0003	25
					Total	0.0012	115	0.0034	334
L01D B07	Mitoxantrone	12mg/m2 d1-3	60	mg	Public	0.0004	73	0.0008	143
					Private	0.0015	257	0.0014	250
					Total	0.0019	330	0.0023	393

ATC	DRUG CLASS & AGENTS	DOSE & DURATION	AVERAGE DOSE PER TREATMENT CYCLE	UNIT	SECTOR	2009		2010	
						TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE	TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE
L01D C01	Bleomycin	30mg/m2 d1, 8, 15	90	mg	Public	0.0070	795	0.0060	696
					Private	0.0016	186	0.0017	199
					Total	0.0086	981	0.0077	895
L01D C03	Mitomycin		12	mg	Public	0.0027	2299	0.0024	2123
					Private	0.0016	1400	0.0012	1076
					Total	0.0043	3699	0.0037	3199
L01X A	**Platinum compounds**								
L01X A01	Cisplatin	75mg/m2	130	mg	Public	0.0978	7712	0.0928	7450
					Private	0.0276	2174	0.1659	13316
					Total	0.1254	9886	0.2587	20766
L01X A02	Carboplatin		500	mg	Public	0.6244	12799	0.3327	6943
					Private	0.0955	1958	1.6825	35114
					Total	0.7199	14757	2.0152	42057
L01X A03	Oxaliplatin	85mg/m2	150	mg	Public	0.0404	2759	0.0519	3614
					Private	0.1011	6909	0.0009	66
					Total	0.1415	9668	0.0529	3679
L01X B	**Methylhydrazines**								
L01X B01	Procarbazine	100mg/m2 d1-14 [max 150mg]	2100	mg	Public	0.0034	17	0.0099	49
					Private	0.0010	5	0.0037	18
					Total	0.0044	21	0.0136	67
L01X C	**Monoclonal antibodies**								
L01X C02	Rituximab	375mg/m2	500	mg	Public	0.0680	1395	0.0959	2001
					Private	0.0352	721	0.2839	5926
					Total	0.1032	2116	0.3798	7927
L01X C03	Trastuzumab	6mg/kg	400	mg	Public	0.0029	73	0.0477	1246
					Private	0.0190	486	0.0502	1310
					Total	0.0218	559	0.0980	2556
L01X C04	Alemtuzumab	30mg [3x/ week]	90	mg	Public	<0.0001	1	<0.0001	5
					Private	-	-	-	-
					Total	<0.0001	1	<0.0001	5
L01X C05	Gemtuzumab	-	5	mg	Public	-	-	<0.0001	5
					Private	<0.0001	13	-	-
					Total	<0.0001	13	<0.0001	5
L01X C06	Cetuximab	250mg/m2 d1+15	800	mg	Public	-	-	0.0149	195
					Private	0.0027	34	0.0056	73
					Total	0.0027	34	0.0206	268
L01X C07	Bevacizumab	5mg/kg	300	mg	Public	0.0001	3	0.0172	599
					Private	0.0286	978	0.0358	1246
					Total	0.0287	981	0.0531	1845
L01X E	**Protein kinase inhibitors**								
L01X E01	Imatinib	400mg od x 28 days	11200	mg	Public	0.1957	179	1.1417	1064
					Private	0.0422	39	0.0087	8
					Total	0.2379	218	1.1504	1072

ATC	DRUG CLASS & AGENTS	DOSE & DURATION	AVERAGE DOSE PER TREATMENT CYCLE	UNIT	SECTOR	2009		2010	
						TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE	TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE
L01X E02	Gefitinib	250mg od x 28 days	7000	mg	Public	0.0002	<1	0.0612	91
					Private	0.0815	119	0.0548	82
					Total	0.0817	120	0.1161	173
L01X E03	Erlotinib	100mg od x 28 days	2800	mg	Public	-	-	0.0238	89
					Private	0.0304	111	0.0157	59
					Total	0.0304	111	0.0395	147
L01X E04	Sunitinib	37.5mg x4/52 rest 2/52	1050	mg	Public	0.0005	5	0.0057	57
					Private	0.0002	2	0.0001	1
					Total	0.0007	7	0.0059	58
L01X E05	Sorafenib	400mg bd x 28 days	22400	mg	Public	0.0001	<1	0.0236	11
					Private	0.0033	2	0.0057	3
					Total	0.0034	2	0.0293	14
L01X E06	Dasatinib	70mg bd x 28 days	3920	mg	Public	<0.0001	<1	0.0073	19
					Private	0.0004	1	-	-
					Total	0.0004	1	0.0073	19
L01X E07	Lapatinib	1250mg od x 28 days	35000	mg	Public	-	-	0.0636	19
					Private	0.3018	88	0.1278	38
					Total	0.3018	88	0.1914	57
L01X E08	Nilotinib	400mg bd x 28 days	38528	mg	Public	0.0640	17	0.0820	22
					Private	-	-	0.0016	<1
					Total	0.0640	17	0.0837	23
L01X E09	Temsirolimus	25 mg per week x 4	100	mg	Public	-	-	-	-
					Private	-	-	<0.0001	1
					Total	-	-	<0.0001	1
L01X X	**Other antineoplastic agents**								
L01X X02	Asparaginase	10000iu/m2	20000	iu	Public	2.8744	1473	4.6804	2442
					Private	0.4133	212	0.2767	144
					Total	3.2877	1685	4.9571	2586
L01X X05	Hydroxycarbamide	500mg tds x 28 days	42000	mg	Public	13.1101	3199	43.508	10809
					Private	2.2703	554	1.8150	451
					Total	15.3804	3753	45.3229	11260
L01X X11	Estramustine	280mg tds d1-5	4200	mg	Public	-	-	-	-
					Private	<0.0001	<1	0.0001	<1
					Total	<0.0001	<1	0.0001	<1
L01X X14	Tretinoin	45mg/m2 d1-15 q12 weeks	1160	mg	Public	0.0142	125	0.0156	141
					Private	0.0026	23	0.0052	46
					Total	0.0168	148	0.0208	187
L01X X17	Topotecan	1.25mg/m2 d2-6	10	mg	Public	-	-	0.0002	191
					Private	<0.0001	23	<0.0001	14
					Total	<0.0001	23	0.0002	205
L01X X19	Irinotecan	180mg/m2	310	mg	Public	0.0129	427	0.0248	835
					Private	0.0090	298	0.0089	299
					Total	0.0219	724	0.0337	1134

ATC	DRUG CLASS & AGENTS	DOSE & DURATION	AVERAGE DOSE PER TREATMENT CYCLE	UNIT	SECTOR	2009		2010	
						TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE	TOTAL DOSAGE/1000 POPULATION	TOTAL NO. OF TREATMENT CYCLE
L01X X23	Mitotane	10 g per day x 28	280000	mg	Public	0.0019	<1	0.2070	**8**
					Private	-	-	-	-
					Total	0.0019	<1	0.2070	8
L01X X27	Arsenic trioxide	10mg od x 42 days	420	mg	Public	-	-	0.0004	9
					Private	<0.0001	<1	<0.0001	1
					Total	<0.0001	<1	0.0004	10
L01X X32	Bortezomib	1.3mg/m2 d1, 4, 8, 11 q21 days	9	mg	Public	0.0003	297	0.0002	244
					Private	<0.0001	34	0.0001	83
					Total	0.0003	331	0.0003	327
L01X X35	Anagrelide	0.5mg bd x 28 days	28	mg	Public	0.0011	400	0.0021	785
					Private	0.0005	178	0.0003	102
					Total	0.0016	578	0.0024	886

Table 16.2: Use of Anti-Neoplastic Agents by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
L02A B	**Progestogens**				
L02A B01	Megestrol	g	Public	-	0.0004
			Private	0.0007	0.0002
			Total	0.0007	0.0006
L02A B02	Medroxyprogesterone	g	Public	<0.0001	0.0001
			Private	0.0003	<0.0001
			Total	0.0003	0.0001
L02A E	**Gonadotropin releasing hormone analogues**				
L02A E01	Buserelin	mg	Public	-	<0.0001
			Private	<0.0001	<0.0001
			Total	<0.0001	<0.0001
L02A E02	Leuprorelin	mg	Public	0.0841	0.0135
			Private	0.0317	0.0140
			Total	0.1157	0.0275
L02A E03	Goserelin	mg	Public	0.0133	0.0231
			Private	0.0136	0.0068
			Total	0.0269	0.0299
L02A E04	Triptorelin	mg	Public	0.0017	0.0014
			Private	<0.0001	<0.0001
			Total	0.0018	0.0014
L02B A	**Anti-estrogens**				
L02B A01	Tamoxifen	mg	Public	0.1241	0.1338
			Private	0.0917	0.0141
			Total	0.2158	0.1480
L02B B	**Anti-androgens**				
L02B B01	Flutamide	g	Public	0.0007	0.0010
			Private	<0.0001	<0.0001
			Total	0.0007	0.0010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
L02B B03	Bicalutamide	mg	Public	0.0088	0.0080
			Private	0.0013	0.0012
			Total	0.0101	0.0091
L02B G	**Aromatase inhibitors**				
L02B G03	Anastrozole	mg	Public	0.0103	0.0173
			Private	0.0032	0.0024
			Total	0.0135	0.0198
L02B G04	Letrozole	mg	Public	0.0124	0.0255
			Private	0.0027	0.0029
			Total	0.0152	0.0284
L02B G06	Exemestane	mg	Public	0.0007	0.0023
			Private	0.0004	0.0020
			Total	0.0011	0.0043

Table 16.3: Use of Anti-Neoplastic Agents by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
L03A A	**Colony stimulating factors**				
L03A A02	Filgrastim	mg	Public	0.0160	0.0027
			Private	0.0011	0.0004
			Total	0.0171	0.0031
L03A A10	Lenograstim	mg	Public	<0.0001	0.0004
			Private	<0.0001	<0.0001
			Total	<0.0001	0.0004
L03A A13	Pegfilgrastim	mg	Public	-	0.0006
			Private	0.0004	0.0006
			Total	0.0004	0.0011
L03A B	**Interferons**				
L03A B04	Interferon alfa-2a	MU	Public	0.0002	0.0003
			Private	-	-
			Total	0.0002	0.0003
L03A B05	Interferon alfa-2b	MU	Public	0.0010	0.0010
			Private	<0.0001	<0.0001
			Total	0.0011	0.0011
L03A B07	Interferon beta-1a	mcg	Public	0.0002	0.0170
			Private	0.0003	<0.0001
			Total	0.0004	0.0170
L03A B08	Interferon beta-1b	MU	Public	-	0.0009
			Private	-	-
			Total	-	0.0009
L03A C	**Interleukins**				
L03A C01	Aldesleukin	mg	Public	-	-
			Private	<0.0001	<0.0001
			Total	<0.0001	<0.0001

Table 16.4: Use of Anti-Emetics Agents by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
A04A	**Antiemetics and antinauseants**				
A04A A	**Serotonin (5HT3) antagonists**				
A04A A01	Ondansetron	mg	Public	0.0024	0.0010
			Private	0.0021	0.0013
			Total	0.0045	0.0023
A04A A02	Granisetron	mg	Public	0.0075	0.0089
			Private	0.0019	0.0012
			Total	0.0094	0.0101

References

1. National Cancer Registry Report.www.makna.org.my/pdf/malaysiacancerstatistics2007.pdf (Access Oct 2014)
2. The Latest Cancer Statistics. www.makna.org.my/cancerstatistics.asp (accessed October, 2014)
3. *Protocol For Systemic Therapy of Cancer,* 2nd Edition. Ministry of Health and Ministry of Higher Education, Malaysia: Kuala Lumpur 2011.

CHAPTER 17: USE OF SYSTEMIC CORTICOSTEROIDS AND IMMUNOSUPPRESIVES AGENTS

Wong H.S.[1], Rosnawati Y.[2], Ong S.G.[2],

1. Selayang Hospital, Selangor, 2. Hospital Kuala Lumpur, Kuala Lumpur.

The list of drugs in this chapter includes mineralocorticoids, glucocorticoids and immunosuppressants such as selective immunosupressants, tumor necrosis factor-α inhibitors, interleukin inhibitors, calcineurin inhibitors, antimetabolites and other immunosuppressants.

Systemic Corticosteroids

Systemic corticosteroids usage in Malaysia for 2009 and 2010 were 11.3204 DDD/1000 population/day and 7.9479 DDD/1000 population/day respectively and were more than 50% higher than those reported in 2008[1]. The difference in the usage of corticosteroids in 2009 and 2010 was mainly due to a reduction in the use of prednisolone in the private sector from 3.8210 DDD/1000 population/day to 0.9371 DDD/1000 population/day. Despite the marked increased in the usage of systemic corticosteroid over the last 2 years, it is still much lower than that reported in Australia[2], Finland[3] and Norway[4] where the DDD/1000 population/day for systemic corticosteroids ranged from 14.90 to 18.74.

Glucocorticoids remained the most commonly used corticosteroids in 2009 and 2010 and accounted for 99.7% of all systemic corticosteroids used in this country. Prednisolone was the most popular glucocorticoids and contributed to 44.2% of the total glucocorticoids used in 2009 (4.9875 DDD/1000 population/day) but reduced to 26.9% in 2010. This is primarily due to a 76.7% reduction in the use of prednisolone in the private sector. Dexamethasone remained the second most commonly used glucocorticoids and in 2009 and 2010, it accounted for about a third.

Betamethasone was essentially used in the private sector and has increased by 25-fold over the last 4 years[1]. In 2010, it accounted for 25.8% of all glucocorticoids used in this country. Methylprednisolone and triamcinolone usage remained very low (1%) and registered a further 50% reduction in 2010.

The use of mineralocorticoids continued to decrease over the last 3 years[1] with a reduction of 29.0% in 2009 and 49.7% in 2010 when compared to 2008.

Immunosuppressive Agents

The use of immunosuppressive agents in Malaysia has remained relative low and unchanged over the last few years[1] with a DDD/1000 population/day of only 0.455 in 2010. This is 5 – 20 times lower than the usage reported in Australia[2], Finland[2] and Norway[4] which have a DDD/1000 population/day of 2.03 – 7.65 for immunosuppressive agents. This vast difference in the usage of immunosuppressive agents is partly contributed by the very low usage of transplant immunosuppressive agents (especially cyclosporine A and tacrolimus) as the number of solid organ transplant recipients were less than 1900 in the Malaysia during that period[5-7].

For calcineurin inhibitors, there was a decrease in the usage of ciclosporin in 2010 compared to 2009 with a corresponding increase in tacrolimus usage; reflecting the preference for tacrolimus over ciclosporine as the primary immunosuppressive agent in solid organ transplantation. The usage of mycophenolic acid continued to increase from 2008[1] and the usage in 2010 was 6.8 times higher compared to 2009. As the number of transplant recipients remained relatively unchanged during this period, this increase is solely due to the use of mycophenolic acid for non transplant indication especially SLE.

There was a marked increase (11-fold) in the usage of leflunomide in 2010 compared to 2009 and this is primarily due to its increasing use in rheumatoid arthritis. More cases of rheumatoid arthritis have been diagnosed over the past 10 years due to a growing awareness about this disease and the importance of using disease modifying antirheumatic drugs (DMARDs) as first-line therapy. One of the DMARDs includes leflunomide.

Azathioprine, thalidomide and methotrexate were mainly used in the public sector and while the use of azathioprine remained unchanged, thalidomide and methotrexate usage have demonstrated a gradual reduction over the last 4 years[1].

Due to the high cost, the overall usage of tumor necrosis factor-α inhibitors, interleukin inhibitors and rabbit anti-human thymocyte immunoglobulin remained low and relatively unchanged over the last 4 years[1].

Table 17.1: Use of Systemic Corticosteroids and Immunosuppressive Agents by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
H02A A	Mineralocorticoids	0.0240	0.0170
H02A B	Glucocorticoids	11.2964	7.9309

Table 17.2: Use of Systemic Corticosteroids and Immunosuppressive Agentsby Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
H02A A	**Mineralocorticoids**			
H02A A02	Fludrocortisone	Public	0.0061	0.0151
		Private	0.0179	0.0019
		Total	0.0240	0.0170
H02A B	**Glucocorticoids**			
H02A B01	Betamethasone	Public	-	<0.0001
		Private	0.1452	1.7311
		Total	0.1452	1.7311
H02A B02	Dexamethasone	Public	1.9569	1.8310
		Private	3.3027	1.4197
		Total	5.2596	3.2506
H02A B04	Methylprednisolone	Public	0.0770	0.0328
		Private	0.0542	0.0276
		Total	0.1312	0.0604
H02A B06	Prednisolone	Public	1.1665	1.1996
		Private	3.8210	0.9371
		Total	4.9875	2.1366
H02A B08	Triamcinolone	Public	0.0087	0.0067
		Private	0.1786	0.0930
		Total	0.1873	0.0997
H02A B09	Hydrocortisone	Public	0.4361	0.4555
		Private	0.1495	0.1971
		Total	0.5855	0.6525

Table 17.3: Use of Immunosuppressive Agents by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
L04	Immunosuppressants	0.1978	0.4555

Table 17.4: Use of Immunosuppressive Agents by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
L04A A	**Selective immunosuppressants**			
L04A A04	Antithymocyte immunoglobulin (rabbit)	Public	-	0.0002
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0002
L04A A06	Mycophenolic acid	Public	0.0138	0.0604
		Private	0.0041	0.0620
		Total	0.0179	0.1224
L04A A10	Sirolimus	Public	0.0005	0.0011
		Private	<0.0001	<0.0001
		Total	0.0005	0.0012
L04A A13	Leflunomide	Public	0.0130	0.1841
		Private	0.0028	0.0007
		Total	0.0158	0.1848
L04A B	**Tumor necrosis factor alpha (TNF-) inhibitors**			
L04A B01	Etanercept	Public	0.0005	0.0010
		Private	0.0002	0.0001
		Total	0.0007	0.0011

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
L04A B02	Infliximab	Public	0.0003	0.0010
		Private	0.0043	0.0028
		Total	0.0046	0.0038
L04A B04	Adalimumab	Public	0.0002	0.0009
		Private	0.0002	0.0002
		Total	0.0004	0.0012
L04A C	**Interleukin inhibitors**			
L04A C02	Basiliximab	Public	<0.0001	<0.0001
		Private	-	-
		Total	<0.0001	<0.0001
L04A D	**Calcineurin inhibitors**			
L04A D01	Ciclosporin	Public	0.0434	0.0345
		Private	0.0008	0.0014
		Total	0.0442	0.0359
L04A D02	Tacrolimus	Public	0.0030	0.0068
		Private	0.0004	0.0002
		Total	0.0034	0.0070
L04A X	**Other immunosuppressants**			
L04A X01	Azathioprine	Public	0.0634	0.0740
		Private	0.0048	0.0031
		Total	0.0682	0.0771
L04A X02	Thalidomide	Public	0.0051	0.0038
		Private	0.0006	0.0005
		Total	0.0057	0.0042
L04A X03	Methotrexate	Public	0.0324	0.0155
		Private	0.0040	0.0012
		Total	0.0364	0.0167

References

1. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre. Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. *Australia Statistics on Medicine 2010;* Australia Government Department of Health and Ageing. Commonwealth of Australia 2011: Australia 2011.
3. *Finnish Statistics on Medicines 2010;* Finnish Medicines Agency Fimea and Social Insurance Institute Printing Office: Helsinki 2011
4. *Drug consumption in Norway 2008-2012.* Norwegian Institute of Public Health Printing Office: Oslo 2013.
5. Md Taib, M.E., David, C.S.P., Yunus, A. Chapter 3: Heart & Lung transplantation in 7th Report of the National Transplant Registry Malaysia 2010. Kuala Lumpur 2013.
6. Omar, H., Kanagasabai, G., Lee, W.S., Lim, C.B., Lim, K.F. Chapter 4 : Liver transplantation in 7th Report of the National Transplant Registry Malaysia 2010. Kuala Lumpur 2013.
7. Goh, B.L., Malek, R., Wong, H.S., Fan, K.S., Yahya, R., Menon, S.P., Tan, S.Y. Chapter 5 : Renal transplantation in 7th Report of the National Transplant Registry Malaysia 2010. Kuala Lumpur 2013.

CHAPTER 18: USE OF DRUGS FOR RHEUMATOLOGICALS AND BONE DISORDERS

Mohd. Shahrir M.S.[1], Hussein H.[2]

1.UKM Medical Centre, Selangor, 2. Hospital Putrajaya, Putrajaya

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 ranked as 10th most used drugs by therapeutic group in Malaysia in 2010 (11.7605 DDD/1000 population/day) with estimated 1.18% population utilising them[1].

Overall, the use of drugs for rheumatological and bone disorders in 2010 were reduced compared with 2009 with the exception of drugs for treatment of bone diseases[1]. In 2010, anti-inflammatory and antirheumatic products ranked first (11.7605 DDD/1000 population/day), followed by antigout preparations (1.5554 DDD/1000 population/day), drugs for treatment of bone diseases (0.6718 DDD/1000 population/day) and then muscle relaxant (0.2786 DDD/1000 population/day).However, in Finland[2], this pattern was seen in the trend of usage only for the top drug but the second and third were for treatment of bone diseases followed by muscle relaxant. Antigout preparations in Finland ranked fourth[2].

For the use of non-steroidal anti-inflammatory drugs (NSAIDs), the top three drugs were acetic acid derivatives and related substances (3.6334 DDD/1000 population/day), followed by oxicams (3.3544 DDD/1000 population/day) and fenamates (2.7669 DDD/1000 population/day). The usage of fenamates (18.4%) and coxib group (75.6%) were reduced but the usage of acetic acid derivatives and related substances (15.5%) and oxicams (145.6%) were increased in 2010. This trend of reduction in usage of coxib is also seen in Australia[3].

The three most used antigout preparations were allopurinol, colchicine and probenecid. There was a reduced usage of allopurinol and colchicine in 2010 (2.8%, 86.4%) but the usage of probenecid increased by 125%.This drastic trend in the reduction of colchicine was seen in the private sector. Benzbromarone was not prescribed at all in 2010.

The three common drugs for treatment for bone diseases were alendronic acid and cholecalciferol (0.3966 DDD/1000 population/day), Alendronic acid (0.2227 DDD/1000 population/day) and ibandronic acid (0.0279 DDD/1000 population/day). There was an increasing trend of usage of alendronic acid and cholecalciferol (77.2%) and usage of alendronic acid (36.8%) but usage ibandronate were reduced by 39.1%. The usage of alendronic acid in Finland was reduced between 2009 till 2010[2].

The top three muscle relaxant drugs used in 2010 were eperisone, baclofen and orphenadrine (citrate).The usage of eperisone (37.7%) and orphenadrine (citrate) (78.4%) were reduced in 2010 compared to 2009.

As for calcium homeostasis agent, both teriparatide and paricalcitol had a remarkable increase in usage (45.5% and 31.8% respectively). The usage of calcitonin (salmon synthetic) was reduced by 26.7%.

The usage of raloxifene was reduced in 2010 by 7.51%.

Table 18.1: Use of Drugs for Rheumatological and Bone Disorders, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
G03X C	Selective estrogen receptor modulators	0.0559	0.0517
H05B A	Calcitonin preparations	0.0045	0.0033
M01	Antiinflammatory and antirheumatic products	13.0335	11.7605
M03	Muscle relaxants	0.9066	0.2786
M04	Antigout preparations	2.3036	1.5554
M05	Drugs for treatment of bone diseases	0.4877	0.6718

Table 18.2.1: Use of Non-Steroidal Anti-inflammatory drugs by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
M01A B	Acetic acid derivatives and related substances	3.1474	3.6344
M01A C	Oxicams	1.3658	3.3544
M01A E	Propionic acid derivatives	0.9619	1.0677
M01A G	Fenamates	3.3898	2.7669
M01A H	Coxibs	4.1660	1.0151

ATC	DRUG CLASS	2009	2010
M01A X	Other antiinflammatory and antirheumatic agents, non-steroids	0.0008	<0.0001
M01C C	Penicillamine and similar agents	0.0018	0.0033

Table 18.2.2: Use of Non-steroidal Anti-inflammatory drugs by Drug Class and Agents, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
M01A B	**Acetic acid derivatives and related substances**			
M01A B01	Indometacin	Public	0.1813	0.1851
		Private	0.0833	0.0506
		Total	0.2646	0.2357
M01A B02	Sulindac	Public	-	-
		Private	<0.0001	-
		Total	<0.0001	-
M01A B05	Diclofenac	Public	0.7555	1.0607
		Private	2.1137	2.3272
		Total	2.8691	3.3878
M01A B15	Ketorolac	Public	<0.0001	0.0006
		Private	0.0013	0.0104
		Total	0.0014	0.0110
M01A B55	Diclofenac, combinations	Public	-	-
		Private	0.0123	-
		Total	0.0123	-
M01A C	**Oxicams**			
M01A C01	Piroxicam	Public	0.1481	0.0059
		Private	0.5096	0.3083
		Total	0.6577	0.3142
M01A C02	Tenoxicam	Public	-	-
		Private	0.0768	0.0160
		Total	0.0768	0.0160
M01A C06	Meloxicam	Public	0.1028	0.0725
		Private	0.5284	2.9517
		Total	0.6313	3.0242
M01A E	**Propionic acid derivatives**			
M01A E01	Ibuprofen	Public	0.1349	0.1466
		Private	0.4965	0.3730
		Total	0.6314	0.5196
M01A E02	Naproxen	Public	0.0407	0.0253
		Private	0.2874	0.4773
		Total	0.3282	0.5025
M01A E03	Ketoprofen	Public	-	0.0297
		Private	0.0023	0.0158
		Total	0.0023	0.0455
M01A G	**Fenamates**			
M01A G01	Mefenamic acid	Public	1.0856	0.9997
		Private	2.3042	1.7672
		Total	3.3898	2.7669
M01A H	**Coxibs**			

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
M01A H01	Celecoxib	Public	0.5048	0.4203
		Private	2.6847	0.5949
		Total	3.1895	1.0151
M01A H04	Parecoxib	Public	0.0019	0.0031
		Private	0.0081	0.0073
		Total	0.0101	0.0104
M01A H05	Etoricoxib	Public	0.1404	0.1400
		Private	0.8261	0.3276
		Total	0.9665	0.4677
M01A X	**Other antiinflammatory and antirheumatic agents, non-steroids**			
M01A X07	Benzydamine	Public	-	<0.0001
		Private	-	<0.0001
		Total	-	<0.0001
M01A X17	Nimesulide	Public	-	-
		Private	0.0008	-
		Total	0.0008	-
M01C C	**Penicillamine and similar agents**			
M01C C01	Penicillamine	Public	0.0016	0.0031
		Private	0.0002	0.0002
		Total	0.0018	0.0033

Table 18.3.1: Use of Muscle relaxants by Drug Class and Agents, in DDD/1000 populaton/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
M03B	**Muscle relaxants, centrally acting agents**			
M03B B52	Chlormezanone, combinations excl. psycholeptics	Public	-	-
		Private	0.0278	-
		Total	0.0278	-
M03B B53	Chlorzoxazone, combinations excl. psycholeptics	Public	-	-
		Private	0.0069	-
		Total	0.0069	-
M03B C01	Orphenadrine (citrate)	Public	0.0007	0.0050
		Private	0.2719	0.0538
		Total	0.2726	0.0588
M03B C51	Orphenadrine, combinations	Public	-	<0.0001
		Private	0.3724	0.0236
		Total	0.3724	0.0236
M03B X01	Baclofen	Public	0.0444	0.0579
		Private	0.0026	0.0262
		Total	0.0471	0.0841
M03B X09	Eperisone	Public	0.0253	0.0455
		Private	0.1545	0.0666
		Total	0.1799	0.1121
M03C	**Muscle relaxants, directly acting agents**			
M03C A01	Dantrolene	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001

Table 18.4.1: Use of Anti-Gout preparations by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
M04A	**Antigout preparations**			
M04A A01	Allopurinol	Public	0.8755	1.0121
		Private	0.6052	0.4267
		Total	1.4807	1.4388
M04A B01	Probenecid	Public	0.0011	0.0018
		Private	0.0013	0.0036
		Total	0.0024	0.0054
M04A B03	Benzbromarone	Public	-	-
		Private	-	<0.0001
		Total	-	<0.0001
M04A C01	Colchicine	Public	0.0343	0.0497
		Private	0.7862	0.0615
		Total	0.8205	0.1112

Table 18.5.1: Use of Bone diseases therapy by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
M05	**Drugs for treatment of bone diseases**			
M05B A02	Clodronic acid	Public	0.0019	0.0013
		Private	0.0006	0.0003
		Total	0.0026	0.0015
M05B A03	Pamidronic acid	Public	0.0001	0.0009
		Private	0.0002	<0.0001
		Total	0.0003	0.0009
M05B A04	Alendronic acid	Public	0.0660	0.2143
		Private	0.0968	0.0084
		Total	0.1628	0.2227
M05B A06	Ibandronic acid	Public	0.0042	0.0184
		Private	0.0416	0.0095
		Total	0.0458	0.0279
M05B A07	Risedronic acid	Public	0.0011	0.0039
		Private	0.0214	0.0010
		Total	0.0225	0.0049
M05B A08	Zoledronic acid	Public	0.0002	0.0003
		Private	0.0002	0.0007
		Total	0.0004	0.0010
M05B B03	Alendronic acid and colecalciferol	Public	0.0458	0.2882
		Private	0.1779	0.1084
		Total	0.2237	0.3966
M05B X03	Strontium ranelate	Public	<0.0001	0.0010
		Private	0.0295	0.0153
		Total	0.0295	0.0163

Table 18.6.1: Use of selective Estrogen Receptor Modulators by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
G03	**Sex hormones and modulators of the genital system**			
G03X C01	Raloxifene	Public	0.0433	0.0458
		Private	0.0126	0.0059
		Total	0.0559	0.0517

Table 18.7.1: Use of Calcitonin preparations by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
H05	**Calcium homeostasis**			
H05A A02	Teriparatide	Public	-	0.0004
		Private	0.0011	0.0012
		Total	0.0011	0.0016
H05B A01	Calcitonin (salmon synthetic)	Public	<0.0001	0.0018
		Private	0.0044	0.0015
		Total	0.0045	0.0033
H05B X02	Paricalcitol	Public	0.0008	0.0016
		Private	0.0014	0.0012
		Total	0.0022	0.0029

References:

1. *Pharmaceutical Services Division & Clinical Research Centre. Malaysian Statistics on Medicines 2008*; Ministry of Health Malaysia, 2009.
2. *National Agency for Medicines, Drug Sales Register*: Finland, 2010.
3. *Australian Government Department of Health and Ageing*; Australian Statistics on Medicines, 2010.

CHAPTER 19: USE OF OPIOID ANALGESICS

Mary S.C.[1], Marzida M.[2], Choo Y. M.[3], Nadia A.R.[1]

1. Selayang Hospital, Selangor, 2. University Malaya Medical Centre, Selangor, 3. Tengku Ampuan Rahimah Hospital, Klang

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 2009 was 0.3174 DDD/1000 population/day, a decrease of 29% compared to 2008 (0.4443 DDD/1000 population/day) and 0.3643 DDD/1000 population/day in 2010, showing an increase of 15% compared to the year before. This is very much lower than the opioid consumption in Norway, Finland and Australia, which recorded opioid consumptions of approximately 20, 16 and 9 DDD/1000 population/day respectively in 2009 and 2010 [1,2,3].

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 in 2009 was 0.2334 DDD/1000 population/day, comprising 73.5% of the total opioid consumption and 0.1892 DDD/1000 population/day in 2010, comprising 51.9% of the total opioid consumption. A similar pattern was observed in Finland and Norway, where consumption of weak opioids was much higher than strong opioids, at 80% and 76% respectively[2,3]. However, Australia showed the opposite trend, with strong opioids accounting for 60% of total opioid consumption[1].

In 2009 & 2010, tramadol and tramadol combinations comprised 87.6% and 88.2% of the total weak opioids consumed respectively. 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. However, there was a 31% reduction in the usage of tramadol in 2009 compared to 2008 (0.2044 DDD/1000 population/day in 2009; 0.2983 DDD/1000 population/day in 2008) and a further 18% decrease in 2010 (0.1669 DDD/1000 population/day). In Finland and Norway, on the other hand, the most common weak opioid used was codeine combinations rather than tramadol[2,3].

The total consumption of strong opioids in 2009 was 0.0781 DDD/1000 population/day, which showed a decrease of 12.6% compared to 2008. However, this increased again in 2010 to 0.1648 DDD/1000 population/day.

Transdermal fentanyl, mainly used for the pain control in cancer patients, continued to decrease by approximately half from 2008 to 2009 and remained low in 2010. The 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; indeed, there was a doubling of the oxycodone consumption in 2010 compared to 2009 (0.006 in 2010 compared to 0.003 in 2009). Nevertheless, these newer strong opioids each only accounted for approximately 3% of the total strong opioids consumed in Malaysia and morphine remains as the most commonly used strong opioid, with an increasing trend over the years - 73.2% of all strong opioids in 2009 and 86.8% in 2010, as compared to 65% in 2008.

In conclusion, the overall usage of opioids in Malaysia is still very low compared to first world countries. As there are few legal barriers to the use of opioids in Malaysia, this difference is most likely due to differences in prescribing practices of physicians in Malaysia; the reasons for these differences may be related to education and awareness, myths and negative perceptions of opioids, fear of addiction, as well as the limited availability of palliative care physicians and pain specialists.

Table 19.1: Use of Analgesics by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N02A	Opioids	0.3174	0.3643

Table 19.1.2: Use of Analgesics by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N02A A	Natural opium alkaloids	0.0940	0.1714
N02A B	Phenylpiperidine derivatives	0.0180	0.0522
N02A F	Morphinan derivatives	0.0011	0.0104
N02A X	Other opioids	0.2044	0.1687

Table 19.2: Use of Opioid Analgesics by Drug Class, agents and Administration Route, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009				2010			
			ORAL	P	TD	TOTAL	ORAL	P	TD	TOTAL
N02A A	**Natural opium alkaloids**									
N02A A01	Morphine	Public	0.0026	0.0297	-	0.0324	0.1113	0.0286	-	0.1399
		Private	0.0213	0.0036	-	0.0248	0.0009	0.0023	-	0.0032
		Total	0.0239	0.0333	-	0.0572	0.1121	0.0309	-	0.1430
N02A A05	Oxycodone	Public	0.0006	0.0016	-	0.0022	0.0024	0.0029	-	0.0053
		Private	0.0007	-	-	0.0007	0.0007	-	-	0.0007
		Total	0.0013	0.0016	-	0.0029	0.0032	0.0029	-	0.0061
N02A A08	Dihydroco-deine	Public	0.0100	-	-	0.0100	0.0070	-	-	0.0070
		Private	0.0191	-	-	0.0191	0.0152	-	-	0.0152
		Total	0.0290	-	-	0.0290	0.0223	-	-	0.0223
N02A A59	Codeine, com-binations excl. psycholeptics	Public	-	-	-	-	<0.0001	-	-	<0.0001
		Private	0.0048	-	-	0.0048	<0.0001	-	-	<0.0001
		Total	0.0048	-	-	0.0048	<0.0001	-	-	<0.0001
N02A B	**Phenylpiperidine derivatives**									
N02A B02	Pethidine	Public	-	0.0038	-	0.0038	-	0.0058	-	0.0058
		Private	-	0.0065	-	0.0065	-	0.0033	-	0.0033
		Total	-	0.0103	-	0.0103	-	0.0091	-	0.0091
N02A B03	Fentanyl	Public	-	-	0.0054	0.0054	-	-	0.0041	0.0041
		Private	-	-	0.0024	0.0024	-	-	0.0389	0.0389
		Total	-	-	0.0077	0.0077	-	-	0.0431	0.0431
N02A F	**Morphinan derivatives**									
N02A F02	Nalbuphine	Public	-	0.0008	-	0.0008	-	0.0103	-	0.0103
		Private	-	0.0003	-	0.0003	-	<0.0001	-	<0.0001
		Total	-	0.0011	-	0.0011	-	0.0104	-	0.0104
N02A X	**Other opioids**									
N02A X02	Tramadol	Public	0.1071	0.0156	-	0.1226	0.0984	0.0200	-	0.1184
		Private	0.0406	0.0054	-	0.0460	0.0279	0.0138	-	0.0417
		Total	0.1477	0.0209	-	0.1687	0.1263	0.0338	-	0.1601
N02A X52	Tramadol, combinations	Public	0.0002	-	-	0.0002	<0.0001	-	-	<0.0001
		Private	0.0355	-	-	0.0355	0.0067	-	-	0.0067
		Total	0.0357	-	-	0.0357	0.0068	-	-	0.0068

References:

1. *Australian Statistics on Medicine 2010,* 16th edition; Australian Government Department of Health and Ageing. Commonwealth of Australia Printing Office: Australia 2012.
2. *Finnish Statistics on Medicines 2011:* Finnish Medicines Agency Fimea and Social Insurance Institution. Helsinki, 2012.
3. *Drug Consumption in Norway 2008-2012,* 35th edition; Norwegian Institute of Public Health. Solveig Sakshaug Printing Office: Oslo 2013.

CHAPTER 20: USE OF DRUGS FOR NEUROLOGICAL DISORDER

Sapiah S.[1], Mohd. Sufian A.[2], Tan R.Y.L.[2], Norsima Nazifah S.[3], Nurul Faezah M.Y.[3], Raymond A.A.[4], Md. Hanip M.R.[2]

1.Sultanah Aminah Hospital, Johor Bharu, 2. Kuala Lumpur Hospital, Kuala Lumpur, 3. Sultanah Nur Zahirah Hospital, Kuala Terengganu, 4. Universiti Kebangsaan Malaysia Medical Centre

For 2009 and 2010, we analysed four major categories of neurological drugs. These include the antiepileptic drugs (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 multiple sclerosis). The latter drugs were grouped together as '*other nervous system drugs*'.

In general, there was an increase in the usage of AEDs and antimigraine preparations compared to 2008[1]. By far, AEDs remained the most frequently prescribed group of neurological drugs for both years (1.8339 and 2.5767, respectively). This can be explained by its usage in other conditions including treatment for migraine, neuropathic pain and selected psychiatric conditions[2]. The second largest group being dispensed was drugs for Parkinson's disease (PD) (0.785 and 0.8393, respectively). The last two groups, 'other nervous system drugs and antimigraine preparations reported a slight reduction in its usage between 2009 and 2010.

Antiepileptic drugs

The most commonly prescribed antiepileptic drug (AED) in 2009 and 2010 was valproic acid, which also showed a more than three-fold increase in its use between 2009 and 2010. This was probably due to its wide spectrum of antiepileptic efficacy, absence of enzyme induction and decline in the use of other older AEDs.

Valproic acid is also indicated for the prevention of migraine and treatment of mood disorders.[3,4,5] The use of the oldest AEDs, namely phenobarbitone, primidone and ethosuximide remained low and continued to show a downward trend. Ethosuximide is the most narrow-spectrum AED, being only effective for absence seizures.[2,6] Medical practitioners, based on the 2010 Malaysian Epilepsy Consensus Guidelines, would choose a broad spectrum AED to treat absence seizures, given the possibility of other seizure types developing subsequently. Primidone use remained low, and was used for movement disorders, notably, essential tremor[6]. Phenobarbitone use, although low, was substantially higher than the other 2 oldest AEDs; it is used primarily by paediatricians and for the termination of status epilepticus.

The use of the enzyme-inducing AEDs, carbamazepine and phenytoin remained fairly constant and high, despite the fear of severe skin reactions in the former[5] and long-term side effects in the latter. Carbamazepine is the first line AED for partial seizures and phenytoin is used mainly for status epilepticus and seizures arising after acute cerebral insults, such as encephalitis and stroke[6]. The use of the newer AEDs, including lamotrigine, topiramate, gabapentin, levetiracetam and pregabalin, continued to rise in both the public and private sectors, except for gabapentin and pregabalin, which are used mainly for neuropathic pain.

Drugs for Parkinson's disease

The five main classes of drugs used for PD in 2009 and 2010 were levodopa (+peripheral dopamine decarboxylase inhibitos), dopamine agonists (ergot and non-ergot), anticholinergics, adamantine derivatives and the enzyme inhibitors (catechol-O-methyltransferase inhibitors and monoamine oxidase inhibitors)[7].

For both 2009 and 2010, the most commonly prescribed drug for parkinsonism was trihexyphenidyl (Artane) (0.5494 and 0.4668, respectively). In comparison to 2008, there was a slight drop in its usage. Other than Parkinson's disease, trihexyphenidyl is also used for the prevention and treatment of drug-induced extrapyramidal syndrome (EPS)[7]. Levodopa and decarboxylase inhibitor combination remains the gold standard therapy for PD with usage of 0.1572 and 0.207, respectively[7]. An increase was also seen in the other combination therapy, levodopa, decarboxylase inhibitor and COMT inhibitor (0.0014 and 0.0061, respectively).

The usage of ropirinole was similar for both years (0.0061 and 0.0063, respectively), but a significant increase in the utilisation of pramipexole was observed from 2009 to 2010 (0.0024 to 0.0544). Among the enzyme inhibitors, selegiline was dispensed more frequently than entacapone (0.0452 and 0.0598 versus 0.009 and 0.0125, respectively).

Antimigraine preparations

The utilisation of antimigraine preparation in Malaysia dropped 35.6% in 2010 compared to 2009. This drop was due to usage of other agents such as flunarizine which was categorised under antivertigo preparations. The utilization of pizotifen as migraine prophylaxis in the public sector in 2010 was 0.0169 as compared to 0.0091 in 2009. However, utilisation of pizotifen in Malaysia was still low compared to Australia in 2010[8].

For drugs used to abort migraine attack, the utilisation of selective serotonin (5HT) receptor agonist in public and private sectors was low at 0.0075 in 2010. The total utilisation of ergot alkaloids was generally low in public sector because of their in availability but their usage in the private sector was at 0.0913. A different pattern of utilisation was seen in Australia where by selective serotonin (5HT) receptor agonist ranked the highest followed by ergot alkaloids in 2010[8].

Other nervous system drugs

Other nervous system drugs were categorised as anticholinesterase, antivertigo, immunomodulator, riluzole and tetrabenazine. Among the anticholinesterase group, parenteral neostigmine usage showed tremendous rise in public sector (89.2%) which was mainly used for neuromuscular reversal post-operatively. This finding was comparable with a report from Norway (0.13)[9]. Meanwhile, pyridostigmine usage which was used for neuromuscular disorder remained constant for both years.

Utilisation for antivertigo drugs was 0.6738 and 0.4919 in 2009 and 2010 respectively. Among the three antivertigo drugs, betahistine ranked the highest for both years. It was used for ear related disorders, which were common in local population[10]. Flunarizine usage was noted to be the lowest as it was mainly used by neurologist as antimigraine prophylaxis. Cinnarizine showed a reduction in utilisation probably due to better disease diagnosis.

In general, the immunomodulators, namely Interferon-β 1-a (Rebif) and Interferon-β 1-b (Betaferon) used in treating remitting-relapsing multiple sclerosis (RRMS) increased due to better disease diagnosis and availability of the drugs in the public sector.

Utilization of riluzole for motor neuron disease stands at 0.0001 in Malaysia from 2007 to 2010. Tetrabenazine which was not in the MOH formulary was initiated in 2010 for hyperkinetic movement disorders.

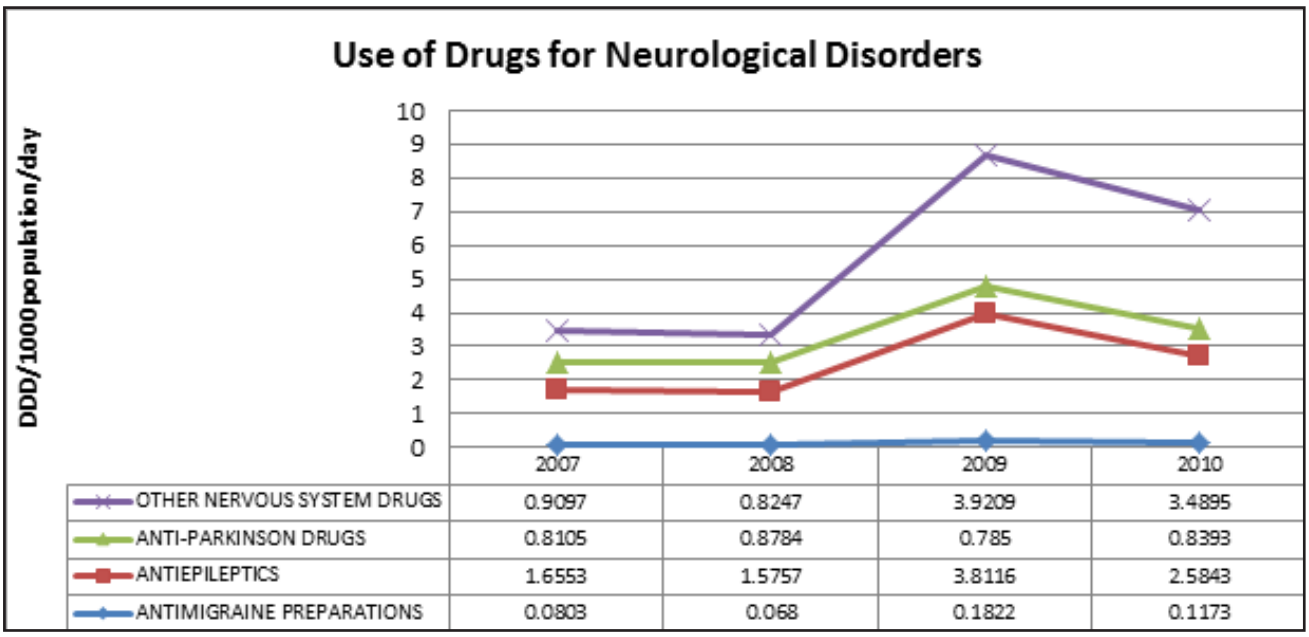


Figure 20.1: Use of Drugs for Neurological Disorders

	2007	2008	2009	2010
Public	0.0213	0.0284	0.0405	0.1085
Private	0.0538	0.0099	0.0042	0.0091
Total	0.0752	0.0383	0.0447	0.1175

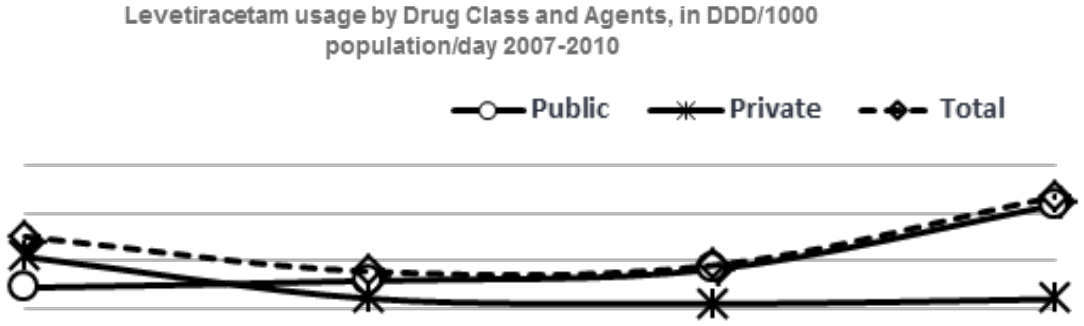


Figure 20.2: Levetiracetam usage by Drug Class and Agents, in DDD/1000population/day 2007-2010

	2007	2008	2009	2010
Public	0.3718	0.3659	0.4869	1.3855
Private	0.0671	0.0417	0.1287	0.0898
Total	0.4389	0.4076	0.6155	1.4754

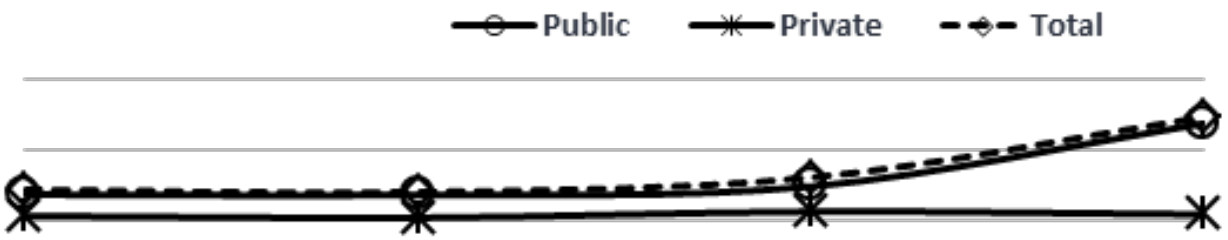


Figure 20.3: Valproate acid usage by Drug Class and Agents, in DDD/1000 population/day 2007-2010

Table 20.1: Use of Drugs for Neurological Disorders, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N02C	Antimigraine preparations	0.1822	0.1173
N03	Antiepileptics	3.8116	2.5843
N04	Anti-parkinson drugs	0.7850	0.8393
N06D	Anti-dementia drugs	0.0402	0.0936
N07	Other nervous system drugs	3.9209	3.4895

Table 20.2: Use of Anti-Epileptics by Drug Class, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N03A	Antiepileptics	1.8339	2.5767
N03A A	Barbiturates and derivatives	0.0848	0.0693
N03A B	Hydantoin derivatives	0.4240	0.4219
N03A D	Succinimide derivatives	-	<0.0001
N03A E	Benzodiazepine derivatives	0.0541	0.0646
N03A F	Carboxamide derivatives	2.2413	0.2664
N03A G	Fatty acid derivatives	0.6159	1.4757
N03A X	Other antiepileptics	0.3915	0.2863

Table 20.3: Use of Anti-Epileptics by Drug Class and Agents, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N03A A	**Barbiturates and derivatives**			
N03A A02	Phenobarbital	Public	0.0701	0.0650
		Private	0.0141	0.0036
		Total	0.0842	0.0686
N03A A03	Primidone	Public	0.0006	0.0007
		Private	<0.0001	<0.0001
		Total	0.0006	0.0007
N03A B	**Hydantoin derivatives**			
N03A B02	Phenytoin	Public	0.3669	0.3865
		Private	0.0572	0.0354
		Total	0.4240	0.4219
N03A D	**Succinimide derivatives**			

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N03A D01	Ethosuximide	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
N03A E	**Benzodiazepine derivatives**			
N03A E01	Clonazepam	Public	0.0381	0.0558
		Private	0.0160	0.0088
		Total	0.0541	0.0646
N03A F	**Carboxamide derivatives**			
N03A F01	Carbamazepine	Public	2.0843	0.2633
		Private	0.1567	0.0025
		Total	2.2410	0.2658
N03A F02	Oxcarbazepine	Public	<0.0001	0.0004
		Private	0.0002	0.0002
		Total	0.0002	0.0007
N03A G	**Fatty acid derivatives**			
N03A G01	Valproic acid	Public	0.4869	1.3855
		Private	0.1287	0.0898
		Total	0.6155	1.4754
N03A G04	Vigabatrin	Public	0.0003	0.0004
		Private	<0.0001	<0.0001
		Total	0.0003	0.0004
N03A X	**Other antiepileptics**			
N03A X09	Lamotrigine	Public	0.0356	0.0676
		Private	0.0020	0.0009
		Total	0.0376	0.0685
N03A X11	Topiramate	Public	0.0127	0.0111
		Private	0.0007	0.0004
		Total	0.0134	0.0115
N03A X12	Gabapentin	Public	0.0392	0.0652
		Private	0.2544	0.0226
		Total	0.2936	0.0878
N03A X14	Levetiracetam	Public	0.0405	0.1085
		Private	0.0042	0.0091
		Total	0.0447	0.1175
N03A X16	Pregabalin	Public	-	0.0004
		Private	0.0023	0.0007
		Total	0.0023	0.0011

Table 20.4: Use of Anti-Parkinson by Drug Class, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N04A	Anticholinergic agents	0.5496	0.4671
N04A A	Tertiary amines	0.5496	0.4671
N04A C	Ethers of tropine or tropine derivatives	-	<0.0001
N04B	Dopaminergic agents	0.2354	0.3722
N04B A	Dopa and dopa derivatives	0.1586	0.2219
N04B B	Adamantane derivatives	0.0069	0.0093
N04B C	Dopamine agonists	0.0158	0.0686

ATC	DRUG CLASS	2009	2010
N04B D	Monoamine oxidase B inhibitors	0.0452	0.0598
N04B X	Other dopaminergic agents	0.0090	0.0125

Table 20.5: Use of Anti-Parkinson by Drug Class and Agents, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N04A A	**Tertiary amines**			
N04A A01	Trihexyphenidyl	Public	0.4654	0.4617
		Private	0.0841	0.0050
		Total	0.5494	0.4668
N04A A04	Procyclidine	Public	0.0001	0.0003
		Private	<0.0001	<0.0001
		Total	0.0001	0.0003
N04A C	**Ethers of tropine or tropine derivatives**			
N04A C01	Benzatropine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
N04B A	**Dopa and dopa derivatives**			
N04B A01	Levodopa	Public	-	0.0089
		Private	-	-
		Total	-	0.0089
N04B A02	Levodopa and decarboxylase inhibitor	Public	0.1462	0.1694
		Private	0.0110	0.0376
		Total	0.1572	0.2070
N04B A03	Levodopa, decarboxylase inhibitor and COMT inhibitor	Public	0.0007	0.0055
		Private	0.0007	0.0006
		Total	0.0014	0.0061
N04B B	**Adamantane derivatives**			
N04B B01	Amantadine	Public	0.0060	0.0088
		Private	0.0009	0.0005
		Total	0.0069	0.0093
N04B C	**Dopamine agonists**			
N04B C01	Bromocriptine	Public	-	0.0002
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0002
N04B C04	Ropinirole	Public	0.0053	0.0058
		Private	0.0008	0.0005
		Total	0.0061	0.0063
N04B C05	Pramipexole	Public	0.0013	0.0534
		Private	0.0011	0.0010
		Total	0.0024	0.0544
N04B C07	Apomorphine	Public	-	<0.0001
		Private	-	0.0008
		Total	-	0.0008
N04B C08	Piribedil	Public	0.0067	0.0065
		Private	0.0006	0.0005
		Total	0.0072	0.0070

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N04B D	**Monoamine oxidase B inhibitors**			
N04B D01	Selegiline	Public	0.0403	0.0571
		Private	0.0049	0.0027
		Total	0.0452	0.0598
N04B X	**Other dopaminergic agents**			
N04B X02	Entacapone	Public	0.0089	0.0124
		Private	0.0001	0.0002
		Total	0.0090	0.0125

Table 20.6: Use of Anti-Migraines by Drug Class, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N02C	Antimigraine preparations	0.1822	0.1173
N02C A	Ergot alkaloids	0.1511	0.0917
N02C C	Selective serotonin (5HT1) agonists	0.0101	0.0075
N02C X	Other antimigraine preparations	0.0210	0.0181

Table 20.7: Use of Anti-Migraines by Drug Class and Agents, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N02C A	**Ergot alkaloids**			
N02C A02	Ergotamine	Public	-	<0.0001
		Private	-	0.0004
		Total	-	0.0004
N02C A52	Ergotamine, combinations excl. psycholeptics	Public	<0.0001	0.0001
		Private	0.1511	0.0911
		Total	0.1511	0.0913
N02C C	**Selective serotonin (5HT1) agonists**			
N02C C01	Sumatriptan	Public	0.0063	0.0052
		Private	0.0038	0.0023
		Total	0.0101	0.0075
N02C X	**Other antimigraine preparations**			
N02C X01	Pizotifen	Public	0.0091	0.0169
		Private	0.0119	0.0012
		Total	0.0210	0.0181
N02C X02	Clonidine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001

Table 20.8: Use of Other Nervous Systems Drugs by Drug Class, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N07A	Parasympathomimetics	0.0850	0.2216
N07A A	Anticholinesterases	0.0850	0.2216
N07A B	Choline esters	-	<0.0001
N07C	Antivertigo preparations	0.6738	0.4919
N07C A	Antivertigo preparations	0.6738	0.4919
L03A	Immunostimulants	0.0007	0.0066
L03A B	Interferons	0.0007	0.0066
N07X	Other nervous system drugs	<0.0001	<0.0001
N07X X	Other nervous system drugs	<0.0001	<0.0001

Table 20.9: Use of Other Nervous Systems Drugs by Drug Class and Agents, in DDD/1000population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N07A A	**Anticholinesterases**			
N07A A01	Neostigmine	Public	0.0131	0.1218
		Private	0.0110	0.0050
		Total	0.0242	0.1267
N07A A02	Pyridostigmine	Public	0.0588	0.0927
		Private	0.0020	0.0021
		Total	0.0608	0.0948
N07A A03	Distigmine	Public	-	-
		Private	-	-
		Total	-	-
N07A B	**Choline esters**			
N07A B01	Carbachol	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001
N07C A	**Antivertigo preparations**			
N07C A01	Betahistine	Public	0.1051	0.1741
		Private	0.2177	0.0775
		Total	0.3228	0.2516
N07C A02	Cinnarizine	Public	0.1006	0.0897
		Private	0.1843	0.1119
		Total	0.2849	0.2016
N07C A03	Flunarizine	Public	0.0121	0.0248
		Private	0.0540	0.0139
		Total	0.0661	0.0387
L03A	**Immunostimulants**			
L03A B07	Interferon beta-1a	Public	0.0002	0.0170
		Private	0.0003	<0.0001
		Total	0.0004	0.0170
L03A B08	Interferon beta-1b	Public	-	0.0009
		Private	-	-
		Total	-	0.0009
N07X X	**Other nervous system drugs**			
N07X X02	Riluzole	Public	<0.0001	<0.0001
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
N07X X06	Tetrabenazine	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001

References:

1. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. Raymond, A. A., Tan C. T., Raihanah, A. K., *Consensus Guidelines on the Management of Epilepsy 2010*. Malaysian Society of Neurosciences, Kuala Lumpur.
3. Rosenberg, G. The mechanisms of action of alproate in neuropsychiatric disorders: can we see the forest for the trees? *Cell Mol Life Sci*. 2007, 64, 2090–2103.
4. Johannessen, C. U. Mechanisms of action of valproate: a commentatory. *Neurochem Int*. 2000, 37, 103–110.
5. Johannessen, C. U.; Johannessen, S. I. Valproate: past, present, and future. *CNS Drug Rev*. 2003, 9, 199–216.
6. Patsalos, P. N. Properties of Antiepileptic Drugs in the Treatment of Idiopathic Generalized Epilepsies. *Epilepsia*. 2005, 46, 140–144.
7. *Malaysian Consensus on Parkinson's Disease 2006*. Malaysian Parkinson's Disease Association (MPDA).
8. *Australian Statistics on Medicines 2010*; Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2012
9. *MOH Drug Formulary 2010*. Kementerian Kesihatan Malaysia.
10. Sakshaug, S (ed), *Drug Consumption in Norway* 2008-2012, Norwegian Institute of Public Health, Printing Office: Oslo 2013.

CHAPTER 21: USE OF DRUGS FOR PSYCHIATRIC DISORDERS

Toh C.L.[1], Nor Hayati A.[1], Azizul A.[2], Mazni M.J.[3], Umi Adzlin S.[2], Noor Ratna N.[4], Shamini R.[5],

1. Selayang Hospital, Selangor, 2. Putrajaya Hospital, Putrajaya, 3.Serdang Hospital, Selangor, 4. Hospital Permai, Johor,5. Hospital Bahagia Ulu Kinta, Perak.

Psychiatric morbidity is high among adults, children and adolescents as shown in The National Health and Morbidity Survey 2006[1].Usage of psychotropic drugs may reflect the utilisation of psychiatric services. Good longitudinal data analyses are valuable in forecasting usage trend of psychotropic drugs. Without the data, it is difficult to know whether changes in drug usage are real or can be attributed to better awareness and detection of disease[2].

Generally, there was an increased use of all drug classes except for the group of anxiolytics, hypnotics and sedatives (Figure 21.1).

Antipsychotics remained the most widely prescribed drugs in psychiatry. The overall use of antipsychotics had increased 11.8% in 2010 from the previous year. They contributed about 52% of the total use of psychotropic prescriptions. The most utilized antipsychotic in 2009 was haloperidol (DDD 0.4809), however fluphenazine was reported to be the most prescribed drug in 2010 (DDD 2.2031). The use of antipsychotics was predominantly prescribed by the public sector in 2009 and 2010 which was 96.1% and 98.9% respectively.

There was also a similar trend of increased usage of atypical antipsychotics in 2010 (32.4%). The prescription of atypical antipsychotics was higher in the public sector in 2010 as opposed to the higher prescription in private sector in 2009 (42.9%).

It was shown that Risperidone (DDD 0.3927) was the most prescribed antipsychotics in 2010 with remarkable increase (93.73%) from the previous year. This may be attributed to the accessibility of this medication in primary care level as well as the availability of the generic form. Corresponding data from Finland in 2010 reported the most used atypical antipsychotic was Olanzapine (DDD 5.2) and Aripiprazole was the most prescribed drug in Australia (DDD 15)[3].

There was a significant drop of 14.34% in the overall usage of anxiolytics, hypnotics and sedatives group from 2009 (DDD 3.2414) to 2010 (DDD 2.7767). The private sector may have contributed to this decline from 2009 (DDD 1.343) to 2010 (DDD 0.3559) while usage in public sector remained stable (DDD 0.2645 in 2009; DDD 0.2877 in 2010). It was likely that this reduction was associated with effective enforcement to curb misuse.

According to the Annual Report of Pharmacy Programme, Ministry of Health Malaysia 2009 and 2010[4,5], 'more audits were carried out to stem the misuse of narcotic drugs and psychotropic substances by health care practitioners for purposes other than the legitimate medical purposes'. An audit study was specifically conducted in 2010 related to the use of controlled substances in registered private medical clinics and pharmacy-licensed premises and there were efforts to create greater awareness of the diversion of psychotropic substances.

In 2009, Alprazolam was the most commonly prescribed anxiolytic (DDD 0.5568); followed by Triazolam (DDD 0.3783; which was prescribed exclusively in private sector); and diazepam (DDD 0.2734). In 2010, the top three were Alprazolam (DDD 0.187), Zolpidem (DDD 0.1411) and Lorazepam (DDD 0.1049). This may again illustrate the impact of enforcement.

However, we should be aware that the overall use of anxiolytics, hypnotics and sedatives were actually very low compared to other developed countries (DDD 3.2414 in 2009; DDD 2.7767 in 2010). The consumption of anxiolytics, hypnotics and sedatives was remarkably lower compared to Norway (DDD 19.55 and DDD 47.75 respectively)[6] and Finland (DDD 27.91 and DDD 48.77 respectively) in 2010[3].

Consumption of antidepressants showed a 16.2% increase; i.e. the DDD increasing from 1.1308 in 2009 to 1.3145 in 2010. The proportion contributed by antidepressants is 23.3% in 2009 compared to 31.2% in 2010. Amongst the different classes, Selective Serotonin Reuptake Inhibitors (SSRIs) remained the biggest contributor in terms of proportion, i.e. 63.3% (DDD 0.7154) in 2009 and 59.87% (DDD 0.787) in 2010.

There were major changes in the top three most-used antidepressants during this time span. For 2009, Fluvoxamine (DDD 0.2009) had lost its grip as the most-used antidepressant, overtaken by Sertaline (DDD 0.2827). The third most-used antidepressant was a tricyclic, Amitriptyline (DDD 0.1476). In year 2010, the top three usages were for Amitriptyline (DDD 0.3516); Escitalopram (DDD 0.3319) and Sertraline (DDD 0.1932). The high use of Amitriptyline may be due to the fact that is it used by many non-psychiatrists for various indications. The increased usage of Escitalopram was driven by the private sector, which shows a noticeable increase in its DDD from 0.096 to 0.2129.

As a whole, utilisation of antidepressants is still much lower in Malaysia as compared to developed countries such as Norway (DDD 56.42)[6] and Finland (DDD 68.8)[3] in 2010. Malaysia also differed in the choice of antidepressant, where the highest consumption was for Escitalopram in Norway in 2010 (DDD 19.51) and Finland (DDD 11.77).

For mood stabilisers, Lithium usage in Malaysia was low. This can be shown by the DDD of 0.013 in 2009 and 0.0277 in 2010. Serum Lithium monitoring is still not easily accessible which may contribute to this observation. Malaysian psychiatrists also use anticonvulsants like Sodium Valproate as mood stabiliser; but its usage cannot be gauged due to data capture technicalities. Taking Finland as an example, DDD for Lithium for 2009 and 2010 was 1.06 and 1.04 respectively[3].

Methadone remained the mostly prescribed agent in Addictive Disorders for 2009 and 2010. However, the use was relatively lower in 2010 (DDD 3.0678 in 2009; DDD 2.9984 in 2010). Most prescriptions came from public sector, 99.83% in 2009 and 98% in 2010. The use of methadone was comparable to countries like Finland and Norway (DDD 0.07 and 2.53 respectively in 2010). Analysis and discussion of addictive drugs class was done separately as it fell under the Harm Reduction Program.

Anti-dementia drugs showed a tremendous increase of 132.8% in its consumption from 2009 (DDD 0.0402) to 2010 (DDD 0.0936). The most commonly utilized anti-dementia drug was Donepezil (DDD 0.0278 in 2009; DDD 0.0365 in 2010) followed by Rivastigmine (DDD 0.0113 in 2009; DDD 0.055 in 2010).

In the treatment of Attention Deficit and Hyperactivity Disorder (ADHD), Methylphenidate was the main prescribed drug both in 2009 and 2010 (DDD 0.0166 and 0.0344 respectively). Atomoxetine was also being used at a much lower rate. For both, the prescribing pattern was higher in public sector. As a comparison, in Australia, the DDD were 80 for Atomoxetine and 30 for Methylphenidate in 2010 [7]. On the other hand, the DDD in Finland were 6.12 for Methylphenidate and 0.025 for Atomoxetine in 2010[3].

In conclusion, overall psychotropic drug usage in Malaysia was very low in relation to the existing established prevalences of psychiatric morbidities and in comparison with other developed countries.

Figure 21.1: Comparison of Drug Used in Treatment of Psychiatric Disorders.

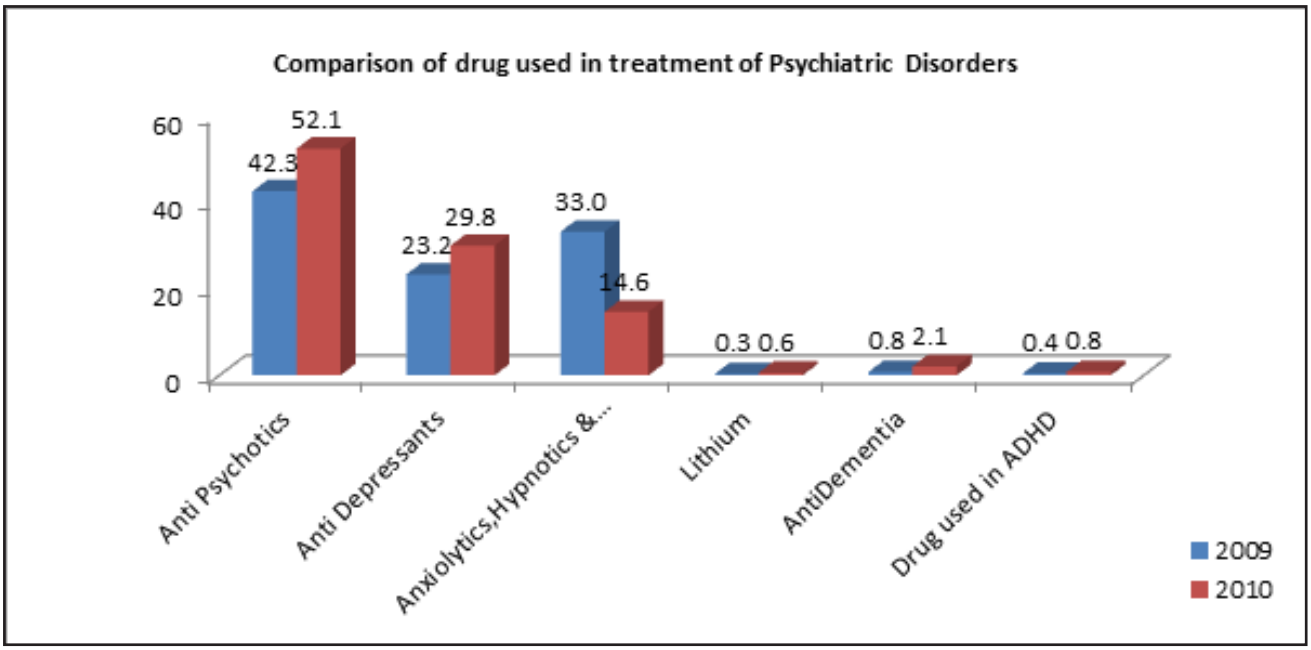


Table 21.1.1: Use of Anti-Psychotics by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N05A A	Phenothiazines with aliphatic side-chain	0.3277	0.3229
N05A B	Phenothiazines with piperazine structure	0.5623	2.2930
N05A D	Butyrophenone derivatives	0.4809	0.2938
N05A E	Indole derivatives	0.0002	0.0003
N05A F	Thioxanthene derivatives	0.1930	1.0029
N05A H	Diazepines, oxazepines, thiazepines and oxepines	0.2373	0.5883
N05A L	Benzamides	0.1394	0.1650
N05A X	Other antipsychotics	0.2193	0.4162

Table 21.1.2: Use of Anti-Psychotics by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N05A A	**Phenothiazines with aliphatic side-chain**			
N05A A01	Chlorpromazine	Public	0.3243	0.3221
		Private	0.0034	0.0008
		Total	0.3277	0.3229
N05A B	**Phenothiazines with piperazine structure**			
N05A B02	Fluphenazine	Public	0.4519	2.1934
		Private	0.0101	0.0098
		Total	0.4620	2.2031
N05A B03	Perphenazine	Public	0.0246	0.0267
		Private	0.0114	0.0008
		Total	0.0359	0.0275
N05A B04	Prochlorperazine	Public	0.0472	0.0838
		Private	0.0535	0.1233
		Total	0.1007	0.2071
N05A B06	Trifluoperazine	Public	0.0610	0.0623
		Private	0.0034	<0.0001
		Total	0.0644	0.0624
N05A D	**Butyrophenone derivatives**			
N05A D01	Haloperidol	Public	0.4732	0.2888
		Private	0.0077	0.0050
		Total	0.4809	0.2938
N05A E	**Indole derivatives**			
N05A E04	Ziprasidone	Public	<0.0001	0.0002
		Private	0.0001	0.0001
		Total	0.0002	0.0003
N05A F	**Thioxanthene derivatives**			
N05A F01	Flupentixol	Public	0.0774	0.9003
		Private	0.0032	0.0168
		Total	0.0806	0.9170
N05A F02	Clopenthixol	Public	-	0.0026
		Private	-	-
		Total	-	0.0026
N05A F05	Zuclopenthixol	Public	0.1094	0.0820
		Private	0.0031	0.0013
		Total	0.1124	0.0833
N05A H	**Diazepines, oxazepines, thiazepines and oxepines**			
N05A H02	Clozapine	Public	0.0522	0.0644
		Private	<0.0001	<0.0001
		Total	0.0523	0.0645
N05A H03	Olanzapine	Public	0.1192	0.4412
		Private	0.0021	0.0024
		Total	0.1213	0.4437
N05A H04	Quetiapine	Public	0.0393	0.0764
		Private	0.0244	0.0037
		Total	0.0637	0.0801
N05A L	**Benzamides**			

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N05A L01	Sulpiride	Public	0.1332	0.1561
		Private	0.0062	0.0086
		Total	0.1394	0.1648
N05A L05	Amisulpride	Public	-	0.0003
		Private	-	<0.0001
		Total	-	0.0003
N05A X	**Other antipsychotics**			
N05A X08	Risperidone	Public	0.1941	0.3838
		Private	0.0086	0.0088
		Total	0.2027	0.3927
N05A X12	Aripiprazole	Public	0.0164	0.0234
		Private	<0.0001	0.0002
		Total	0.0164	0.0236
N05A X13	Paliperidone	Public	-	-
		Private	0.0002	-
		Total	0.0002	-

Table 21.1.3: Use of Antipsychotics in DDD/1000 population/ day 2009-2010 Public and Private Sector

TOTAL ANTIPSYCHOTICS	2009		2010	
	DDD /1000 population/day	%	DDD /1000 population/day	%
Public	2.0762	96.1	5.0241	98.9
Private	0.0837	3.9	0.0584	1.1
Total	2.1600	100	5.0825	100

Table 21.1.4: Use of Atypical Antipsychotics in DDD/1000 population/ day 2009-2010 Public and Private Sector

ATYPICAL ANTIPSYCHOTIC	2009		2010	
	DDD /1000 population/day	%	DDD /1000 population/day	%
Public/Total	0.2270/2.0762	10.9	0.6058/5.0240	12.1
Private/Total	0.0269/.0837	32.1	0.0066/.0584	11.2

Table 21.2.1: Use of Mood Stabilizing Agent by Drug Class in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N05A N	Lithium	0.0130	0.0277

Table 21.2.2: Use of Mood Stabilizing Agent by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N05A N	**Lithium**			
N05A N01	Lithium	Public	0.0126	0.0268
		Private	0.0004	0.0009
		Total	0.0130	0.0277

Table 21.3.1: Use of Anti-Depressants by Drug Class in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N06A A	Non-selective monoamine reuptake inhibitors	0.2403	0.4363
N06A B	Selective serotonin reuptake inhibitors	0.7154	0.7870
N06A F	Monoamine oxidase inhibitors, non-selective	-	0.0002
N06A G	Monoamine oxidase A inhibitors	0.0759	0.0039
N06A X	Other antidepressants	0.0992	0.0871

Table 21.3.2: Use of Anti-Depressants by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N06A A	**Non-selective monoamine reuptake inhibitors**			
N06A A02	Imipramine	Public	0.0122	0.0125
		Private	0.0029	0.0065
		Total	0.0151	0.0191
N06A A04	Clomipramine	Public	0.0037	0.0079
		Private	0.0006	0.0016
		Total	0.0043	0.0095
N06A A09	Amitriptyline	Public	0.0493	0.0620
		Private	0.0984	0.2896
		Total	0.1476	0.3516
N06A A10	Nortriptyline	Public	-	-
		Private	0.0003	-
		Total	0.0003	-
N06A A16	Dosulepin	Public	0.0357	0.0504
		Private	0.0349	0.0049
		Total	0.0706	0.0553
N06A A21	Maprotiline	Public	0.0010	0.0008
		Private	0.0015	<0.0001
		Total	0.0024	0.0008
N06A B	**Selective serotonin reuptake inhibitors**			
N06A B03	Fluoxetine	Public	0.0469	0.0823
		Private	0.0365	0.0123
		Total	0.0834	0.0946
N06A B04	Citalopram	Public	0.0019	-
		Private	0.0024	0.0006
		Total	0.0043	0.0006
N06A B05	Paroxetine	Public	0.0012	0.0002
		Private	0.0048	0.0025
		Total	0.0059	0.0026
N06A B06	Sertraline	Public	0.1436	0.1734
		Private	0.1391	0.0198
		Total	0.2827	0.1932
N06A B08	Fluvoxamine	Public	0.1882	0.1424
		Private	0.0127	0.0217
		Total	0.2009	0.1641
N06A B10	Escitalopram	Public	0.0422	0.1190
		Private	0.0960	0.2129
		Total	0.1382	0.3319
N06A F	**Monoamine oxidase inhibitors, non-selective**			
N06A F04	Tranylcypromine	Public	-	0.0002
		Private	-	-
		Total	-	0.0002
N06A G	**Monoamine oxidase A inhibitors**			
N06A G02	Moclobemide	Public	0.0757	0.0038
		Private	0.0002	0.0001
		Total	0.0759	0.0039

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N06A X	**Other antidepressants**			
N06A X03	Mianserin	Public	0.0002	<0.0001
		Private	<0.0001	0.0002
		Total	0.0003	0.0003
N06A X11	Mirtazapine	Public	0.0203	0.0282
		Private	0.0056	0.0061
		Total	0.0258	0.0344
N06A X12	Bupropion	Public	<0.0001	-
		Private	<0.0001	<0.0001
		Total	<0.0001	<0.0001
N06A X14	Tianeptine	Public	0.0002	0.0002
		Private	0.0012	0.0042
		Total	0.0014	0.0044
N06A X16	Venlafaxine	Public	0.0142	0.0242
		Private	0.0018	0.0030
		Total	0.0160	0.0272
N06A X21	Duloxetine	Public	0.0083	0.0170
		Private	0.0473	0.0037
		Total	0.0555	0.0206
N06A X23	Desvenlafaxine	Public	-	-
		Private	-	0.0002
		Total	-	0.0002

Table 21.4.1: Use of Anxiolytics, Hypnotics and Sedatives by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N05B A	Benzodiazepine derivatives	1.0065	0.3744
N05B B	Diphenylmethane derivatives	0.1199	0.0936
N05C C	Aldehydes and derivatives	1.3867	1.0739
N05C D	Benzodiazepine derivatives	0.4933	0.1034
N05C F	Benzodiazepine related drugs	0.1077	0.1658
N05C H	Melatonin receptor agonists	0.0027	0.0015
N05C M	Other hypnotics and sedatives	0.1246	0.9640

Table 21.4.2: Use of Anxiolytics, Hypnotics and Sedatives by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N05B A	**Benzodiazepine derivatives**			
N05B A01	Diazepam	Public	0.0604	0.0303
		Private	0.2130	0.0358
		Total	0.2734	0.0661
N05B A02	Chlordiazepoxide	Public	-	-
		Private	0.0009	<0.0001
		Total	0.0009	<0.0001
N05B A05	Potassium clorazepate	Public	-	-
		Private	0.0027	0.0023
		Total	0.0027	0.0023

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N05B A06	Lorazepam	Public	0.0366	0.0683
		Private	0.0842	0.0365
		Total	0.1208	0.1049
N05B A08	Bromazepam	Public	0.0019	0.0013
		Private	0.0129	0.0082
		Total	0.0148	0.0095
N05B A09	Clobazam	Public	0.0025	0.0007
		Private	0.0346	0.0040
		Total	0.0372	0.0047
N05B A12	Alprazolam	Public	0.0856	0.1000
		Private	0.4712	0.0870
		Total	0.5568	0.1870
N05B B	**Diphenylmethane derivatives**			
N05B B01	Hydroxyzine	Public	0.0313	0.0352
		Private	0.0887	0.0585
		Total	0.1199	0.0936
N05C C	**Aldehydes and derivatives**			
N05C C01	Chloral hydrate	Public	1.2229	0.9185
		Private	0.1638	0.1554
		Total	1.3867	1.0738
N05C C05	Paraldehyde	Public	<0.0001	<0.0001
		Private	<0.0001	-
		Total	<0.0001	<0.0001
N05C D	**Benzodiazepine derivatives**			
N05C D02	Nitrazepam	Public	0.0025	0.0025
		Private	0.0089	0.0004
		Total	0.0114	0.0028
N05C D05	Triazolam	Public	-	-
		Private	0.3783	0.0140
		Total	0.3783	0.0140
N05C D08	Midazolam	Public	0.0423	0.0439
		Private	0.0613	0.0427
		Total	0.1035	0.0866
N05C F	**Benzodiazepine related drugs**			
N05C F01	Zopiclone	Public	-	-
		Private	0.0279	0.0247
		Total	0.0279	0.0247
N05C F02	Zolpidem	Public	0.0337	0.0408
		Private	0.0461	0.1003
		Total	0.0798	0.1411
N05C H	**Melatonin receptor agonists**			
N05C H01	Melatonin	Public	0.0025	0.0011
		Private	0.0002	0.0004
		Total	0.0027	0.0015
N05C M	**Other hypnotics and sedatives**			

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N05C M05	Scopolamine	Public	-	-
		Private	0.1246	0.9640
		Total	0.1246	0.9640

Table 21.5.1: Use of Drugs used in Additive Disorders by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N07B	Drugs used in addictive disorders	3.1959	3.0450
N07B A	Drugs used in nicotine dependence	0.0345	0.0095
N07B B	Drugs used in alcohol dependence	0.0011	0.0044
N07B C	Drugs used in opioid dependence	3.1602	3.0311

Table 21.5.2: Use of Drugs used in Additive Disorder by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N07B A	**Drugs used in nicotine dependence**			
N07B A01	Nicotine	Public	<0.0001	0.0001
		Private	0.0261	0.0037
		Total	0.0262	0.0038
N07B A03	Varenicline	Public	<0.0001	0.0029
		Private	0.0083	0.0028
		Total	0.0083	0.0057
N07B B	**Drugs used in alcohol dependence**			
N07B B04	Naltrexone	Public	0.0011	<0.0001
		Private	<0.0001	0.0044
		Total	0.0011	0.0044
N07B C	**Drugs used in opioid dependence**			
N07B C01	Buprenorphine	Public	-	-
		Private	-	-
		Total	-	-
N07B C02	Methadone	Public	3.0628	2.9381
		Private	0.0050	0.0604
		Total	3.0678	2.9984
N07B C51	Buprenorphine, combinations	Public	-	0.0120
		Private	0.0924	0.0207
		Total	0.0924	0.0327

Table 21.6: Use of Antidementia Drugs by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	2009	2010
N06D	Anti-dementia drugs	0.0402	0.0936
N06D A	Anticholinesterases	0.0391	0.0921
N06D X	Other anti-dementia drugs	0.0010	0.0016

Table 20.6.1: Use of Antidementia Drugs by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N06D A	**Anticholinesterases**			
N06D A02	Donepezil	Public	0.0261	0.0346
		Private	0.0017	0.0019
		Total	0.0278	0.0365

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
N06D A03	Rivastigmine	Public	0.0108	0.0543
		Private	0.0005	0.0007
		Total	0.0113	0.0550
N06D A04	Galantamine	Public	0	0.0005
		Private	<0.0001	<0.0001
		Total	<0.0001	0.0006
N06D X	**Other anti-dementia drugs**			
N06D X01	Memantine	Public	0.0002	0.0007
		Private	0.0008	0.0009
		Total	0.001	0.0016

References:

1. *The Third National Health and Morbidity Survey (NHMS III) 2006*; Institute for Public Health (IPH) Ministry of Health Malaysia Printing Office: Kuala Lumpur 2008.
2. Federation of the European Academies of Medicines; published by Psychiatricke Centrum Praha – Prague Psychiatric Center 2010
3. *Finnish Statistics of Medicine 2010;* Finnish Medicines Agency Fimea & Social Insurance Institution Printing Office: Helsinki 2011.
4. Annual Report 2009. Pharmacy Programme, Pharmaceutical Services Division, Ministry of Health.
5. Annual Report 2010. Pharmacy Programme, Pharmaceutical Services Division. Ministry of Health.
6. Sakshaug, S. et al. *Drug Consumption in Norway 2008-2012;* Norwegian Institute of Public Health Printing Office: Oslo, March 2013
7. *Australian Statistics on Medicine 2010*. Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2010

CHAPTER 22: USE OF DRUGS FOR OBSTRUCTIVE AIRWAYS DISEASES

Roslina A.M.[1], Pang Y.K.[2], Nurhayati M.M.[3], Suhadah A.[4], Pang S.F.[5]

1.UKM Medical Centre 2. University Malaya Medical Centre 3. Institute of Respiratory Medicine 4. Hospital Melaka 5. Hospital Tuanku Ampuan Najihah

This drug utilization survey for obstructive airway disease is conducted between 2009-2010. The data does not differentiate between drug use in asthma and COPD. The estimated prevalence of COPD in Malaysia is 4.7%, which translated into 448,000 affected persons[1]. It is 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].

Similar to 2007-2008, there is a continuous and steady reduction (28.6%) in the use of inhaled selective beta-2-adrenoceptor agonists in 2009-2010 (2.9565 to 2.1300 DDD/1000 population/day). This drop is largely due to a decrease usage of inhaled salbutamol (38.9%) in the public sector.

The use of inhaled short-acting adrenergics in combination with other drugs for obstructive airway diseases (fenoterol/ipratropium, salbutamol/ipratropium) has reduced in 2009-2010 compared to 2007-2008[4] (0.59 vs 0.74 mean DDD/1000 population/day). Similarly, the use of inhaled long-acting adrenergics in combination with other drugs (ICS/LABA) for obstructive airway diseases (salmeterol/fluticasone, formoterol/budesonide) has reduced in 2009-2010 compared to 2007-2008[4] (0.56 vs 0.65 mean DDD/1000 population/day). However, we would like to point out that the data in 2009 was lower than expected and seem deviated from the overall trend from 2007 to 2010; hence the 2 year mean DDD for 2007-2008 and 2009-2010 was used respectively.

The usage of inhaled anticholinergics (ipratropium bromide, tiotropium bromide) has reduced by 25.2% in 2009-2010; this is attributed to a significant decrease in the usage of ipratropium bromide from 0.3428 to 0.1733 DDD/1000 population/day. Nonetheless, the tiotropium bromide usage has increased (0.0499 to 0.1202 DDD/1000 population/day).

The use of inhaled glucocorticoid monotherapy has increased in 2009-2010 (2.2325 vs 2.4395 DDD/1000 population/day); this continues the pattern seen in 2007-2008[4]. This is an encouraging trend and may help to explain the reduced usage of inhaled selective beta-2-adrenoceptor agonists above.

The use of systemic beta-2-adrenoceptor agonists (0.9443 vs 0.9961 DDD/1000 population/day) and xanthines (0.9820 vs 0.9661 DDD/1000 population/day) remain stable in 2009-2010. The use of leukotriene receptor antagonists (montelukast) has increased slightly from 0.1645 to 0.1897 DDD/1000 population/day.

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[5]. Meanwhile, theophylline usage are almost twice as much in Malaysia compared to Australia (0.86 vs 0.40 DDD/1000 population/day) whilst montelukast is more widely used in Australia (0.19 vs 10.0 DDD/1000 population/day).

Table 22.1: Use of Medicines for Obstructive Airway Diseases by Drug Class, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS	ROUTE	2009	2010
R03A C	Selective beta-2-adrenoreceptor agonists	Inhal.aerosol	2.9565	2.1300
		Inhal.powder		
		Inhal.solution		
R03A K	Adrenergics and other drugs for obstructive airway diseases	Inhal.aerosol	0.7009	1.5957
		Inhal.powder		
		Inhal.solution		
R03B A	Glucocorticoids	Inhal.aerosol	2.2325	2.4395
		Inhal.powder		
		Inhal.solution		
R03B B	Anticholinergics	Inhal.aerosol	0.3927	0.2936
		Inhal.powder		
		Inhal.solution		
R03C A	Alpha- and beta-adrenoreceptor agonists	Oral	0.0108	<0.0001

ATC	DRUG CLASS	ROUTE	2009	2010
R03C C	Selective beta-2-adrenoreceptor agonists	Oral	0.9443	0.9961
		Parenteral		
		Rectal		
R03D A	Xanthines	Oral	0.9820	0.9661
		Parenteral		
		Rectal		
R03D C	Leukotriene receptor antagonists	Oral	0.1645	0.1897
R03D X	Other systemic drugs for obstructive airway diseases	Oral	-	<0.0001
		Parenteral	-	-

Table 22.2: Use of Medicines for Obstructive Airway Diseases by Drug Class and Agents, in DDD/1000 population/ day 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
R03A C	**Selective beta-2-adrenoreceptor agonists**			
R03A C02	Salbutamol	Public	2.3521	0.6895
		Private	0.4238	1.0051
		Total	2.7759	1.6946
R03A C03	Terbutaline	Public	0.1126	0.0038
		Private	0.0575	0.1792
		Total	0.1700	0.1829
R03A C04	Fenoterol	Public	0.0002	0.0033
		Private	0.0016	0.0014
		Total	0.0018	0.0047
R03A C12	Salmeterol	Public	-	0.2362
		Private	<0.0001	-
		Total	<0.0001	0.2362
R03A C13	Formoterol	Public	0.0070	0.0101
		Private	0.0018	0.0014
		Total	0.0088	0.0115
R03A K	**Adrenergics and other drugs for obstructive airway diseases**			
R03A K03	Fenoterol and other drugs for obstructive airway diseases	Public	-	0.1858
		Private	0.0217	0.0044
		Total	0.0217	0.1903
R03A K04	Salbutamol and other drugs for obstructive airway diseases	Public	0.1738	0.7243
		Private	0.0398	0.0270
		Total	0.2137	0.7514
R03A K06	Salmeterol and other drugs for obstructive airway diseases	Public	0.0887	0.4315
		Private	0.2577	0.0839
		Total	0.3464	0.5154
R03A K07	Formoterol and other drugs for obstructive airway diseases	Public	0.0235	0.1247
		Private	0.0957	0.0140
		Total	0.1191	0.1387
R03B A	**Glucocorticoids**			
R03B A01	Beclometasone	Public	0.6717	0.9568
		Private	0.0521	0.0671
		Total	0.7238	1.0239

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
R03B A02	Budesonide	Public	1.3276	1.1006
		Private	0.0794	0.0770
		Total	1.4069	1.1776
R03B A05	Fluticasone	Public	0.0393	0.0900
		Private	0.0194	0.0260
		Total	0.0586	0.1160
R03B A08	Ciclesonide	Public	0.0046	0.0202
		Private	0.0386	0.1017
		Total	0.0431	0.1220
R03B B	**Anticholinergics**			
R03B B01	Ipratropium bromide	Public	0.2921	0.1247
		Private	0.0507	0.0486
		Total	0.3428	0.1733
R03B B04	Tiotropium bromide	Public	0.0349	0.1021
		Private	0.0150	0.0182
		Total	0.0499	0.1202
R03C A	**Alpha- and beta-adrenoreceptor agonists**			
R03C A02	Ephedrine	Public	0.0066	-
		Private	0.0042	<0.0001
		Total	0.0108	<0.0001
R03C C	**Selective beta-2-adrenoreceptor agonists**			
R03C C02	Salbutamol	Public	0.3797	0.3479
		Private	0.3584	0.2408
		Total	0.7381	0.5887
R03C C03	Terbutaline	Public	0.0531	0.3241
		Private	0.1454	0.0786
		Total	0.1985	0.4027
R03C C04	Fenoterol	Public	-	-
		Private	0.0031	0.0024
		Total	0.0031	0.0024
R03C C08	Procaterol	Public	-	-
		Private	0.0045	0.0022
		Total	0.0045	0.0022
R03C C12	Bambuterol	Public	-	-
		Private	0.0001	-
		Total	0.0001	-
R03D A	**Xanthines**			
R03D A04	Theophylline	Public	0.6260	0.8560
		Private	0.3525	0.0996
		Total	0.9785	0.9557
R03D A05	Aminophylline	Public	0.0027	0.0102
		Private	0.0006	0.0002
		Total	0.0033	0.0104
R03D A54	Theophylline, combinations excl. psycholeptics	Public	-	-
		Private	0.0001	-
		Total	0.0001	-
R03D C	**Leukotriene receptor antagonists**			

ATC	DRUG CLASS AND AGENTS	SECTOR	2009	2010
R03D C03	Montelukast	Public	0.0795	0.1027
		Private	0.0850	0.0870
		Total	0.1645	0.1897
R03D X	**Other systemic drugs for obstructive airway diseases**			
R03D X05	Omalizumab	Public	-	<0.0001
		Private	-	-
		Total	-	<0.0001

Reference:

1. Regional COPD Working Group. Trends in COPD mortality and hospitalizations in countries and regions of Asia-Pacific. *Respirology*.2009, 14, 90-97.
2. Beasley, R.; Ellwood, P.; Asher, I. International patterns of the prevalence of pediatric asthma the ISAAC program. *Pediatr Clin North Am.* 2003, 50(3), 539-53.
3. *The Third National Health and Morbidity Survey (NHMS III)*; Ministry of Health Malaysia, 2006.
4. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013
5. *Australian Statistics on Medicines 2010*; Australian Department of Health and Aging:Commonwealth of Australia, 2009.
6. *WHO Collaborating Centre for Drug Statistics Methodology, Guidelines for ATC Classification and DDD Assignment*, 2011.

CHAPTER 23: USE OF ANTIHISTAMINES AND NASAL DECONGESTANTS

Valuyeetham K.A.[1], Saraiza A.B.[2], Leow W.L.[3], Aswani Yanti B.[4], Primuharsa Putra S.H.A.[5]

1. Tuanku Ja'afar Hospital, Seremban, 2. Serdang Hospital, Selangor, 3. Hospital Kuala Lumpur, Kuala Lumpur, 4. AmpangHospital, Selangor, 5. KPJ Seremban Specialist Hospital/KPJ Healthcare University College.

Nasal decongestants and antihistamines are commonly used drugs for allergy and nasal symptoms in otorhinolaryngology clinics in Malaysia. The 2009 and 2010 survey showed usage of nasal preparations was 2.1171 and 3.3519 DDD/population/year respectively, while usage of antihistamines for systemic use was 5.2875 and 4.9504 DDD/population/year respectively.

For nasal preparations (R01), significant increase was shown in daily and yearly usage in 2009 and 2010 as compared to 2008[1]. This may be due to increasing use of pseudoephedrine, combinations (R01BA52) as these preparations are easily available.

Generally, the commonly used nasal steroids in both public* and private** sectors in 2009 and 2010 are fluticasone, budesonide, mometasone, and beclomethasone. In 2009, the usage of fluticasone was highest followed by mometasone and budesonide. However, in 2010, the usage of budesonide was the highest followed by fluticasone and beclomethasone. This may be due to budesonide nasal spray which has comparable efficacy with other corticosteroid nasal decongestants but can be obtained at lower costs of treatment.

Budesonide usage in 2009 and 2010 was lower than the Australian[2] (1.108 and 0.935 DDD/1000 population/day respectively) and Norwegian[3] data (3.99 and 3.52 DDD/1000 population/day respectively). The same results were seen when comparing Australian[2] (2.352 and 2.353 DDD/1000 population/day respectively) and Norwegian data[3] (8.05 DDD/1000 population/day for both years) for mometasone.

The common nasal decongestant used in Malaysia was oxymetazoline. There were no significant changes in the usage of oxymetazoline through 2009 and 2010 in both public and private sectors. However, the usage of oxymetazoline is higher in the private sectors; mainly because its easily available as over-the-counter medication. Our usage of oxymetazoline was higher than the Australian[2] data (0.004 and 0.003 DDD/1000 population/day respectively) but much lower than Norwegian[3] data (1.85 and 1.65 DDD/1000 population/day respectively).

Antihistamines (R06A) can be divided into several subgroups that are sedative and non-sedative. The most common sedative antihistamines used in Malaysia were diphenhydramine, chlorpheniramine, dexchlorpheniramine and promethazine while the most common non-sedative antihistamines were loratadine, cetirizine, fexofenadine and desloratadine. In general the usage of sedative and non-sedative antihistamines has increased in 2009 and 2010 compared to 2008[1]. In comparison, our usage of antihistamines was higher than Australia[2] but lower than Norway[3]. Among the sedative antihistamines, diphenhydramine (R06AA02) and its' combination (R06AA52), usage was exceptionally higher than previous years. This can be explained by the high prevalence (29.64 rate per 100 encounter of Upper Respiratory Tract Infection reported in the National Medical Care Survey, 2010[4]

Footnote:

* public sector refers to government-owned hospital dan health clinics

** private sector refers to private-owned hospitals, general practitioners, and retail pharmacies.

Table 23.1: Use of Anti-Histamines and Nasal Decongestants, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS	DDD/1000 population/day		DDD/population/year	
		2009	2010	2009	2010
R01	Nasal preparations	5.8003	9.1834	2.1171	3.3519
R06	Antihistamines for systemic use	14.4565	13.5624	5.2875	4.9504

Table 23.2.1: Use of Nasal Decongestants by Drug Class, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS	DDD/1000 population/day		DDD/population/year	
		2009	2010	2009	2010
R01A	Decongestants and other nasal preparations for topical use	2.0121	1.5850	0.7344	0.5785
R01A A	Sympathomimetics, plain	0.3186	0.3145	0.1163	0.1148
R01A C	Antiallergic agents, excl. corticosteroids	0.0004	0.0001	0.0001	<0.0001

ATC	DRUG CLASS	DDD/1000 population/day		DDD/population/year	
		2009	2010	2009	2010
R01B	Nasal decongestants for systemic use	3.8110	7.3690	1.3910	2.6897
R01B A	Sympathomimetics	3.8110	7.3690	1.3910	2.6897

Table 23.2.2: Use of Nasal Decongestants by Drug Class and Agents, in DDD/1000 population/day and DDD/ population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 population/day		DDD/population/ year	
			2009	2010	2009	2010
R01A A	**Sympathomimetics, plain**					
R01A A03	Ephedrine	Public	0.0002	<0.0001	<0.0001	<0.0001
		Private	-	-	-	-
		Total	0.0002	<0.0001	<0.0001	<0.0001
R01A A05	Oxymetazoline	Public	0.0126	0.0169	0.0046	0.0062
		Private	0.2892	0.2854	0.1056	0.1042
		Total	0.3018	0.3023	0.1102	0.1103
R01A A07	Xylometazoline	Public	-	-	-	-
		Private	0.0166	0.0123	0.0061	0.0045
		Total	0.0166	0.0123	0.0061	0.0045
R01A C	**Antiallergic agents, excl. corticosteroids**					
R01A C01	Cromoglicic acid	Public	-	-	-	-
		Private	0.0004	0.0001	0.0001	<0.0001
		Total	0.0004	0.0001	0.0001	<0.0001
R01A D	**Corticosteroids**					
R01A D01	Beclometasone	Public	0.0032	0.3367	0.0012	0.1229
		Private	0.0117	0.0397	0.0043	0.0145
		Total	0.0149	0.3764	0.0054	0.1374
R01A D05	Budesonide	Public	0.2402	0.2674	0.0877	0.0976
		Private	0.1052	0.1875	0.0384	0.0685
		Total	0.3455	0.4550	0.1261	0.1661
R01A D08	Fluticasone	Public	-	0.0040	-	0.0015
		Private	0.6419	0.4032	0.2343	0.1472
		Total	0.6419	0.4072	0.2343	0.1486
R01A D09	Mometasone	Public	0.0063	0.0673	0.0023	0.0246
		Private	0.5631	0.0890	0.2055	0.0325
		Total	0.5694	0.1562	0.2078	0.0570
R01A D11	Triamcinolone	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.0987	0.1021	0.0360	0.0373
		Total	0.0987	0.1021	0.0360	0.0373
R01A D12	Fluticasone furoate	Public	-	-	-	-
		Private	-	0.0028	-	0.0010
		Total	-	0.0028	-	0.0010
R01B A	**Sympathomimetics**					
R01B A02	Pseudoephedrine	Public	0.0007	0.0068	0.0002	0.0025
		Private	0.0102	0.0041	0.0037	0.0015
		Total	0.0108	0.0109	0.0040	0.0040

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 population/day		DDD/population/ year	
			2009	2010	2009	2010
R01B A52	Pseudoephedrine, combinations	Public	2.3108	4.4340	0.8435	1.6184
		Private	1.4735	2.9215	0.5378	1.0664
		Total	3.7844	7.3556	1.3813	2.6848
R01B A53	Phenylephrine, combinations	Public	-	-	-	-
		Private	0.0158	0.0025	0.0058	0.0009
		Total	0.0158	0.0025	0.0058	0.0009

Table 23.3.1: Use of Anti-Histamines by Drug Class, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS	DDD/1000 population/day		DDD/population/year	
		2009	2010	2009	2010
R06A	Antihistamines for systemic use	14.4565	13.5624	5.2875	4.9504
R06A A	Aminoalkyl ethers	4.0847	2.7917	1.4909	1.0190
R06A B	Substituted alkylamines	6.3854	7.8180	2.3306	2.8536
R06A D	Phenothiazine derivatives	0.5213	0.2888	0.1903	0.1054
R06A E	Piperazine derivatives	2.3214	2.2908	0.8473	0.8361
R06A X	Other antihistamines for systemic use	1.1437	0.3731	0.4284	0.1363

Table 23.3.2: Use of Anti-Histamines by Drug Class and Agents, in DDD/1000 population/day and DDD/population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 population/day		DDD/population/ year	
			2009	2010	2009	2010
R06A A	**Aminoalkyl ethers**					
R06A A02	Diphenhydramine	Public	0.0046	0.9590	0.0017	0.3500
		Private	0.1729	0.2112	0.0631	0.0771
		Total	0.1775	1.1702	0.0648	0.4271
R06A A04	Clemastine	Public	-	-	-	-
		Private	0.0116	0.0008	0.0042	0.0003
		Total	0.0116	0.0008	0.0042	0.0003
R06A A08	Carbinoxamine	Public	-	-	-	-
		Private	0.0002	<0.0001	<0.0001	<0.0001
		Total	0.0002	<0.0001	<0.0001	<0.0001
R06A A52	Diphenhydramine, combinations	Public	2.1268	0.0064	0.7763	0.0023
		Private	1.7686	1.6143	0.6455	0.5892
		Total	3.8954	1.6207	1.4218	0.5916
R06A B	**Substituted alkylamines**					
R06A B01	Brompheniramine	Public	-	-	-	-
		Private	0.0984	0.0020	0.0359	0.0007
		Total	0.0984	0.0020	0.0359	0.0007
R06A B02	Dexchlorpheniramine	Public	0.0168	0.3341	0.0061	0.1220
		Private	0.6313	1.8922	0.2304	0.6907
		Total	0.6480	2.2263	0.2365	0.8126
R06A B04	Chlorphenamine	Public	3.0784	4.3764	1.1236	1.5974
		Private	2.5554	1.2066	0.9327	0.4404
		Total	5.6338	5.5830	2.0563	2.0378

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 population/day		DDD/population/ year	
			2009	2010	2009	2010
R06A B05	Pheniramine	Public	-	-	-	-
		Private	-	<0.0001	-	<0.0001
		Total	-	<0.0001	-	<0.0001
R06A B54	Chlorphenamine, combinations	Public	-	-	-	-
		Private	0.0053	0.0067	0.0019	0.0024
		Total	0.0053	0.0067	0.0019	0.0024
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	0.2575	0.1810	0.0940	0.0661
		Private	0.1183	0.0870	0.0432	0.0318
		Total	0.3758	0.2681	0.1372	0.0978
R06A D07	Mequitazine	Public	-	-	-	-
		Private	0.0906	0.0091	0.0331	0.0033
		Total	0.0906	0.0091	0.0331	0.0033
R06A D52	Promethazine, combinations	Public	-	<0.0001	-	<0.0001
		Private	0.0549	0.0116	0.0201	0.0042
		Total	0.0549	0.0116	0.0201	0.0042
R06A E	**Piperazine derivatives**					
R06A E01	Buclizine	Public	-	-	-	-
		Private	0.0307	0.0248	0.0112	0.0091
		Total	0.0307	0.0248	0.0112	0.0091
R06A E05	Meclozine	Public	-	0.0058	-	0.0021
		Private	0.0004	0.0017	0.0001	0.0006
		Total	0.0004	0.0076	0.0001	0.0028
R06A E07	Cetirizine	Public	0.1632	0.2284	0.0596	0.0834
		Private	2.0278	1.3726	0.7401	0.5010
		Total	2.1910	1.6010	0.7997	0.5843
R06A E09	Levocetirizine	Public	0.0032	0.0074	0.0012	0.0027
		Private	0.0897	0.0662	0.0327	0.0242
		Total	0.0929	0.0736	0.0339	0.0269
R06A E55	Meclozine, combinations	Public	0.0023	0.5437	0.0008	0.1984
		Private	0.0042	0.0402	0.0015	0.0147
		Total	0.0064	0.5838	0.0023	0.2131
R06A X	**Other antihistamines for systemic use**					
R06A X07	Triprolidine	Public	0.0004	0.0050	0.0001	0.0018
		Private	0.0074	0.0043	0.0027	0.0016
		Total	0.0078	0.0093	0.0028	0.0034
R06A X09	Azatadine	Public	-	-	-	-
		Private	0.0015	-	0.0005	-
		Total	0.0015	-	0.0005	-
R06A X13	Loratadine	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.4465	0.0738	0.1630	0.0269
		Total	0.4466	0.0738	0.1630	0.0270

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD/1000 population/day		DDD/population/ year	
			2009	2010	2009	2010
R06A X17	Ketotifen	Public	<0.0001	<0.0001	<0.0001	<0.0001
		Private	0.4569	0.0733	0.1668	0.0267
		Total	0.4570	0.0733	0.1668	0.0268
R06A X18	Acrivastine	Public	-	-	-	-
		Private	<0.0001	-	<0.0001	-
		Total	<0.0001	-	<0.0001	-
R06A X19	Azelastine	Public	-	-	-	-
		Private	-	0.0018	-	0.0007
		Total	-	0.0018	-	0.0007
R06A X26	Fexofenadine	Public	0.0015	0.0004	0.0005	0.0002
		Private	0.0858	0.1136	0.0313	0.0414
		Total	0.0873	0.1140	0.0319	0.0416
R06A X27	Desloratadine	Public	0.0194	0.0207	0.0071	0.0076
		Private	0.1542	0.0802	0.0563	0.0293
		Total	0.1735	0.1009	0.0633	0.0368

References:

1. *Malaysian Statistics on Medicines 2008;* Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health Malaysia Printing Office: Kuala Lumpur 2013.
2. *Australian Statistics on Medicines 2010;* Australian Drug Utilization Subcommittee Secretariat, Pharmaceutical Benefits Advisory Committee Printing Office: Australia 2012
3. Sakshaug, S. et al. *Drug Consumption in Norway 2008-2012;* Norwegian Institute of Public Health Printing Office: Oslo, March 2013.
4. *National Medical Care Statistics 2010*; Ministry of Health, Malaysia, 2012.

CHAPTER 24: USE OF OPHTHALMOLOGICALS

Elias H.[1], Bethel L.[2], Shamala R.[3], Manimegahlai S.[4], Nur Izzura M.S.[5]

1. Selayang Hospital, 2. Tuanku Ja'afar Hospital, 3.Sg Buloh Hospital, 4. Raja Permaisuri Bainun Hospital, Ipoh, 5. Malacca Hospital

The National Medicine Use Survey 2009 and 2010 has results on common ophthalmological agents used over a two year period in Malaysia. The source data providers are from the government facilities (100%), university hospitals (100%), army hospitals (100%), private hospitals (23%), general practitioners (7.1%) and retail pharmacies (49%). In view of the fact that many of the private ophthalmology services are non-hospital based, these may not have been captured in the source data sampling.

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 was chloramphenicol (0.8116g/ml/cc per 1000 population/ day in 2009 and 0.8732g/ml/cc per 1000 population/ day in 2010), followed by gentamicin (0.0726 g/ml/cc per 1000 population/day in 2009 and 0.0511 g/ml/cc per 1000 population/ day in 2010) and fucidic acid (0.0288g/ml/cc per 1000 population/day in 2009 and 0.0180 g/ml/cc per 1000 population/ day in 2010). Usage of chloramphenicol has increased steadily over the years and this is probably due to the expansion of primary care services in the country. It is alarming that there is an increase in the use of combination antibiotics as it may lead to increase in resistance. Most cases of bacterial conjunctivitis can be treated with a single antiobiotic[1]. In the public sector, there is a two fold increase in the use of moxifloxacin. This may be due to shift in the trend of management of bacterial keratitis towards using a broader spectrum antibiotic in the initial phase and an increased usage in post cataract surgical prophylaxis[2,3].

For topical steroids, there is an increasing trend in both the public and private sector. This is partly due to increased number of surgical procedures done in both the public and private sectors for which dexamethasone is the mainstay steroid choice. The use of ketorolac is seeing an increasing trend in both the sectors due to its wider indications such as in the prophylaxis of macular oedema post ocular surgery particularly in diabetic patients and in laser procedures.

Combination of dexamethasone and antiinfectives showed a reducing pattern in both the sectors because there was some difficulty in procurement of this. Previously this combination was widely used in post ocular surgery. This may explain the increased use of single antibiotic and single steroid prescribed individually for use together in place of combination drugs.

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 (2.9492 DDD/1000 population/ day) in 2009. However, its use is on the decline in 2010 (2.0147 DDD/1000 population/ day). Among the anti-glaucoma agents, latanoprost remains the second commonest used drug in 2009 (0.5675 DDD/1000 population/ day) and 2010 (1.8523 DDD/1000 population/ day). The other commonly used anti-glaucoma agents (in order of usage) were pilocarpine, dorzolamide, betaxolol, brimonidine and bimatoprost. In 2009 and 2010, 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 2008. 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 patterns among 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 (0.0829 DDD/1000 population/ day in 2009 and 0.0611 DDD/1000 population/ day in 2010). Among the longer acting dilating agents, homatropine (0.1442 DDD/1000 population/ day in 2009 and 0.0154 DDD/1000 population/ day in 2010) is the most common.

Cromoglicic acid remains the commonest anti-allergen followed by olopatadine. The trend is similar to the values in 2008. 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 2009 and 2010. The use of verteporfin and ranibizumab remains similar to 2008.

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 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01A A	**Antibiotics**				
S01A A01	Chloramphenicol	g/ml/cc	Public	0.5626	0.6165
			Private	0.2490	0.2566
			Total	0.8116	0.8732
S01A A02	Chlortetracycline	g/ml/cc	Public	0.0002	0.0002
			Private	-	-
			Total	0.0002	0.0002
S01A A03	Neomycin	g/ml/cc	Public	-	-
			Private	0.0004	-
			Total	0.0004	-
S01A A09	Tetracycline	g/ml/cc	Public	-	-
			Private	0.0006	-
			Total	0.0006	-
S01A A10	Natamycin	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0002	<0.0001
			Total	0.0003	<0.0001
S01A A11	Gentamicin	g/ml/cc	Public	0.0075	0.0089
			Private	0.0651	0.0422
			Total	0.0726	0.0511
S01A A12	Tobramycin	g/ml/cc	Public	-	<0.0001
			Private	0.0056	0.0023
			Total	0.0056	0.0023
S01A A13	Fusidic acid	g/ml/cc	Public	0.0093	0.0038
			Private	0.0195	0.0142
			Total	0.0288	0.0180
S01A A17	Erythromycin	g/ml/cc	Public	-	-
			Private	0.0008	0.0001
			Total	0.0008	0.0001
S01A A18	Polymyxin B	g/ml/cc	Public	-	-
			Private	<0.0001	<0.0001
			Total	<0.0001	<0.0001
S01A A23	Netilmicin	g/ml/cc	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001
S01A A30	Combinations of different antibiotics	g/ml/cc	Public	0.0060	0.0111
			Private	0.0129	0.0172
			Total	0.0189	0.0283
S01A D	**Antivirals**				
S01A D03	Aciclovir	g/ml/cc	Public	0.0018	0.0006
			Private	0.0012	0.0005
			Total	0.0030	0.0011
S01A D05	Interferon	g/ml/cc	Public	-	<0.0001
			Private	-	-
			Total	-	<0.0001

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01A X	**Other antiinfectives**				
S01A X11	Ofloxacin	g/ml/cc	Public	-	0.0003
			Private	-	-
			Total	-	0.0003
S01A X12	Norfloxacin	g/ml/cc	Public	0.0003	-
			Private	0.0074	0.0027
			Total	0.0077	0.0027
S01A X13	Ciprofloxacin	g/ml/cc	Public	0.0426	0.0121
			Private	0.2568	0.0073
			Total	0.2995	0.0193
S01A X17	Lomefloxacin	g/ml/cc	Public	-	<0.0001
			Private	0.0016	0.0011
			Total	0.0016	0.0011
S01A X19	Levofloxacin	g/ml/cc	Public	-	-
			Private	0.0014	<0.0001
			Total	0.0014	<0.0001
S01A X21	Gatifloxacin	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0019	0.0006
			Total	0.0020	0.0007
S01A X22	Moxifloxacin	g/ml/cc	Public	0.0016	0.0032
			Private	0.0111	0.0026
			Total	0.0127	0.0058

Table 24.2: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01B A	**Corticosteroids, plain**				
S01B A01	Dexamethasone	g/ml/cc	Public	0.0092	0.0279
			Private	0.0103	0.0154
			Total	0.0194	0.0433
S01B A04	Prednisolone	g/ml/cc	Public	0.0020	0.0002
			Private	0.0067	0.0057
			Total	0.0088	0.0059
S01B A06	Betamethasone	g/ml/cc	Public	0.0101	0.0032
			Private	0.0007	<0.0001
			Total	0.0108	0.0032
S01B A07	Fluorometholone	g/ml/cc	Public	0.0108	0.0019
			Private	0.0048	0.0020
			Total	0.0157	0.0039
S01B C	**Antiinflammatory agents, non-steroids**				
S01B C03	Diclofenac	g/ml/cc	Public	-	-
			Private	0.0002	<0.0001
			Total	0.0002	<0.0001
S01B C05	Ketorolac	g/ml/cc	Public	0.0033	0.0059
			Private	0.0016	0.0034
			Total	0.0049	0.0092

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01B C10	Nepafenac	g/ml/cc	Public	-	-
			Private	0.0015	0.0003
			Total	0.0015	0.0003

Table 24.3: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01C A	**Corticosteroids and antiinfectives in combination**				
S01C A01	Dexamethasone and antiinfectives	g/ml/cc	Public	0.0133	0.0035
			Private	0.0559	0.0423
			Total	0.0692	0.0457
S01C A05	Betamethasone and antiinfectives	g/ml/cc	Public	0.0093	0.0101
			Private	0.0035	0.0006
			Total	0.0128	0.0107
S01C A07	Fluorometholone and antiinfectives	g/ml/cc	Public	-	-
			Private	0.0004	-
			Total	0.0004	-

Table 24.4: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01E A	**Sympathomimetics in glaucoma therapy**				
S01E A05	Brimonidine	ml	Public	0.0218	0.0708
			Private	0.0081	0.0052
			Total	0.0299	0.0759
S01E B	**Parasympathomimetics**				
S01E B01	Pilocarpine	mg	Public	2.2108	0.6005
			Private	0.1402	0.0707
			Total	2.3510	0.6712
S01E B02	Carbachol	ml	Public	0.0022	0.0062
			Private	0.0015	0.0007
			Total	0.0038	0.0070
S01E C	**Carbonic anhydrase inhibitors**				
S01E C01	Acetazolamide	g	Public	0.0088	0.0128
			Private	0.0022	0.0020
			Total	0.0110	0.0148
S01E C03	Dorzolamide	ml	Public	0.6821	0.3122
			Private	0.0109	0.0025
			Total	0.6930	0.3148
S01E C04	Brinzolamide	ml	Public	0.0437	0.0293
			Private	0.0460	0.0123
			Total	0.0897	0.0417
S01E D	**Beta blocking agents**				
S01E D01	Timolol	ml	Public	2.8853	1.9842
			Private	0.0639	0.0305
			Total	2.9492	2.0147
S01E D02	Betaxolol	ml	Public	0.0650	0.2130
			Private	0.0087	0.0023
			Total	0.0737	0.2153

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01E D03	Levobunolol	ml	Public	-	-
			Private	0.0013	0.0047
			Total	0.0013	0.0047
S01E D51	Timolol, combinations	ml	Public	0.0020	0.0050
			Private	0.0193	0.0090
			Total	0.0213	0.0141
S01E E	**Prostaglandin analogues**				
S01E E01	Latanoprost	ml	Public	0.5075	1.8319
			Private	0.0600	0.0204
			Total	0.5675	1.8523
S01E E03	Bimatoprost	ml	Public	0.0075	0.0511
			Private	0.0047	0.0049
			Total	0.0122	0.0560
S01E E04	Travoprost	ml	Public	0.0095	0.0086
			Private	0.0184	0.0047
			Total	0.0279	0.0133

Table 24.5: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01F A	**Anticholinergics**				
S01F A01	Atropine	g/ml/cc	Public	0.0092	0.0036
			Private	0.0010	0.0018
			Total	0.0102	0.0055
S01F A04	Cyclopentolate	g/ml/cc	Public	0.0229	0.0071
			Private	0.0044	0.0019
			Total	0.0273	0.0090
S01F A05	Homatropine	g/ml/cc	Public	0.1395	0.0104
			Private	0.0047	0.0050
			Total	0.1442	0.0154
S01F A06	Tropicamide	g/ml/cc	Public	0.0736	0.0521
			Private	0.0093	0.0090
			Total	0.0829	0.0611
S01F B	**Sympathomimetics excl. antiglaucoma preparations**				
S01F B01	Phenylephrine	g/ml/cc	Public	0.0107	0.0073
			Private	0.0015	0.0008
			Total	0.0122	0.0081

Table 24.6: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01G A	**Sympathomimetics used as decongestants**				
S01G A01	Naphazoline	g/ml/cc	Public	-	-
			Private	0.0004	0.0002
			Total	0.0004	0.0002
S01G A02	Tetryzoline	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0117	0.0065
			Total	0.0118	0.0065

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01G A05	Phenylephrine	g/ml/cc	Public	-	-
			Private	-	0.0002
			Total	-	0.0002
S01G A51	Naphazoline, combinations	g/ml/cc	Public	0.0015	-
			Private	0.0140	0.0104
			Total	0.0155	0.0104
S01G A52	Tetryzoline, combinations	g/ml/cc	Public	0.0023	0.0074
			Private	0.0287	0.0116
			Total	0.0310	0.0190
S01G A55	Phenylephrine, combinations	g/ml/cc	Public	0.0003	0.0025
			Private	0.0001	<0.0001
			Total	0.0004	0.0025
S01G X	**Other antiallergics**				
S01G X01	Cromoglicic acid	g/ml/cc	Public	0.0283	0.0080
			Private	0.0153	0.0053
			Total	0.0436	0.0134
S01G X05	Lodoxamide	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0005	0.0001
			Total	0.0005	0.0001
S01G X06	Emedastine	g/ml/cc	Public	<0.0001	<0.0001
			Private	0.0012	0.0006
			Total	0.0013	0.0006
S01G X08	Ketotifen	g/ml/cc	Public	-	-
			Private	0.0011	0.0007
			Total	0.0011	0.0007
S01G X09	Olopatadine	g/ml/cc	Public	0.0030	0.0043
			Private	0.0041	0.0006
			Total	0.0072	0.0049

Table 24.7: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01H A	**Local anesthetics**				
S01H A02	Oxybuprocaine	g/ml/cc	Public	-	-
			Private	<0.0001	<0.0001
			Total	<0.0001	<0.0001
S01H A03	Tetracaine	g/ml/cc	Public	<0.0001	-
			Private	<0.0001	<0.0001
			Total	0.0001	<0.0001
S01H A04	Proxymetacaine	g/ml/cc	Public	0.1632	0.0705
			Private	0.0207	0.0169
			Total	0.1839	0.0874

Table 24.8: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01L A	**Antineovascularisation agents**				
S01L A01	Verteporfin	mg	Public	-	<0.0001
			Private	<0.0001	<0.0001
			Total	<0.0001	0.0001

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01L A04	Ranibizumab	g/ml/cc	Public	-	<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 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S01X A	**Other ophthalmologicals**				
S01X A13	Alteplase	g/ml/cc	Public	-	-
			Private	-	<0.0001
			Total	-	<0.0001
S01X A18	Ciclosporin	g/ml/cc	Public	0.0003	0.0023
			Private	0.0013	0.0017
			Total	0.0016	0.0040

Table 24.10: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S03A A	**Antiinfectives**				
S03A A06	Gentamicin	g/ml/cc	Public	0.0030	0.0002
			Private	0.0025	0.0028
			Total	0.0055	0.0030
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 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S03B A	**Corticosteroids**				
S03B A03	Betamethasone	g/ml/cc	Public	0.0027	0.0023
			Private	0.0047	<0.0001
			Total	0.0075	0.0024

Table 24.12: Use of Ophthalmological by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S03C A	**Corticosteroids and antiinfectives in combination**				
S03C A01	Dexamethasone and antiinfectives	g/ml/cc	Public	0.0024	0.2710
			Private	0.1715	0.1352
			Total	0.1738	0.4062
S03C A06	Betamethasone and antiinfectives	g/ml/cc	Public	0.0003	0.0002
			Private	0.0178	0.0067
			Total	0.0180	0.0069

References:

1. Dart, J.K. Eye disease at A Community Health Centre. *Br Med J (Clin Res Ed)*. 1986, 293-1477
2. Leibowitz, H.M. The Red Eye. *N EngI J Med*. 2000,343-345
3. Yagci, R.; Oflu ,Y.;Dincel, A.; Kaya, E.; Yagci, S.; Bayar, B.; Duman, S.; Bozkurt, A. Penetration of Second, Third and Fourth Generation Topical Fluoroquinolones Into Aqueous and Vitreous Humor In a Rabbit Endophthalmitis Model. *Eye (Lond)*. **2007** Jul,21(7),990-4
4. *National Clinical Practice Guidelines on Management of Primary Open Angle Glaucoma;* Ministry of Health, 2008.

CHAPTER 25: USE OF OTOLOGICALS

Valuyeetham K.A.[1], Saraiza A.B.[2], Leow W.L. [3], Aswani Yanti B.[4], Primuharsa Putra S.H.A.[5]

1. Tuanku Ja'afar Hospital, Seremban, 2. Serdang Hospital,Selangor, 3. Hospital Kuala Lumpur, Kuala Lumpur, 4. Ampang Hospital, Selangor, 5. KPJ Seremban Specialist Hospital/KPJ Healthcare University College

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 antiinfective is chloramphenicol (S02AA01) which is easily available in peripheral government clinics and private general practitioners. The overall usage of chloramphenicol has increased from 2008[2] to 2010. Other drugs such as gentamicin (S02AA14), and antiinfectives, combination (S02AA30) 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. In comparison, our usage trend was comparable to Australian data[3].

Table 25.1: Use of Otologicals by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S02A A	**Antiinfectives**				
S02A A01	Chloramphenicol	g/ml/cc	Public	0.1290	0.1479
			Private	0.0344	0.0572
			Total	0.1634	0.2050
S02A A03	Boric acid	g/ml/cc	Public	-	-
			Private	-	0.0004
			Total	-	0.0004
S02A A14	Gentamicin	g/ml/cc	Public	-	-
			Private	0.0004	-
			Total	0.0004	-
S02A A16	Ofloxacin	g/ml/cc	Public	0.0064	0.0075
			Private	0.2542	0.0052
			Total	0.2606	0.0127
S02A A30	Antiinfectives, combinations	g/ml/cc	Public	-	-
			Private	0.0086	0.0031
			Total	0.0086	0.0031

Table 25.2: Use of Otologicals by Drug Class and Agents, in DDD/1000 population/day 2009-2010

ATC	DRUG CLASS AND AGENTS	UNIT	SECTOR	2009	2010
S02C A	**Corticosteroids and antiinfectives in combination**				
S02C A03	Hydrocortisone and antiinfectives	g/ml/cc	Public	0.0019	0.0001
			Private	0.0065	0.0137
			Total	0.0084	0.0139
S02C A04	Triamcinolone and antiinfectives	g/ml/cc	Public	0.0009	-
			Private	0.0002	-
			Total	0.0012	-
S02C A06	Dexamethasone and antiinfectives	g/ml/cc	Public	0.0359	<0.0001
			Private	<0.0001	0.0009
			Total	0.0360	0.0009

References:

1. *Guidelines for ATC Classification and DDD Assignment 16th edition*; WHO Collaborating Centre for Drug Statistics Methodology, Oslo, 2012.
2. *Malaysian Statistics On Medicines 2008*; Pharmaceutical Services Division & Clinical Research Centre, Ministry of Health, Malaysia, April 2013.
3. *Australian Statistics on Medicines 2010*; Commonwealth of Australia, 2012.

CHAPTER 26: USE OF DRUGS FOR COUGH AND COLD

Tan K.K.[1], Primuharsa Putra S.H.A.[2], Ho B.K.[3], Husni H.[4],Chan P.L.[5], Norazida A.R.[6], Saraiza A.B.[7]

1. Hospital Tuanku Ja'afar, Seremban 2. KPJ Seremban Specialist Hospital/KPJ Healthcare University College 3. Klinik Kesihatan Bandar Botanik, Klang 4. Klinik Kesihatan Putrajaya 5. Healthcare Statistics Unit, Clinical Research Centre 6. Pharmaceutical Services Division 7. Hospital Serdang, Selangor.

Upper respiratory tract infection (URTI) is one of the leading causes of medical consultations in primary care. The National Medical Care Survey 2010 reported that the prevalence of URTI was 29.64% in all age groups[1]. Earlier data from the National Health and Morbidity Survey 2006 showed that acute respiratory illness (ARI) affected daily activities of 30.8% of the population with 60.6% of those having ARI sought treatment for the illness. Common cold was the commonest illness reported among those with ARI (16.9%)[2].

Cough and cold medicines are commonly used to treat upper respiratory tract symptoms in children and adults. These medicines do not cure the infection, but aim to reduce symptoms such as runny nose and cough. Drugs commonly used for symptomatic relief of URTI include antihistamines, nasal decongestants, cough suppressants, expectorants and mucolytics, in single or multiple-ingredients preparations.

Cough and cold combination products reported in this chapter has been coded according to the standard rules for ATC coding based on WHO guidelines, as shown in Figure 26.1. There is no specific defined daily dose (DDD) assigned by WHO for combinations of cough and cold preparations, though it does recommend that fixed DDDs based on the product's recommended dosage to be assigned[3]. 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. For this report, the DDD adopted for combination of cough and cold preparations are 30ml (oral liquid formulation) and 6 tablets (tablets/capsules/caplets).

Drugs used for cough and cold were categorised by drug class and agents. Overall, systemic antihistamines (R06A) were the most commonly used in year 2009 and 2010 (Table 26.1.1). This was followed by systemic nasal decongestants (R01B) and cough suppressants excluding combinations with expectorants (R05D). Of these main drug classes, total utilisation of systemic nasal decongestants (R01B) and expectorants combinations (R05C) increased from 2009 to 2010, but the rest showed decreasing trend in total utilisation.

The usage of pseudoephedrine combinations (R01BA52) was 1.3813 DDD/population/year in 2009, the highest in its class of systemic nasal decongestants (Table 26.2.1). The number increased up to two-fold in 2010, showing increased in utilisation of this agent. Their usage was also slightly higher in the public sector. If we compared the 2010 data, the consumption of pseudoephedrine combinations was much lower in Finland (2.50 DDD/1000 population/day) compared to Malaysia (7.36 DDD/1000 population/day)[4]. There was not much difference in the usage of pseudoephedrine (R01BA02) as it remains low. On the other hand, phenylephrine combinations (R01BA53) were only used in private sector.

As for cough suppressants, most of the products were used in private sectors only, while public sector recorded very minimal usage of dextromethorphan (R05DA09), cough suppressants combinations (R05DA20), and cloperastine (R05DB21). Most of the cough suppressant products were not easily available in public sector especially in the primary care clinics and some were not included in national drug formulary, which led to low utilisation compared to private sector.

As shown in Table 26.1.1, overall utilisation of systemic antihistamines decreased by 6.4% from 2009 to 2010. Chlorpheniramine was the most used systemic antihistamine in 2009, but its utilisation decreased by 0.9% in 2010 (Table 26.2.5). By comparison, dexchlorpheniramine was the second most used drug in 2009 but their utilisation showed little change and decreased an increment of 243% in 2010. Diphenhydramine combination (R06AA52) was the third commonly used drugs in both years. Among the non-sedating antihistamines, cetirizine and loratadine reported highest utilisation. Comparison between sectors showed that non-sedating antihistamines were used more frequently in private sector (Table 26.2.5). Nevertheless, it is important to note that usage of systemic antihistamines in this report also include their use for other indications. Hence this does not reflect the usage for systemic antihistamines for treatment of cough and cold alone.

Several combination products were presented in the table included in this chapter. Among these combination preparations, pseudoephedrine combinations (R01BA52) was the most used, followed by diphenhydramine combinations and promethazine combinations, the latter being mostly used in the private sector.

In conclusion, cough and cold preparations are widely used in Malaysia for symptomatic relief. Most of the drugs showed a decreasing trend in their usage, especially systemic antihistamines. This may be related to increasing awareness towards safety profile of this agent, which discourage the prescribing of antihistamines especially for children below two years. While the data presented in this chapter represented majority of the drugs used for cough and cold, the usage reported was based partially on procurement data which may not accurately reflect total consumption pattern in Malaysia.

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

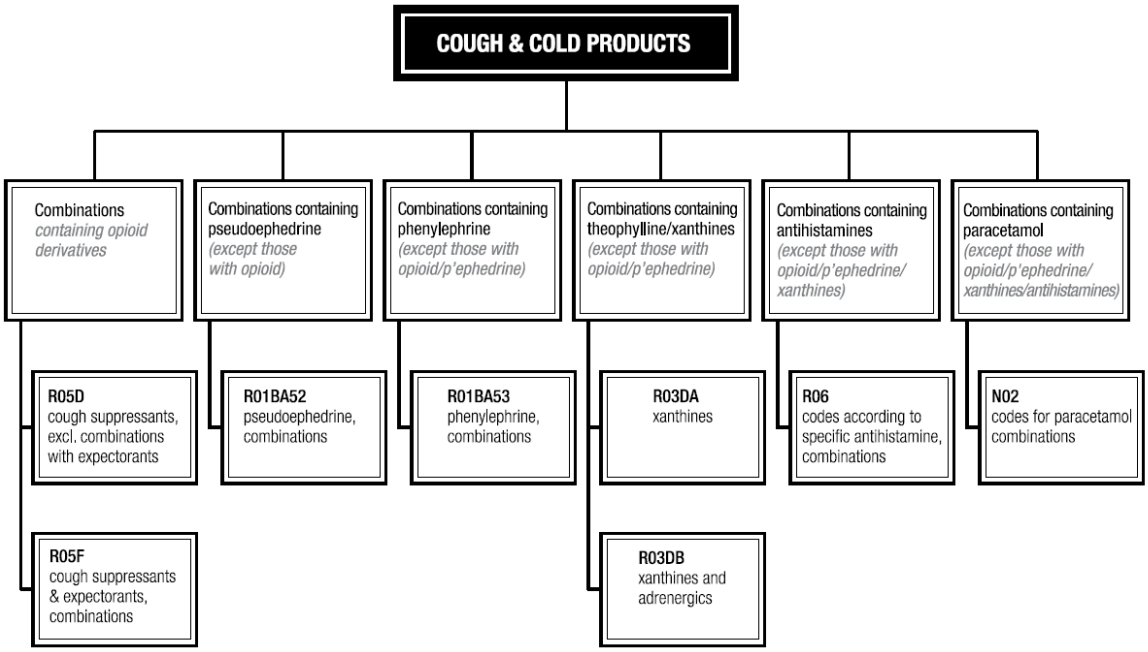


Table 26.1.1: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/ population/year 2009-2010

ATC	DRUG CLASS	DDD/1000 population/day		DDD/population/year	
		2009	2010	2009	2010
R01B	Nasal decongestants for systemic use	3.8110	7.3690	1.3910	2.6897
R03D	Other systemic drugs for obstructive airway diseases	1.3550	1.2322	<0.0001	-
R05C	Expectorants, excl. combinations with cough suppressants	0.1196	0.6672	0.0199	0.0188
R05D	Cough suppressants, excl. combinations with expectorants	1.0568	0.7413	0.3857	0.2706
R05F	Cough suppressants and expectorants, combinations	0.0558	0.0177	0.0204	0.0065
R06A	Antihistamines for systemic use	14.4866	13.5625	5.2847	4.9470

Table 26.2.1: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/ population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 population/day		DDD/population/year	
				2009	2010	2009	2010
R01B	**Nasal decongestants for systemic use**						
R01B A	**Sympathomimetics**						
R01B A02	Pseudoephedrine	Public	0.24g	0.0007	0.0068	0.0002	0.0025
		Private		0.0102	0.0041	0.0037	0.0015
		Total		0.0108	0.0109	0.0040	0.0040
R01B A52	Pseudoephedrine, combinations	Public	0.24g	2.3108	4.4340	0.8435	1.6184
		Private		1.4735	2.9215	0.5378	1.0664
		Total		3.7844	7.3556	1.3813	2.6848
R01B A53	Phenylephrine, combinations	Public	6tablet/30ml	-	-	-	-
		Private		0.0158	0.0025	0.0058	0.0009
		Total		0.0158	0.0025	0.0058	0.0009

Table 26.2.2: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/ population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 population/day		DDD/population/year	
				2009	2010	2009	2010
R05C	**Expectorants, excl. combinations with cough suppressants**						
R05C A	**Expectorants**						
R05C A10	Combinations	Public	30ml	-	-	-	-
		Private		0.0406	0.0415	0.0148	0.0151
		Total		0.0406	0.0415	0.0148	0.0151
R05C B	**Mucolytics**						
R05C B10	Combinations	Public	30ml	-	-	-	-
		Private		0.0139	0.0100	0.0051	0.0036
		Total		0.0139	0.0100	0.0051	0.0036

Table 26.2.3: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/ population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 population/day		DDD/population/year	
				2009	2010	2009	2010
R05D	**Cough suppressants, excl. combinations with expectorants**						
R05D A	**Opium alkaloids and derivatives**						
R05D A04	Codeine	Public	0.1g	-	-	-	-
		Private		0.0015	0.0056	0.0005	0.0021
		Total		0.0015	0.0056	0.0005	0.0021
R05D A08	Pholcodine	Public	50mg	-	-	-	-
		Private		0.0571	0.0826	0.0208	0.0302
		Total		0.0571	0.0826	0.0208	0.0302
R05D A09	Dextromethorphan	Public	90mg	0.0007	-	0.0002	-
		Private		0.5938	0.2248	0.2167	0.0820
		Total		0.5944	0.2248	0.217	0.0820
R05D A20	Combinations, cough suppressants opioid alkaloids and derivatives	Public	6 tablet/ 30ml	<0.0001	<0.0001	<0.0001	<0.0001
		Private		0.3356	0.3763	0.1225	0.1373
		Total		0.3356	0.3763	0.1225	0.1373
R05D B	**Other cough suppressants**						
R05D B21	Cloperastine	Public	60mg	-	0.0008	-	0.0003
		Private		0.0682	0.0512	0.0249	0.0187
		Total		0.0682	0.0520	0.0249	0.0190

Table 26.2.4: Use of Cough and Cold Preparations by Drug Class, in DDD/1000 population/day and DDD/ population/year 2009-2010

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 population/day		DDD/population/year	
				2009	2010	2009	2010
R05F	**Cough suppressants and expectorants, combinations**						
R05F A	**Opium derivatives and expectorants**						
R05F A01	Opium derivatives and mucolytics	Public	30ml	-	-	-	-
		Private		0.0442	0.0106	0.0161	0.0039
		Total		0.0442	0.0106	0.0161	0.0039
R05F A02	Opium derivatives and expectorants	Public	6 tablet/ 30ml	-	-	-	-
		Private		0.0116	0.0072	0.0042	0.0026
		Total		0.0116	0.0072	0.0042	0.0026

Table 26.2.5: 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	
				2009	2010	2009	2010
R06A	**Antihistamines for systemic use**						
R06A A	**Aminoalkyl ethers**						
R06A A02	Diphenhydramine	Public	0.2/0.3g	0.0046	0.9590	0.0017	0.3500
		Private		0.1729	0.2112	0.0631	0.0771
		Total		0.1775	1.1702	0.0648	0.4271
R06A A04	Clemastine	Public	2mg	-	-	-	-
		Private		0.0116	0.0008	0.0042	0.0003
		Total		0.0116	0.0008	0.0042	0.0003
R06A A08	Carbinoxamine	Public	16mg	-	-	-	-
		Private		0.0002	<0.0001	<0.0001	<0.0001
		Total		0.0002	<0.0001	<0.0001	<0.0001
R06A A52	Diphenhydramine, combinations	Public	30ml	2.1268	0.0064	0.7763	0.0023
		Private		1.7686	1.6143	0.6455	0.5892
		Total		3.8954	1.6207	1.4218	0.5916
R06A B	**Substituted alkylamines**						
R06A B01	Brompheniramine	Public	24mg	-	-	-	-
		Private		0.0984	0.0020	0.0359	0.0007
		Total		0.0984	0.0020	0.0359	0.0007
R06A B02	Dexchlorpheniramine	Public	6mg	0.0168	0.3341	0.0061	0.1120
		Private		0.6313	1.8922	0.2304	0.6907
		Total		0.6480	2.2263	0.2365	0.8126
R06A B04	Chlorphenamine	Public	12mg	3.0784	4.3764	1.1236	1.5974
		Private		2.5554	1.2066	0.9327	0.4404
		Total		5.6338	5.5830	2.0563	2.0378
R06A B54	Chlorphenamine, combinations	Public	6 tablet /30ml	-	-	-	-
		Private		0.0053	0.0067	0.0019	0.0024
		Total		0.0053	0.0067	0.0019	0.0024
R06A D	**Phenothiazine derivatives**						
R06A D01	Alimemazine	Public	30mg	-	-	-	-
		Private		<0.0001	<0.0001	<0.0001	<0.0001
		Total		<0.0001	<0.0001	<0.0001	<0.0001
R06A D02	Promethazine	Public	25mg	0.2575	0.1810	0.0940	0.0661
		Private		0.1183	0.0870	0.0432	0.0318
		Total		0.3758	0.2681	0.1372	0.0978
R06A D07	Mequitazine	Public	10mg	-	-	-	-
		Private		0.0906	0.0091	0.0033	0.0331
		Total		0.0906	0.0091	0.0033	0.0331
R06A D52	Promethazine, combinations	Public	30ml	-	<0.0001	-	<0.0001
		Private		0.0549	0.0116	0.0042	0.0201
		Total		0.0549	0.0116	0.0042	0.0201
R06A E	**Piperazine derivatives**						
R06A E01	Buclizine	Public	50mg	-	-	-	-
		Private		0.0307	0.0248	0.0112	0.0091
		Total		0.0307	0.0248	0.0112	0.0091

ATC	DRUG CLASS AND AGENTS	SECTOR	DDD	DDD/1000 population/day		DDD/population/year	
				2009	2010	2009	2010
R06A E05	Meclozine	Public	50mg	-	0.0058	-	0.0021
		Private		0.0004	0.0017	0.0001	0.0006
		Total		0.0004	0.0076	0.0001	0.0028
R06A E07	Cetirizine	Public	10mg	0.1632	0.2284	0.0596	0.0834
		Private		2.0278	1.3726	0.7401	0.5010
		Total		2.1910	1.6010	0.7997	0.5843
R06A E09	Levocetirizine	Public	5mg	0.0032	0.0074	0.0012	0.0027
		Private		0.0897	0.0662	0.0327	0.0242
		Total		0.0929	0.0736	0.0339	0.0269
R06A E55	Meclozine, combinations	Public		0.0023	0.5437	0.0008	0.1984
		Private		0.0042	0.0402	0.0015	0.0147
		Total		0.0064	0.5838	0.0023	0.2131
R06A X	**Other antihistamines for systemic use**						
R06A X09	Azatadine	Public	2mg	-	-	-	-
		Private		0.0015	-	0.0005	-
		Total		0.0015	-	0.0005	-
R06A X13	Loratadine	Public	10mg	<0.0001	<0.0001	<0.0001	<0.0001
		Private		0.4465	0.0738	0.1630	0.0269
		Total		0.4466	0.0738	0.1630	0.0270
R06A X17	Ketotifen	Public	2mg	<0.0001	<0.0001	<0.0001	<0.0001
		Private		0.4569	0.0733	0.1668	0.0267
		Total		0.4570	0.0733	0.1668	0.0268
R06A X18	Acrivastine	Public	24mg	-	-	-	-
		Private		<0.0001	-	<0.0001	-
		Total		<0.0001	-	<0.0001	-
R06A X19	Azelastine	Public	4mg	-	-	-	-
		Private		-	0.0018	-	0.0007
		Total		-	0.0018	-	0.0007
R06A X26	Fexofenadine	Public	0.12g	0.0015	0.0004	0.0005	0.0002
		Private		0.0858	0.1136	0.0313	0.0414
		Total		0.0873	0.114	0.0319	0.0416
R06A X27	Desloratadine	Public	5mg	0.0194	0.0207	0.0071	0.0076
		Private		0.1542	0.0802	0.0563	0.0293
		Total		0.1735	0.1009	0.0633	0.0368

References:

1. *National Medical Care Survey 2010*;Clinical Research Centre, Ministry of Health Malaysia.
2. *The Third National Health and Morbidity Survey 2006*; Institute of Public Health, Ministry of Health Malaysia.
3. *Guidelines for ATC Classification and DDD Assignment 2011*;WHO Collaborating Centre for Drug Statistics Methodology,Oslo, 2010.
4. *Finnish Statistics on Medicines 2010*;Finnish Medicines Agency and Kansaneläkelaitos.

CHAPTER 27: USE OF VACCINES

Tan K.K.[1], Rohani J.[2], Nor Saleha I.T.[2], Saidatul Norbaya B.[3], Najwa A.H.[3], Nik Nor Aklima N.O.[4]

1. Tuanku Ja'afar Hospital, Seremban 2. Diseases Control Division, Ministry of Health 3. Family Health Development Division, Ministry of Health, 4. Clinical Research Centre, Ministry of Health.

Control of infectious diseases through vaccination is an important strategy in achieving MDG4 goals of reducing the under-five mortality by two-third in 2015. New vaccines have contributed to significant reduction in morbidity and mortality worldwide[1]. Understanding the epidemiology of infectious disease in local setting can help to identify and prioritise areas of immunisation needs. Knowing the consumption patterns of vaccines in the country can identify wastage and contribute to immunization planning and cost saving. Furthermore, knowledge of private sector vaccine consumption can contribute to understanding the impact of new vaccines that have not been introduced in the public sector, such as pneumococcal vaccination for preventing invasive pneumococcal disease (IPD). The use of new formulated vaccines with less adverse events has contributed to increase acceptability and compliance by children and parents.

This report served to indicate the procurement and consumption trend of vaccines in the country in year 2008 until 2010. For the purpose of this report, trend of vaccine usage was used rather than DDD (number of vaccine doses for complete vaccination for the defined population). An estimated coverage could be calculated based on number of vaccine consumed for a course per birth cohort with an estimated birth cohort each year about 500,000. For example, DTaP-IPV//Hib 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 aged 1 and 7 years old. The population is obtained from Department of Statistics Malaysia[2].

Overall, the trend of viral vaccines consumptions was more as compared to bacterial vaccines or combined bacterial-viral vaccines. Hepatitis B vaccines, Human papillomavirus (HPV), measles as well as measles-mumps-rubella (MMR) vaccines were the most used. Hepatitis B usage increased in year 2009 onwards because of change in policy. The 3rd dose which was given with combined DTP-HBV//Hib vaccine to children aged 5 months was changed to hepatitis B monovalent, given at 6 months. There was an increase usage of hepatitis B vaccines adult dose in year 2010. It was most probably due to awareness campaign on hepatitis B vaccination campaign following a nationwide study on seroprevalence of hepatitis B in 2009.

In year 2010, HPV vaccine was introduced into the National Immunisation Programme (NIP). It was given to female students aged 13 years in schools. Meanwhile usage of measles and MMR vaccines were high in 2008 and 2009 because of measles outbreaks that occurred in a few states. However in 2010, used of MMR vaccine dropped because the MMR multidose preparation was no longer produced by one of the manufacturers. This particular product was the only one that fulfilled the technical specification of MOH.

The amount of rubella vaccine (J07B J01) purchased was also lower in 2010 as compared to the previous years. This was attributed by the change of rubella vaccination policy. The vaccination was given to 12 year old schedule given to school girls. However, when the birth cohort who received MMR (J07B D52) at schools reached their 12-year birthday, they do not need a booster for rubella. MMR was given to school children at seven years old starting in 2004. Hence, rubella vaccination was stopped in 2008/09. Thereafter, the procurement of rubella vaccines were only for women who missed their vaccination during adolescent or adulthood, or given to community as part of an outbreak response. The consumption of influenza vaccine (J07B B02) was high in 2010 as compared to the previous years following the pandemic influenza H1N1. There were influenza H1N1 cases in Malaysia. The intake of influenza vaccine and other viral vaccines not in NIP schedule were higher in private sector as compared to public sector.

Pandemic influenza in 2009 did influence the consumption of pneumococcal vaccines, particularly 10-valent conjugated pneumococcal vaccine (J07A L52). The same noted to 23-valent (J07A L01), the marked increased of usage in 2010 was most probably contributed by heighten awareness and recommendation to the hajj pilgrims. The consumptions of these two vaccines were high in private sector as the MOH did not offer these vaccines yet. Typhoid vaccine (J07AP03) showed a marked increase in consumption in 2010 following the gazzettment and enforcement of Food Hygiene Regulation 2009. However the use of injection typhoid (J07AP03) was significantly higher as compared to oral typhoid vaccine (J07A P01).

The most frequently used combined vaccine in the public sector was diphtheria-pertussis- tetanus-poliomyelitis-*Haemophilus influenzae* b (DTaP-IPV//Hib) (J0C A06) as the government started using this vaccine in the NIP since 2008. This 5-in-1 vaccine was given to children at the aged of 2, 3, 5 and 18 month. The consumption in public sector was 55 times more as compared to private sector and the amount was slightly higher from the number of birth cohort. The 6-in-1 vaccine, combination of diphtheria-pertussis-tetanus-poliomyelitis-Hepatitis B-*Haemophilus influenzae* b (J0C A09) was also used in government sector despite DTaP-IPV//Hib already in NIP. However the number was small and probably was used in hospital for special cases.

The consumption of pertussis combined vaccine with tetanus and diphtheria, also known as triple antigen (J07A J52) dropped significantly in 2010. This was the effect of DTaP-IPV//Hib (J07C A06) given to children as booster dose at 18 months. The implementation of Hib booster dose in 2010 also was most probably the cause of high consumption of Hib monovalent vaccine (J07A G01) in private sectors in that year. The amount was double as compared to year 2009.

In this report, it is assumed that procurement data reflects consumption. However, it was noted that in some MOH facilities, the vaccines were procured in big amount, kept as buffer stock for up to two to three months. Hence the number procured in the coming year was noticed to be low. It was noted with DTaP-IPV//Hib vaccine (J0C A06) procurement. It's usage in the coming year 2011 onwards would be able to explain better. This also happened to procurement trend of tetanus toxoid (J07A M01), BCG (J07A N01) and polio vaccine (J07B F02) in 2008 to 2010. This assumption was supported by the average consumptions of these vaccines for the three years which were comparable with the estimated numbers of birth cohort. The calculation took into consideration the 20% wastage of multidose vaccine when it was used.

In conclusion, the consistent trend of presumed consumption of vaccines in the health services; i.e. private and public sectors was in accordance to policy changes, enforcement of Act and Regulations, and local landscape of infectious diseases outbreaks including the occurrence of vaccine preventable diseases. The consumptions data also gave some ideas on the acceptability of vaccines by pubic and the coverage of vaccination.

Table 27.1: Use of Vaccines by Drug Class in Total Doses and Cost

ATC	DRUG CLASS	YEAR	TOTAL
J07A	Bacterial vaccines	2008	5,529
		2009	24,357
		2010	15,997
J07B	Viral vaccines	2008	5,383
		2009	52,648
		2010	19,363
J07C	Bacterial and viral combined vaccines	2008	3,231
		2009	8,229
		2010	2,908

Table 27.2.1: Use of Bacterial Vaccines by Drug Class and Agents, in Total Doses and Cost for year 2008 – 2010

ATC	Drug Class and Agents (Bacterial Vaccines)	Defined Population	Population no ('000)	No. of doses)	Year	Public	Private	Total
J07A E01	Cholera, inactivated, whole cell	General	27,728.7	1	2008	-	101	101
			28,081.5		2009	-	1,876	1,876
			28,588.6		2010	-	475	475
J07A G01	Haemophilus influenza B, purified antigen purified	Children below 1 year old	653.4	1	2008	2,393	18,615	21,008
			669.9		2009	664	12,222	12,887
			691.5		2010	9	31,610	31,619
J07A G52	Haemophilus influenza B, combinations with pertussis and toxoids	Children below 1 year old	653.4	1	2008	8,899	285	9,185
			669.9		2009	3,500	-	3,500
			691.5		2010	-	-	-
J07A H03	Meningococcus A, C, bivalent purified polysaccharides antigen	General	27,728.7	1	2008	-	96	96
			28,081.5		2009	-	4	4
			28,588.6		2010	-	-	-
J07A H04	Meningococcus A, C, Y, W-135, tetravalent purified polysaccharides antigen	General	27,728.7	1	2008	75,522	17,393	92,915
			28,081.5		2009	1,979,309	12,292	1,991,601
			28,588.6		2010	2,484,693	22,132	2,506,824

ATC	Drug Class and Agents (Bacterial Vaccines)	Defined Population	Population no ('000)	No. of doses)	Year	Public	Private	Total
J07A J52	Pertussis, purified antigen, combinations with toxoids (Triple Antigen)	Children 1 to less than 2 years old	641.5	1 (18 months old)	2008	488,085	12,073	500,158
			654.4		2009	4,456,560	9,880	4,466,440
			672.1		2010	-	23,960	23,960
J07A L01	Pneumococcus, purified polysaccharides antigen (23-valent)	General	27,728.7	1	2008	1,404	3,385	4,789
			28,081.5		2009	800	4,631	5,431
			28,588.6		2010	1,293	11,522	12,815
J07A L02	Pneumococcus, purified polysaccharides antigen conjugated (7-valent)	Children less than 2 years old	1294.9	4 (3+1)	2008	-	34,547	34,547
			1324		2009	25	37,703	37,728
			1364		2010	226	19,007	19,233
J07A L52	Pneumococcus, purified polysaccharides antigen and Haemophilus influenza, conjugated (10-valent)	Children less than 2 years old	1294.9	4 (3+1)	2008	-	101	101
			1324		2009	-	1801	1,801
			1364		2010	-	6,309	6,309
J07A M01	Tetanus toxoid	General	27,728.7	1	2008	2,148,712	456,816	2,605,528
			28,081.5		2009	1,866,734	327,929	2,194,663
			28,588.6		2010	225,870	242,557	468,427
J07A M51	Tetanus toxoid, combinations with diphtheria toxoid	Children 7 years old	589.5	1	2008	724,748	-	724,748
			596.3		2009	4,887,628	5	4,887,633
			605		2010	5,287,083	152	5,287,235
J07A N01	Tuberculosis, live attenuated	Live birth	487.346	1	2008	1,098,374	289,266	1,387,640
			471.634		2009	1,057,1421	44,328	10,615,749
			510.853		2010	64,1625	26,763	668,388
J07A P01	Typhoid, oral, live attenuated	Above 18 years old	17108	3 (Day 0, 3 and Day 5)	2008	-	5,490	5,490
			17205		2009	-	4,984	4,984
			17615		2010	-	3,750	3,750
J07A P03	Typhoid, purified polysaccharide antigen	General	27,728.7	1	2008	112,112	30,641	142,753
			28,081.5		2009	124,918	7,606	132,524
			28,588.6		2010	138,684	6,828,735	6,967,419

Table 27.2.2: Use of Viral Vaccines by Drug Class and Agents, in Total Doses and Cost for year 2008 - 2010

ATC	Drug Class and Agents (Viral Vaccines)	Defined Population	Population no ('000)	No. of doses	Year	Public	Private	Total
J07B A02	Encephalitis, Japanese, inactivated, whole virus	Children below 15 years old (Sarawak only)	810.7	7	2008	150,968	5,505	156,473
			824		2009	101,726	3,841	105,567
			837		2010	14,599	7,167	21,766
J07B B02	Influenza, inactivated, split virus or surface antigen	General	27,728.7	1	2008	3,801	26,559	30,360
			28,081.5		2009	-	28,276	28,276
			28,588.6		2010	200,390	37,844	38,234

ATC	Drug Class and Agents (Viral Vaccines)	Defined Population	Population no ('000)	No. of doses	Year	Public	Private	Total
J07B C01	Hepatitis B, purified antigen	Children below 1 year old	653.4	3	2008*	574,258	246,625	820,883
			669.9		2009	4,139,464	114,165	4,253,629
			691.5		2010	1,237,222	78,496	1,315,717
		Above 18 years old	17108	3	2008*	574,258	246,625	820,883
			17205		2009	34,789	14,433	49,222
			17615		2010	14,217,367	2,091,113	16,308,480
J07B C02	Hepatitis A, inactivated, whole virus	General	27,728.7	2	2008	51	32,795	32,846
			28,081.5		2009	-	17,567	17,567
			28,588.6		2010	16	19,826	19,842
J07B C20	Combinations (Hepatitis B and Hepatitis C)	General	27,728.7	3	2008	-	12,141	12,141
			28,081.5		2009	300	6,263	6,563
			28,588.6		2010	156	10,350	10,506
J07B D01	Measles, live attenuated	Children below 1 year old (Sabah)	67.5	1	2008	144,872	168	145,040
			68.7		2009	1,191,433	-	1,191,433
			69.7		2010	141,402	-	141,402
J07B D52	Measles, combinations with mumps and rubella, live attenuated	Children 1 and 8 years old	4962.1	2	2008	1,316,557	40671	1,357,228
			504.9		2009	1,093,055	55,125	1,148,180
			515.5		2010	441,418	25,650	467,068
J07B F02	Poliomyelitis oral, trivalent, live attenuated	Children 2, 3, 5,18 months & 7 yearsold	589.5	4 + 1	2008	2,557,031	8,118	2,565,149
			596.3		2009	44,725,568	5,360	44,730,928
			605		2010	884,155	155	884,310
J07B G01	Rabies, inactivated, whole virus	General (0,7,14,21 or 28 days post bite)	27,728.7	4	2008	515	2,033	2,548
			28,081.5		2009	383	1,422	1,806
			28,588.6		2010	458	2,721	3,178
J07B H01	Rota virus, live attenuated	Children below 1 years old	653.4	3	2008	-	12,511	12,511
			669.9		2009	-	15,287	15,287
			691.5		2010	210	17,752	17,962
J07B J01	Rubella, live attenuated	General (female)	13,388.5	1	2008	201796	176	201,972
			13,624.6		2009	1048648	89	1,048,737
			13,858.1		2010	97232	150	97,382
J07B K01	Varicella, live attenuated	Children 1 to less than 2 years old	641.5	1	2008	229	23,804	24,032
			654.4		2009	5	28,906	28,912
			672.1		2010	208	19,206	19,414
J07B L01	Yellow fever, live attenuated	General	27,728.7	1	2008	40	474	514
			28,081.5		2009	505	253	758
			28,588.6		2010	35	1,145	1,180
J07B M01	Papillomavirus (human type 6, 11, 16, 18) (quadrivalent)	General (female)	13,388.5	3	2008	20	16,003	16,023
			13,624.6		2009	-	9,538	9,538
			13,858.1		2010	55	10,140	10,195
J07B M02	Papillomavirus (human type 16, 18) (bivalent)	General (female)	13,388.5	3	2008	-	4,978	4,978
			13,624.6		2009	-	11,990	11,990
			13,858.1		2010	869,753	6,609	6,662

***2008 is for both children and adult due to its data which processed previously was not being separated for children and adult**

Table 27.2.3: Use of Bacterial & Viral Vaccines, combined by Drug Class & Agent, in Total Doses and Total Cost for year 2008-2010

ATC	Drug Class and Agents (Viral Vaccines)	Defined Population	Population no ('000)	No. of doses	Year	Public	Private	Total
J07C A02	Diphteria-pertussis-poliomyelitis-tetanus	1 - < 2 years old	641.5	1	2008	368	21701	22069
			654.4		2009	-	13736	13736
			672.1		2010	600	14873	15473
J07C A05	Diphteria-hepatitis B-pertussis-tetanus	Below 1 years old	653.4	3	2008	83430	832	84262
			669.9		2009	-	-	-
			691.5		2010	-	10864	10864
J07C A06	Diphteria-Haemophilus influenza B-pertussis-poliomyelitis-tetanus	Below 1 years old	653.4	3	2008	833125	76552	909677
			669.9		2009	8119746	63860	8183606
			691.5		2010	1350042	47336	1397378
J07C A09	Diphteria-Haemophilus influenza B-pertussis-poliomyelitis-tetanus-hepatitis B	Below 2 years old	1294.9	4	2008	31	36581	36612
			1324		2009	-	25723	25723
			1364		2010	55934	23587	79521
J07C A10	Typhoid-hepatitis A	General	27,728.7	1	2008	-	55	55
			28,081.5		2009	-	133	133
			28,588.6		2010	-	213	213
J07C A11	Diphteria-Haemophilus influenza B-pertussis-tetanus-hepatitis B	Below 1 years old	653.4	3	2008	2178173		
			669.9		2009	6200	-	6200
			691.5		2010	-	-	-

References

1. WHO Global Vaccine Action Plan. A65/22.11 May 2012
2. *Population Dataset 2008*;Department of Statistics Malaysia,2009 & 2010.

APPENDIX 1: PARTICIPANTS OF THE NATIONAL MEDICINES USE SURVEY

Hospitals participating in NMUS survey

No	Ministry of Health Hospitals	No	Ministry of Health Hospitals
1	Alor Gajah Hospital	43	Kota Tinggi Hospital
2	Ampang Hospital	44	Kuala Kangsar Hospital
3	Bahagia Hospital, Ulu Kinta	45	Kuala Krai Hospital
4	Balik Pulau Hospital	46	Kuala Kubu Bharu Hospital
5	Baling Hospital	47	Kuala Lipis Hospital
6	Banting Hospital	48	Kuala Lumpur Hospital
7	Batu Gajah Hospital	49	Kuala Nerang Hospital
8	Batu Pahat Hospital	50	Kuala Penyu Hospital
9	Bau Hospital	51	Kudat Hospital
10	Beaufort Hospital	52	Kulim Hospital
11	Beluran Hospital	53	Kunak Hospital
12	Bentong Hospital	54	Labuan Hospital
13	Besut Hospital	55	Lahad Datu Hospital
14	Betong Hospital	56	Langkawi Hospital
15	Bintulu Hospital	57	Lawas District Hospital
16	Bukit Mertajam Hospital	58	Likas Hospital
17	Changkat Melintang Hospital	59	Limbang Hospital
18	Dalat Hospital	60	Lundu District Hospital
19	Daro Hospital	61	Machang Hospital
20	Duchess of Kent Hospital, Sandakan	62	Marudi Hospital
21	Dungun Hospital	63	Melaka Hospital
22	Gerik Hospital	64	Mersing Hospital
23	Gua Musang Hospital	65	Mesra Hospital Bukit Padang
24	Hulu Terengganu Hospital	66	Miri Hospital
25	Jasin Hospital	67	Muadzam Shah Hospital
26	Jelebu Hospital	68	Mukah Hospital
27	Jeli Hospital	69	Papar Hospital
28	Jempol Hospital	70	Parit Buntar Hospital
29	Jengka Hospital	71	Pasir Mas Hospital
30	Jerantut Hospital	72	Pekan Hospital
31	Jitra Hospital	73	Permai Hospital
32	Kajang Hospital	74	Pitas Hospital
33	Kampar Hospital	75	Pontian Hospital
34	Kanowit Hospital	76	Port Dickson Hospital
35	Kapit Hospital	77	Pulau Pinang Hospital
36	Kemaman Hospital	78	Putrajaya Hospital
37	Keningau Hospital	79	Queen Elizabeth Hospital
38	Kepala Batas Hospital	80	Queen Elizabeth II Hospital
39	Kinabatangan Hospital	81	Raja Perempuan Zainab II Hospital, Kota Bharu
40	Kluang Hospital	82	Raja Permaisuri Bainun Hospital, Ipoh
41	Kota Belud Hospital	83	Rajah Charles Brooke Memorial Hospital
42	Kota Marudu Hospital	84	Ranau Hospital

Hospitals participating in NMUS survey

No	Ministry of Health Hospitals	No	Ministry of Health Hospitals
85	Raub Hospital	111	Sultanah Hajjah Kalsum Hospital
86	Saratok Hospital	112	Sultanah Nur Zahirah Hospital, Kuala Terengganu
87	Sarawak General Hospital	113	Sungai Bakap Hospital
88	Sarikei Hospital	114	Sungai Buloh Hospital
89	Seberang Jaya Hospital	115	Sungai Siput Hospital
90	Segamat Hospital	116	Taiping Hospital
91	Selama Hospital	117	Tambunan Hospital
92	Selayang Hospital	118	Tampin Hospital
93	Semporna Hospital	119	Tanah Merah Hospital
94	Sentosa Hospital	120	Tangkak Hospital
95	Serdang Hospital	121	Tanjong Karang Hospital
96	Seri Manjung Hospital	122	Tapah Hospital
97	Serian Hospital	123	Tawau Hospital
98	Setiu Hospital	124	Teluk Intan Hospital
99	Sibu Hospital	125	Temenggung Seri Maharaja Tun Ibrahim Hospital
100	Sik Hospital	126	Tengku Ampuan Afzan Hospital, Kuantan
101	Simunjan Hospital	127	Tengku Ampuan Jemaah Hospital, Sabak Bernam
102	Sipitang Hospital	128	Tengku Ampuan Rahimah Hospital, Klang
103	Slim River Hospital	129	Tengku Anis Hospital, Pasir Puteh
104	Sri Aman Hospital	130	Tenom Hospital
105	Sultan Abdul Halim Hospital, Sungai Petani	131	Tuanku Ampuan Najihah Hospital, Kuala Pilah
106	Sultan Haji Ahmad Shah Hospital, Temerloh	132	Tuanku Fauziah Hospital, Kangar
107	Sultan Ismail Hospital, Johor Bahru	133	Tuanku Ja'afar Hospital, Seremban
108	Sultanah Aminah General Hospital, Johor Bahru	134	Tuaran Hospital
109	Sultanah Bahiyah Hospital, Alor Setar	135	Tumpat Hospital
110	Sultanah Fatimah Specialist Hospital, Muar	136	Yan Hospital

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

No	Armed Forces Hospitals
1	Hospital Angkatan Tentera Tuanku Mizan
2	Hospital Angkatan Tentera Kem Syed Sirajuddin
3	Hospital Angkatan Tentera Lumut
4	Hospital Angkatan Tentera Terendak

No	Private Hospitals	No	Private Hospitals
1	Al-Islam Specialist Hospital (Formerly known as Kampong Baru Medical Centre @ KBMC)	4	Beacon International Specialist Centre
2	Arunamari Specialist Medical Centre	5	Columbia Asia Extended Care Hospital
3	Assunta Hospital	6	Columbia Asia Hospital - Taiping

Hospitals participating in NMUS survey

No	Private Hospitals	No	Private Hospitals
7	Columbia Asia Hospital - Miri	43	Mahkota Medical Centre Sdn. Bhd
8	Columbia Asia Hospital - Puchong	44	Mawar Renal Medical Centre
9	Columbia Asia Hospital Seremban	45	Medical Specialist Centre (JB) Sdn. Bhd
10	Damai Medical and Heart Clinic Sdn. Bhd	46	Metro Specialist Hospital
11	Damai Service Hospital (HQ) Sdn. Bhd.	47	Miri City Medical Centre
12	Fatimah Hospital	48	Mount Miriam Hospital
13	Gleneagles Intan Medical Centre	49	National Heart Institute Sdn. Bhd.
14	Gleneagles Medical Centre, Penang	50	NCI Cancer Hospital
15	Hospital Pantai Ayer Keroh Sdn. Bhd.	51	Pantai Hospital Batu Pahat
16	Hospital Waqaf An-Nur Pasir Gudang	52	Pantai Hospital Ampang
17	Island Hospital	53	Pantai Hospital Cheras
18	JB Specialist Hospital Sdn. Bhd	54	Pantai Hospital Ipoh
19	Kajang Plaza Medical Centre	55	Pantai Hospital Klang
20	Kelana Jaya Medical Centre	56	Pantai Hospital Penang (formerly Pantai Mutiara Hospital)
21	Kempas Medical Centre	57	Pantai Hospital Sungai Petani
22	Kinta Medical Centre Sdn. Bhd.	58	Penang Adventist Hospital (Adventist Hospital & Clinic Services (M)
23	KPJ Ampang Puteri Specialist Hospital	59	Perak Community Specialist Hospital
24	KPJ Damansara Specialist Hospital	60	Prince Court Medical Centre
25	KPJ Ipoh Specialist Hospital	61	Pudu Specialists Centre Sdn. Bhd
26	KPJ Johor Specialist Hospital	62	PUSRAWI Hospital Sdn. Bhd
27	KPJ Kajang Specialist Hospital	63	Putra Medical Centre
28	KPJ Kedah Medical Centre	64	Putra Specialist Hospital (Batu Pahat) Sdn. Bhd
29	KPJ Kuantan Specialist Hospital	65	Putra Specialist Hospital (Melaka) Sdn. Bhd.
30	KPJ Kuching Specialist Hospital	66	QHC Medical Center Sdn Bhd
31	KPJ Penang Specialist Hospital	67	Rafflesia Medical Centre
32	KPJ Perdana Specialist Hospital	68	Regency Specialist Hospital
33	KPJ Puteri Specialist Hospital / Hospital Pakar Puteri	69	Sibu Specialist Medical Centre
34	KPJ Selangor Specialist Hospital	70	Sime Darby Medical Centre Subang Jaya
35	KPJ Sentosa Medical Centre Sdn. Bhd.	71	Sri Kota Specialist Medical Centre (SKSMC)
36	KPJ Seremban Specialist Hospital Sdn. Bhd.	72	Sri Manjung Specialist Centre Sdn Bhd
37	KPJ Taiping Medical Centre	73	Sunway Medical Centre
38	KPJ Tawakal Specialist Hospital	74	The Tun Hussein Onn National Eye Hospital
39	KPMC Puchong Sdn. Bhd	75	Timberland Medical Centre
40	Kuantan Medical Centre Sdn. Bhd.	76	Tropicana Medical Centre (M) Sdn Bhd
41	Loh Guan Lye & Sons Sdn Bhd (Loh Guan Lye Specialists Centre)	77	Tung Shin Hospital
42	Lourdes Medical Centre		

Public Health Authorities participating in NMUS survey

No	State/District/Area Health Departments	No	State/District/Area Health Departments
1	Pejabat Kesihatan Daerah Alor Gajah	3	Pejabat Kesihatan Daerah Baling
2	Pejabat Kesihatan Daerah Bachok	4	Pejabat Kesihatan Daerah Bandar Baharu

Public Health Authorities participating in NMUS survey

No	State/District/Area Health Departments	No	State/District/Area Health Departments
5	Pejabat Kesihatan Daerah Barat Daya	48	Pejabat Kesihatan Daerah Machang
6	Pejabat Kesihatan Daerah Batang Padang	49	Pejabat Kesihatan Daerah Manjung
7	Pejabat Kesihatan Daerah Batu Pahat	50	Pejabat Kesihatan Daerah Maran
8	Pejabat Kesihatan Daerah Bentong	51	Pejabat Kesihatan Daerah Marang
9	Pejabat Kesihatan Daerah Bera	52	Pejabat Kesihatan Daerah Melaka Tengah
10	Pejabat Kesihatan Daerah Besut	53	Pejabat Kesihatan Daerah Mersing
11	Pejabat Kesihatan Daerah Cameron Highlands	54	Pejabat Kesihatan Daerah Muar
12	Pejabat Kesihatan Daerah Dungun	55	Pejabat Kesihatan Daerah Padang Terap
13	Pejabat Kesihatan Daerah Gombak	56	Pejabat Kesihatan Daerah Pasir Mas
14	Pejabat Kesihatan Daerah Gua Musang	57	Pejabat Kesihatan Daerah Pasir Puteh
15	Pejabat Kesihatan Daerah Hilir Perak	58	Pejabat Kesihatan Daerah Pekan
16	Pejabat Kesihatan Daerah Hulu Kinta	59	Pejabat Kesihatan Daerah Penampang
17	Pejabat Kesihatan Daerah Hulu Langat	60	Pejabat Kesihatan Daerah Pendang
18	Pejabat Kesihatan Daerah Hulu Perak	61	Pejabat Kesihatan Daerah Perak Tengah
19	Pejabat Kesihatan Daerah Hulu Selangor	62	Pejabat Kesihatan Daerah Petaling
20	Pejabat Kesihatan Daerah Hulu Terengganu	63	Pejabat Kesihatan Daerah Pontian
21	Pejabat Kesihatan Daerah Jasin	64	Pejabat Kesihatan Daerah Port Dickson
22	Pejabat Kesihatan Daerah Jeli	65	Pejabat Kesihatan Daerah Raub
23	Pejabat Kesihatan Daerah Jempol	66	Pejabat Kesihatan Daerah Rembau
24	Pejabat Kesihatan Daerah Jerantut	67	Pejabat Kesihatan Daerah Rompin
25	Pejabat Kesihatan Daerah Johor Bharu	68	Pejabat Kesihatan Daerah Sabak Bernam
26	Pejabat Kesihatan Daerah Kangar	69	Pejabat Kesihatan Daerah Seberang Perai Selatan
27	Pejabat Kesihatan Daerah Kemaman	70	Pejabat Kesihatan Daerah Seberang Perai Tengah
28	Pejabat Kesihatan Daerah Kerian	71	Pejabat Kesihatan Daerah Seberang Perai Utara
29	Pejabat Kesihatan Daerah Kinta	72	Pejabat Kesihatan Daerah Segamat
30	Pejabat Kesihatan Daerah Klang	73	Pejabat Kesihatan Daerah Semporna
31	Pejabat Kesihatan Daerah Kluang	74	Pejabat Kesihatan Daerah Sepang
32	Pejabat Kesihatan Daerah Kota Bharu	75	Pejabat Kesihatan Daerah Seremban
33	Pejabat Kesihatan Daerah Kota Setar	76	Pejabat Kesihatan Daerah Setiu
34	Pejabat Kesihatan Daerah Kota Tinggi	77	Pejabat Kesihatan Daerah Sik
35	Pejabat Kesihatan Daerah Kuala Kangsar	78	Pejabat Kesihatan Daerah Tampin
36	Pejabat Kesihatan Daerah Kuala Krai	79	Pejabat Kesihatan Daerah Tanah Merah
37	Pejabat Kesihatan Daerah Kuala Langat	80	Pejabat Kesihatan Daerah Temerloh
38	Pejabat Kesihatan Daerah Kuala Lipis	81	Pejabat Kesihatan Daerah Timur Laut
39	Pejabat Kesihatan Daerah Kuala Muda	82	Pejabat Kesihatan Daerah Tumpat
40	Pejabat Kesihatan Daerah Kuala Pilah	83	Pejabat Kesihatan Daerah Yan
41	Pejabat Kesihatan Daerah Kuala Terengganu	84	Pejabat Kesihatan Jelebu
42	Pejabat Kesihatan Daerah Kuantan	85	Pejabat Kesihatan Kawasan Beaufort
43	Pejabat Kesihatan Daerah Kubang Pasu	86	Pejabat Kesihatan Kawasan Beluran
44	Pejabat Kesihatan Daerah Kulim	87	Pejabat Kesihatan Kawasan Keningau
45	Pejabat Kesihatan Daerah Langkawi	89	Pejabat Kesihatan Kawasan Kota Kinabalu
46	Pejabat Kesihatan Daerah Larut Matang dan Selama	90	Pejabat Kesihatan Kawasan Lahad Datu
47	Pejabat Kesihatan Daerah Ledang	91	Pejabat Kesihatan Kawasan Sandakan

Public Health Authorities participating in NMUS survey

No	State/District/Area Health Departments	No	State/District/Area Health Departments
92	Pejabat Kesihatan Kawasan Tawau	117	Pejabat Kesihatan Putrajaya
93	Pejabat Kesihatan Kawasan Tuaran	118	Pejabat Kesihatan Wilayah
94	Pejabat Kesihatan KLIA	119	Pejabat Pergigian Bahagian Bintulu
95	Pejabat Kesihatan Kuala Selangor	120	Pejabat Pergigian Bahagian Kuching
96	Pejabat Kesihatan Kulai	121	Pejabat Pergigian Bahagian Miri
97	Pejabat Kesihatan Pergigian Bahagian Betong	122	Pejabat Pergigian Bahagian Samarahan
98	Pejabat Kesihatan Pergigian Bahagian Labuan	123	Pejabat Pergigian Bahagian Sibu
99	Pejabat Kesihatan Pergigian Bahagian Limbang	124	Pejabat Pergigian Bahagian Sri Aman
100	Pejabat Kesihatan Pergigian Daerah Jasin	125	Pejabat Pergigian Beaufort
101	Pejabat Kesihatan Pergigian Daerah Jelebu	126	Pejabat Pergigian Daerah Petaling
102	Pejabat Kesihatan Pergigian Daerah Jempol	127	Pejabat Pergigian Daerah Seberang Perai Utara
103	Pejabat Kesihatan Pergigian Daerah Kota Tinggi	128	Pejabat Pergigian Gua Musang
104	Pejabat Kesihatan Pergigian Daerah Kubang Pasu	129	Pejabat Pergigian Kanan Mersing
105	Pejabat Kesihatan Pergigian Daerah Muar	130	Pejabat Pergigian Kawasan Penampang
106	Pejabat Kesihatan Pergigian Daerah Padang Terap	131	Pejabat Pergigian Kluang
107	Pejabat Kesihatan Pergigian Daerah Rembau	132	Pejabat Pergigian Negeri Perak
108	Pejabat Kesihatan Pergigian Daerah Seremban	133	Pejabat Pergigian Sandakan
109	Pejabat Kesihatan Pergigian Daerah Temerloh	134	Pejabat Pergigian Tawau
110	Pejabat Kesihatan Pergigian Daerah Yan	135	Pejabat Perkhidmatan Pergigian Bachok
111	Pejabat Kesihatan Pergigian Kangar, Perlis	136	Pejabat Perkhidmatan Pergigian Daerah Alor Gajah
112	Pejabat Kesihatan Pergigian Kawasan Keningau	137	Pejabat Perkhidmatan Pergigian Daerah Kemaman
113	Pejabat Kesihatan Pergigian Kawasan Kudat	138	Pejabat Perkhidmatan Pergigian Melaka Tengah
114	Pejabat Kesihatan Pergigian Ledang	139	Pejabat Timbalan Pengarah Kesihatan (Pergigian) Negeri Sembilan
115	Pejabat Kesihatan Pergigigian Daerah Kulim		
116	Pejabat Kesihatan Perlis		

Ministry of Health Institutions participating in NMUS survey

No	Ministry of Health Institution	No	Ministry of Health Institution
1	Bahagian Perkhidmatan Farmasi Kelantan	16	Disease Control Division, NPHL
2	College of Allied Health Science, Kuching	17	Divisional Store Kapit
3	College of Allied Health Science, Sg Buloh	18	Divisional Store Limbang
4	College of Community Nursing, Jerantut	19	Divisional Store Sibu
5	College of Community Nursing, Kluang	20	Ibu Pejabat Kesihatan Negeri Sabah
6	College of Community Nursing, Kulim	21	Institute for Medical Research (IMR)
7	College of Nursing, Bukit Mertajam	22	Institut Kesihatan Umum
8	College of Nursing, Ipoh	23	Jabatan Kesihatan Negeri Johor
9	College of Nursing, Kota Kinabalu	24	Jabatan Kesihatan WP Kuala Lumpur
10	College of Nursing, Kuala Terengganu	25	Jabatan Patologi
11	College of Nursing, Kubang Kerian	26	Kolej Jururawat Masyarakat
12	College of Nursing, Malacca	27	Kolej Jururawat Masyarakat Seremban
13	College of Nursing, Muar	28	Kolej Kejururawatan Johor Bharu
14	College of Nursing, Pulau Pinang	29	Kolej Kejururawatan Melaka
15	Department of Public Health	30	Kolej Radiografi (Pengimejan Perubatan)

Ministry of Health Institutions participating in NMUS survey

No	Ministry of Health Institution	No	Ministry of Health Institution
31	Makmal Kesihatan Awam Kota Kinabalu	37	National Blood Centre
32	Makmal Perubatan Dan Stor Kuching	38	Pusat Bekalan Farmasi Negeri Sabah
33	Makmal Ubat & Stor Miri	39	Stor Farmasi Jabatan Kesihatan WP Kuala Lumpur
34	Makmal Ubat & Stor Sarikei	40	Stor Pergigian Negeri Selangor
35	Makmal Ubat & Stor Sri Aman	41	Stor Pergigian Pusat Kota Kinabalu
36	Makmal Ubat dan Stor Bahagian Sibu	42	Unit Kawalan Penyakit Bawaan Vektor, Kedah

Primary Care Clinics participating in NMUS survey

No	Ministry of Health Clinics	No	Ministry of Health Clinics
1	Klinik Kesihatan Bandar Miri	20	Klinik Pergigian Jeli
2	Klinik Kesihatan Putrajaya	21	Klinik Pergigian Jerantut
3	Klinik Kesihatan WP Labuan	22	Klinik Pergigian Kinta
4	Klinik Pakar Pergigian Hospital Umum Sarawak	23	Klinik Pergigian Komuniti Tapah
5	Klinik Pergigian Bangsar	24	Klinik Pergigian Kuala Krai
6	Klinik Pergigian Bentong	25	Klinik Pergigian Kuala Pilah
7	Klinik Pergigian Besar Baling	26	Klinik Pergigian Kuantan
8	Klinik Pergigian Besar Langkawi	27	Klinik Pergigian Kubang Semang
9	Klinik Pergigian Besar Raub	28	Klinik Pergigian Lahad Datu
10	Klinik Pergigian Besar Sungai Petani	29	Klinik Pergigian Machang
11	Klinik Pergigian Besar Telok Wanjah	30	Klinik Pergigian Mukah
12	Klinik Pergigian Bintulu	31	Klinik Pergigian Pasir Mas
13	Klinik Pergigian Cameron Highlands	32	Klinik Pergigian Pasir Puteh
14	Klinik Pergigian Daerah Kerian	33	Klinik Pergigian Perak Tengah
15	Klinik Pergigian Hospital Kuala Kangsar	34	Klinik Pergigian Port Dickson
16	Klinik Pergigian Hospital Mentakab	35	Klinik Pergigian Tampin
17	Klinik Pergigian Hospital Tanah Merah	36	Klinik Pergigian Tumpat
18	Klinik Pergigian Hospital Teluk Intan	37	Klinik Pergigian Wilayah
19	Klinik Pergigian Hulu Perak		

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
1	24 Jam Poliklinik Yap	13	Damai Medical And Heart Clinic Sdn Bhd
2	Anga Plastik & Kosmetik Surgery Sdn BHd	14	Dispensari Huang
3	Asia Clinic	15	Dr. Peter Kong Specialist Eye Centre
4	Aziz Clinic	16	Dr.Lim Beng Kiat.
5	B. P. Diagnostic Centre	17	Dr.Nor Hamidah Specialist Clinic.
6	Berchaam Medical Centre	18	Dr.Siaw Heart Specialist Clinic
7	BP Diagnostic Centre Sdn Bhd	19	Dr.Tan Cheng Hock(Mullan Lim& Tan Sdn Bhd)
8	BP Diagnostic Centre Sdn Bhd (tmn Century)	20	Drs. Tong, Leow, Chiam & Partners
9	Chan Chee Hoe Medical Specialist Practice		(Chong Dispensary)
10	Cheong Surgical Specialist Klinik	21	Drs. Tong, Leow, Chiam & Partners
11	Choy Medical Specialist		(Chong Dispensary) - Medan Pasar
12	CO Lim Orthopaedic Centre	22	Drs. Tong, Leow, Chiam & Partners- Jln Ampang

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
23	Federal Clinic (Century Garden)	66	Klinik A Wahab
24	Foh San Clinic	67	Klinik Abdul Rahaman Pozan
25	Gastro Centre Ipoh	68	Klinik Achutha
26	Goh Clinic	69	Klinik Adham (Senai I)
27	Hans Medical Clinic	70	Klinik Adham (Bandar Putra)
28	Ho Eye Specialist Centre	71	Klinik Adham (Caw. Larkin)
29	Horeb Services Sdn. Bhd.	72	Klinik Adham Cawangan Indahpura
30	Hyperbaric Oxygen Therapy Centre Sdn. Bhd.	73	Klinik Adham Cawangan Kota Tinggi
31	Ipoh Skin Clinic & General	74	Klinik Aishah
32	Island Medical Associates Sdn Bhd	75	Klinik Al\'azhim Tampin
33	JB Orthopaedic & Trauma Surgery	76	Klinik Ali
34	Jelutong Poliklinik Khoo	77	Klinik Aliza Sdn Bhd
35	Kalo Cosmetic Surgery Sdn. Bhd.	78	Klinik Amar
36	Kang's Clinic	79	Klinik An Nuur
37	Kelinik Ayer Keroh	80	Klinik Anand & Viknesh
38	Kelinik Che Wan	81	Klinik Anda
39	Kelinik Chin	82	Klinik Ang
40	Kelinik Das	83	Klinik Anita
41	Kelinik Ho	84	Klinik An-Nisa
42	Kelinik K.M. Chao	85	Klinik Ariffin
43	Kelinik Keningau Dan Surgery	86	Klinik Arun
44	Kelinik Khoo	87	Klinik Asniza
45	Kelinik Leong	88	Klinik Awana Kijal
46	Kelinik Lung	89	Klinik B S Tan
47	Kelinik Malaysia Johor Bahru	90	Klinik Baba Sdn. Bhd.
48	Kelinik Malin	91	Klinik Bagan Ajam
49	Kelinik Malin Tengkera Sdn. Bhd	92	Klinik Bakti
50	Kelinik Mersing	93	Klinik Bala
51	Kelinik Poorni	94	Klinik Balik Pulau 16 Jam
52	Kelinik Rakyat (Yong Peng)	95	Klinik Ban
53	Kelinik Ratna	96	Klinik Bandar Raya
54	Kelinik Sri Larkin (Tmn Perindustrian Tebrau)	97	Klinik Bandaran, Section 15
55	Kelinik Wah Hai Sit	98	Klinik Bangi
56	Kelinik Woo & Hong	99	Klinik Beaufort & Surgeri (Pusat X-Ray)
57	Khong Klinik	100	Klinik Benta
58	Klinic Pakar Kanak Kanak Dr Chin Tshun Leong	101	Klinik Berkat
59	Klinik Australia	102	Klinik Berkat Beluran
60	Klinik & Dispensari Shahril	103	Klinik Bersatu 16 Jam
61	Klinik & Surgeri Chuah	104	Klinik Bersatu 24 Jam Air Hitam
62	Klinik & Surgeri Dr Jingul	105	Klinik Bersatu, Tmn Ratna
63	Klinik & Surgeri Hon	106	Klinik Bertam
64	Klinik & Surgeri Sipitang	107	Klinik Bhajan
65	Klinik A Famosa	108	Klinik Bharu Jerteh

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
109	Klinik Britain	152	Klinik Dr Nida
110	Klinik Budi Sungai Ara	153	Klinik Dr Ramzi
111	Klinik Bukit Jambul	154	Klinik Dr Rashidah
112	Klinik C K Chan	155	Klinik Dr Rosly
113	Klinik Ceria	156	Klinik Dr Tan Kok Sui
114	Klinik Chai	157	Klinik Dr. Elis
115	Klinik Cham	158	Klinik Dr. Jammy Suzana
116	Klinik Chan & Ng	159	Klinik Dr. Kassim
117	Klinik Chee	160	Klinik Dr. Kon
118	Klinik Cheng	161	Klinik Dr. Kuan Pui Seng
119	Klinik Cheng & Su, Tmn Sejati Indah	162	Klinik Dr. Ng S.G.
120	Klinik Cheng & Su, Wisma Bandaran	163	Klinik Dr. Norliazura
121	Klinik Chew Dan Surgeri	164	Klinik Dr. Wan Abdul Kadir
122	Klinik Chin	165	Klinik Dr. Yasiman Perdana
123	Klinik Chin & Surgeri	166	Klinik Dr.Raimah & X-Ray
124	Klinik Chin, Jln Sultan Sulaiman	167	Klinik Dr.Zanawati
125	Klinik Choo	168	Klinik Eirena
126	Klinik Chua	169	Klinik Fa\'iza Dan Rakan Rakan
127	Klinik Chung & Hon	170	Klinik Faisal Hamdi
128	Klinik Cinta Sayang, Tmn Ria jaya	171	Klinik Famili
129	Klinik Comfort	172	Klinik Famili Shah Alam
130	Klinik Cybermedik	173	Klinik Family Hill City
131	Klinik Cyril Songan	174	Klinik Farisya
132	Klinik Dan Surgeri Taman Daya	175	Klinik Fatah & Abdullah
133	Klinik Daya Singh Sdn Bhd	176	Klinik Fateh Mohd & Rakan-Rakan
134	Klinik Desa Ara	177	Klinik Fatimah
135	Klinik Dhass Sdn Bhd	178	Klinik Fernandez Lunas
136	Klinik Diong Mee Nee	179	Klinik Foo
137	Klinik Doktor Lee	180	Klinik Foong
138	Klinik Dominic Songan	181	Klinik G.S
139	Klinik Doreen Khoo	182	Klinik Gan Surgery
140	Klinik Dr Adam	183	Klinik Genting Uni-Med, Gohtong Jaya
141	Klinik Dr Azizah, Tmn Dagang	184	Klinik Githa (Tmn Mesra, Saleng)
142	Klinik Dr Choo & Liew	185	Klinik Githa, Kelapa Sawit
143	Klinik Dr Choong Dan Jenny Physiotherapy	186	Klinik Githa, Tmn Kulai Utama
144	Klinik Dr Fateh Mohd dan Rakan-Rakan	187	Klinik Glugor
145	Klinik Dr Halim & Nor	188	Klinik Goh
146	Klinik Dr Halim Sdn Bhd	189	Klinik Goh & Surgeri
147	Klinik Dr Kamaludin	190	Klinik Gurdip
148	Klinik Dr Lee	191	Klinik Gurun
149	Klinik Dr Lo	192	Klinik H.T. Lee
150	Klinik Dr Monty	193	Klinik Halbans
151	Klinik Dr Najiha	194	Klinik Hasbullah

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
195	Klinik Hee	234	Klinik Keluarga Keningau
196	Klinik Hee & Annandan Sdn Bhd	235	Klinik Keluarga Lee
197	Klinik Hee (Batang Melaka)	236	Klinik Kesihatan Ayer Hitam, Batu Pahat
198	Klinik Hee Annandan & Siva	237	Klinik Kesihatan Ayer Molek
199	Klinik Ho	238	Klinik Kesihatan Badang
200	Klinik Ho & Fong	239	Klinik Kesihatan Bagan
201	Klinik Hon	240	Klinik Kesihatan Bakar Arang
202	Klinik Hooi	241	Klinik Kesihatan Bakri
203	Klinik Hosanna	242	Klinik Kesihatan Balai
204	Klinik Huang	243	Klinik Kesihatan Bandar Alor Setar
205	Klinik Hussien	244	Klinik Kesihatan Bandar Baharu
206	Klinik i Care	245	Klinik Kesihatan Bandar Tun Razak
207	Klinik Idzham Sdn. Bhd, Danau Kota	246	Klinik Kesihatan Batu Kawa
208	Klinik Ikthiar Kota Jambal	247	Klinik Kesihatan Bestari Jaya
209	Klinik Iman	248	Klinik Kesihatan Biawak
210	Klinik Inn	249	Klinik Kesihatan Bidor
211	Klinik Insaf	250	Klinik Kesihatan Bota Kiri
212	Klinik Insan	251	Klinik Kesihatan Changkat Jering
213	Klinik Insan Sdn Bhd (Tmn U)	252	Klinik Kesihatan Changkat Keruing
214	Klinik Intan, Johor Bahru	253	Klinik Kesihatan Chenderong Balai
215	Klinik Inthira / Joe Fernandez	254	Klinik Kesihatan Chini
216	Klinik Ishi	255	Klinik Kesihatan Gaal
217	Klinik Isza	256	Klinik Kesihatan Gopeng
218	Klinik Jamaliah	257	Klinik Kesihatan Gual Ipoh
219	Klinik jaya	258	Klinik Kesihatan Hutan Melintang
220	Klinik Joe Fernandez	259	Klinik Kesihatan Jalan Baru
221	Klinik Joe Fernandez - Tmn Nagasari	260	Klinik Kesihatan Jelai
222	Klinik Joseph Varghese	261	Klinik Kesihatan Kampung Bantal
223	Klinik Julian Wee	262	Klinik Kesihatan Kampung Gajah
224	Klinik Kamal	263	Klinik Kesihatan Kedai Empat
225	Klinik Kanak-Kanak Lim	264	Klinik Kesihatan Kepala Batas
226	Klinik Kanak-kanak Yee & Klinik Lee	265	Klinik Kesihatan Kuah
227	Klinik Kaulsay	266	Klinik Kesihatan Kuala Balingian
228	Klinik Kaunseling Penawar Care	267	Klinik Kesihatan Kuala Kurau
229	Klinik Kelana Puteri	268	Klinik Kesihatan Kuala Sungai Baru
230	Klinik Keluarga	269	Klinik Kesihatan Kulai Besar
231	Klinik Keluarga (Segamat)	270	Klinik Kesihatan Kulim
232	Klinik Keluarga Dan Surgeri	271	Klinik Kesihatan Lambor Kiri
233	Klinik Keluarga Dr.Fauziah	272	Klinik Kesihatan Lanchang

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
273	Klinik Kesihatan Lekir	312	Klinik Kesihatan Tasek Gelugor
274	Klinik Kesihatan Lenggeng	313	Klinik Kesihatan Tian
275	Klinik Kesihatan Lintang	314	Klinik Kesihatan Titi
276	Klinik Kesihatan Long Sukang	315	Klinik Kesihatan Trong
277	Klinik Kesihatan Lui Muda	316	Klinik Kesihatan Tronoh
278	Klinik Kesihatan Luyang	317	Klinik Kesihatan Trusan
279	Klinik Kesihatan Mak Mandin	318	Klinik Kesihatan Tubau
280	Klinik Kesihatan Menglembu	319	Klinik Kesihatan Ujong Pasir
281	Klinik Kesihatan Merbok	320	Klinik Kesihatan Wakaf Bharu
282	Klinik Kesihatan Nanga Ensiring	321	Klinik Khaira
283	Klinik Kesihatan Nanga Entaih	322	Klinik Khaw
284	Klinik Kesihatan Nanga Patoh	323	Klinik Khong
285	Klinik Kesihatan Nanga Semah	324	Klinik Khor.
286	Klinik Kesihatan Nanga Tau	325	Klinik Khuzaini & Raja Himah Sdn. Bhd.
287	Klinik Kesihatan Nanga Wak	326	Klinik King
288	Klinik Kesihatan Nibong Tebal	327	Klinik Kip
289	Klinik Kesihatan Padang Luas	328	Klinik Kiu
290	Klinik Kesihatan Padang Matsirat	329	Klinik K-K
291	Klinik Kesihatan Pakan	330	Klinik Klang Anda
292	Klinik Kesihatan Palong 4,5,6	331	Klinik Koeh
293	Klinik Kesihatan Pantai	332	Klinik Koidupan
294	Klinik Kesihatan Pengkalan Chepa	333	Klinik Kok
295	Klinik Kesihatan Peringgit	334	Klinik Kok Dan Segeri
296	Klinik Kesihatan Pertang	335	Klinik Kong Dan Rakan-Rakan
297	Klinik Kesihatan Pokok Assam	336	Klinik Kook
298	Klinik Kesihatan Putrajaya	337	Klinik Kota Bharu
299	Klinik Kesihatan Redang Panjang	338	Klinik Kota, Yong Peng
300	Klinik Kesihatan Sambir	339	Klinik Kotaraya (Demak Laut)
301	Klinik Kesihatan Sanggang	340	Klinik Krystal
302	Klinik Kesihatan Sematan	341	Klinik Kulit Pertama
303	Klinik Kesihatan Sentul	342	Klinik Kumpulan Muslimah
304	Klinik Kesihatan Spaoh	343	Klinik Kwang
305	Klinik Kesihatan Sungai Acheh	344	Klinik L.T. Wong
306	Klinik Kesihatan Sungai Bayor	345	Klinik Lam
307	Klinik Kesihatan Sungai Lembing	346	Klinik Lathika
308	Klinik Kesihatan Sungai Limau Dalam	347	Klinik Lee
309	Klinik Kesihatan Tanjung Manis	348	Klinik Lenggong
310	Klinik Kesihatan Tanjung Piandang	349	Klinik Leong
311	Klinik Kesihatan Tarat	350	Klinik Liew Choo Sin

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
351	Klinik Lim	390	Klinik Nik Amrah & Zaliha Sdn Bhd
352	Klinik Lim & Lau	391	Klinik Nik Amrah & Zaliha Sdn. Bhd
353	Klinik Lim Chin Chong Sdn Bhd	392	Klinik Nirmala
354	Klinik Lim Siew Kim	393	Klinik Noh
355	Klinik Looi	394	Klinik Noor Shila
356	Klinik Low	395	Klinik Nuqman
357	Klinik Lua, Jln Sultan Yahya Petra	396	Klinik P. N. Teoh
358	Klinik M. Y. Wong	397	Klinik P.H Yew
359	Klinik Mahkota	398	Klinik Pakar Dr Adnan Osman (Poliklinik Pakar Perubatan Jitra)
360	Klinik Maiza	399	Klinik Pakar Dr. Leonard
361	Klinik Makmur	400	Klinik Pakar George Thava
362	Klinik Malaysia	401	Klinik Pakar Kanak-Kanak Butterworth
363	Klinik Malaysia (Cawangan Jalan Pantai)	402	Klinik Pakar Kanak-Kanak Choo
364	Klinik Malaysia (Cawangan Sesb)	403	Klinik Pakar Kanak-Kanak dan Bayi Dr Wong Ming Chee.
365	Klinik Mamad Sdn Bhd	404	Klinik Pakar Kanak-Kanak Ho
366	Klinik Mariana Sdn. Bhd	405	Klinik Pakar Kanak-Kanak Kulim
367	Klinik Masjid Tanah	406	Klinik Pakar Kanak-Kanak Lee
368	Klinik Medicate Jln Raja Chulan	407	Klinik Pakar Kanak-Kanak Loo
369	Klinik Medik 24-7, Bandar Country Homes	408	Klinik Pakar Kanak-Kanak Pelangi Sdn Bhd
370	Klinik Medinosis	409	Klinik Pakar Kanak-Kanak S.T. Lim
371	Klinik Medisense Cheras	410	Klinik Pakar Kanak-Kanak T.C. Yeo
372	Klinik Medisense.	411	Klinik pakar kanak-Kanak Tan
373	Klinik Mohan	412	Klinik Pakar Kanak-kanak Tang
374	Klinik Mok & Loh	413	Klinik Pakar Kanak-Kanak Teow
375	Klinik Mulia Pasir Gudang	414	Klinik Pakar Mata Anna
376	Klinik Munnir	415	Klinik Pakar Mata Dan Surgeri Masran (Tmn Berlian)
377	Klinik Murshid & Tharizah Sdn. Bhd	416	Klinik Pakar Mata Khong Sdn Bhd
378	Klinik Mutiara	417	Klinik Pakar Orthopedik John Anatham
379	Klinik Mutiara Inanam	418	Klinik Pakar Perubatan Century
380	Klinik Nabilah	419	Klinik Pakar Perubatan Ch Ng
381	Klinik Nagoke Sdn Bhd	420	Klinik Pakar Perubatan Chan
382	Klinik Naharajan & Imaging Centre	421	Klinik Pakar Perubatan Foo
383	Klinik Nasha	422	Klinik Pakar Perubatan Ho
384	Klinik Nasir & Surgeri	423	Klinik Pakar Wanita dan Kanak-Kanak CT
385	Klinik Naveen	424	Klinik Pakar Wanita K.C. Foo
386	Klinik Ng	425	Klinik Pakar Wanita Tan
387	Klinik Ng & Rakan Rakan	426	Klinik Pantai, Rantau
388	Klinik Ng Sendirian		
389	Klinik Nik		

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
427	Klinik Papar Medical Group	465	Klinik Robert Wong
428	Klinik Parit Yaani	466	Klinik Rohani
429	Klinik Pekan	467	Klinik Rompin
430	Klinik Penawar & Surgeri, Kluang	468	Klinik Roslina
431	Klinik People (Permas Jaya)	469	Klinik Rusli
432	Klinik Perdana - Bgn PKINK	470	Klinik Rusnah
433	Klinik Perdana Cawangan Islah	471	Klinik S F Chung
434	Klinik Perdana Melor	472	Klinik S. T. Ng
435	Klinik Perintis Health Care	473	Klinik Sabrina
436	Klinik Pertama	474	Klinik Sairam
437	Klinik Pertama (Tmn Johor Jaya)	475	Klinik Sanan
438	Klinik Perubatan & Surgeri Dr. Ahmad	476	Klinik Sandhu Senai
439	Klinik Perubatan Chan	477	Klinik Saujana
440	Klinik Pillai	478	Klinik Sayyida Sdn.Bhd.
441	Klinik Pontian	479	Klinik Sein
442	Klinik Praba	480	Klinik Sejahtera (Pt. Raja)
443	Klinik Prihatin	481	Klinik Selesa Jaya
444	Klinik Public	482	Klinik Senggarang (Klinik Teo & Tan Sdn BHd)
445	Klinik Public, Kulai	483	Klinik Sentosa
446	Klinik Puteri Anwar	484	Klinik Sentul
447	Klinik Putra	485	Klinik Seong
448	Klinik Ragavan	486	Klinik Seremban
449	Klinik Rahim Hamzah Halim & Razali Sdn Bhd (Batu 6)	487	Klinik Seri Pulau
450	Klinik Rahim Hamzah Halim & Razali Sdn Bhd (Jln Sultan Omar)	488	Klinik Shafee
451	Klinik Rahimah	489	Klinik Shaik M. R.
452	Klinik Rakyat	490	Klinik Shanti
453	Klinik Ramli & Adibah	491	Klinik Shatin
454	Klinik Rantau Petronas	492	Klinik Shifak
455	Klinik Rapha	493	Klinik Sia Dan Surgeri
456	Klinik Rashid Dan Raudhah	494	Klinik Siau
457	Klinik Ratnam	495	Klinik Sidhu
458	Klinik Rawatan Ahsan	496	Klinik Simee
459	Klinik Rawatan Keluarga	497	Klinik Sinaran
460	Klinik Razak	498	Klinik Singapore
461	Klinik Redzuan	499	Klinik Siva
462	Klinik Rembau	500	Klinik Skudai
463	Klinik Reuben	501	Klinik Sohvindir
464	Klinik Revin	502	Klinik Soma
		503	Klinik Soong

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
504	Klinik Special	543	Klinik Ummi
505	Klinik Sri Cengal	544	Klinik Ummi Azizan
506	Klinik Sri Penawar	545	Klinik Ummu Roihan Sdn Bhd
507	Klinik Sri Pinang	546	Klinik United
508	Klinik Sri Rambai	547	Klinik Utama
509	Klinik Sri Sulong	548	Klinik Utama & Surgeri
510	Klinik Su	549	Klinik Utama Ipoh
511	Klinik Suhaila	550	Klinik Utama Kosas
512	Klinik Sulaiman	551	Klinik Vijayapadmam
513	Klinik Sulaiman Jerantut	552	Klinik Wakaf An-Nur
514	Klinik Sulaiman, Jengka	553	Klinik Wan Fatimah
515	Klinik Swaran	554	Klinik Wan Suhaimi
516	Klinik Syed Alwi dan Chandran	555	Klinik Wang
517	Klinik Syed Badaruddin	556	Klinik Wanita Wisma Maria
518	Klinik Syed Salleh Dan Rakan-Rakan Sdn. Bhd	557	Klinik Waqaf An-Nur
519	Klinik Syifaa	558	Klinik Waqaf An-Nur Sarawak
520	Klinik Tai	559	Klinik Wawasan
521	Klinik Tampin	560	Klinik Widuri
522	Klinik Tan & Appaduray.	561	Klinik Widury
523	Klinik Tan & Lum (Benut)	562	Klinik Wira
524	Klinik Tan & Lum (Pekan Nenas)	563	Klinik Wong (Jln Senohong Dua)
525	Klinik Tan Dan Rakan-Rakan	564	Klinik Wong (Jln Temenggong)
526	Klinik Tan Dan Surgeri	565	Klinik Wong Choong Howe
527	Klinik Tawakal, Rengit	566	Klinik Y. L. Khoo Sdn Bhd
528	Klinik Team Medic	567	Klinik Y. M. Lo
529	Klinik Tee	568	Klinik Yahya
530	Klinik Teo	569	Klinik Yasmin
531	Klinik Teo (Klinik Teo & Tan Sdn Bhd)	570	Klinik Yee
532	Klinik Teoh Kim Yong	571	Klinik Yeoh & Ong
533	Klinik Teong	572	Klinik Yeoh Oon Theam Sdn. Bhd
534	Klinik Theesan (Taman U)	573	Klinik Yii
535	Klinik Toledo	574	Klinik Yong & Ng
536	Klinik Tony Sim Tong Aik	575	Klinik Yusof
537	Klinik Topcare (ALMA) Sdn Bhd	576	Klinik Zahra
538	Klinik Tropika Sdn Bhd	577	Klinik Zainab
539	Klinik Tune	578	Klinik Zainon
540	Klinik Tweedie	579	Klinik Zalfah
541	Klinik Ujong Pasir	580	Klinik Zalina
542	Klinik Uma	581	Klinik Zulkifli (Poliklinik & Surgeri)

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
582	Kota Kinabalu Clinic	619	Poliklinik Anggerik
583	Kumpulan Perubatan SMP Sdn. Bhd (Klinik Pertama)	620	Poliklinik Berkat
584	Lee Eye Centre Sdn Bhd	621	Poliklinik Cempaka (Tmn Air Biru)
585	Lim Dispensary	622	Poliklinik Chen
586	Lim Eye Specialist Clinic	623	Poliklinik Chiah
587	Lim Kok Chee Ear,Nose & Throat Surgery Sdn Bhd	624	Poliklinik Chik
588	Lim Skin Specialist Clinic	625	Poliklinik Dahlia
589	Ling Eye Specialist Clinic & Surgery	626	Poliklinik Damai & Surgeri, Tmn Desa Jaya
590	Loh Cosmetic & Laser Surgery	627	Poliklinik dan Surgeri Khor
591	Loh Medical Clinic	628	Poliklinik Dan Surgeri Rahang (Cawangan Rasah Jaya)
592	Low gastroenterology & Medical Clinic	629	Poliklinik Dan Surgeri Serdang
593	Luke Klinik	630	Poliklinik Desa Permai
594	Marvin Chong Specialist Clinic	631	Poliklinik Dr Chan
595	Mediklinik Ehsan Alor Setar	632	Poliklinik Dr. Azhar & Rakan-rakan
596	Medi-klinik Teh	633	Poliklinik Dr. Azhar & Rakan-rakan, Plaza Kuala Kedah
597	Merdeka Health Care Clinic	634	Poliklinik Dr. C.Y.Ong Sdn. Bhd.
598	Moses Ear, Nose & Throat Clinic	635	Poliklinik Dr. Jalaludin
599	Neong Pusat Pakar Perbidanan & sakit Puan	636	Poliklinik Dr. Velu
600	New Town Poliklinik	637	Poliklinik Duta Jaya
601	Ng Siew Eng Women Specialist Clinic	638	Poliklinik Fair Park
602	Occupational Health Centre	639	Poliklinik Famili
603	Oh Klinik Pakar Kanak-Kanak	640	Poliklinik Fatimah (Taman Daya)
604	Optimax Eye Specialist Centre	641	Poliklinik Hashim, Sabariah Mohamad
605	PC Gastro Medical Specialist Centre Sdn Bhd	642	Poliklinik Hidayah
606	Peoples kelinik	643	Poliklinik Hidayah Sdn. Bhd.
607	Perdana Polyclinic Lumut	644	Poliklinik Hidayah, Kamunting
608	Perfect Outcome Sdn Bhd	645	Poliklinik Hijrah (Tmn Puteri Wangsa)
609	Permai Polyclinics Lintas Plaza	646	Poliklinik Idaman
610	Permai Polyclinics Sdn. Bhd	647	Poliklinik Ihsan (Tmn Kempas)
611	Petronas Fertilizer (Kedah) Sdn. Bhd. Industrial Clinic	648	Poliklinik Impian
612	Policlinic Qualimedic Sdn Bhd	649	Poliklinik Ipoh Jaya
613	Polikelinik Bakti, Parit Buntar	650	Poliklinik Jaya Skudai
614	Poliklinik & Surgeri Batu Gajah	651	Poliklinik Johari
615	Poliklinik Afiat	652	Poliklinik John
616	Poliklinik Alex	653	Poliklinik Khor & Arun, Sg Besi
617	Poliklinik Aman	654	Poliklinik Koh
618	Poliklinik Amin	655	Poliklinik Komuniti Air Tawar 2
		656	Poliklinik Komuniti Al-Muktafi Billah Shah

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
657	Poliklinik Komuniti Banai	695	Poliklinik Laksmana Dan Surgeri
658	Poliklinik Komuniti Batu Anam	696	Poliklinik Leong
659	Poliklinik Komuniti Bukit Besar	697	Poliklinik Leong & Ho
660	Poliklinik Komuniti Bundu Tuhan	698	Poliklinik Limlee (formerly Poli Klinik)
661	Poliklinik Komuniti Hulu Langat (Klinik Kesihatan Batu 13 1/4)	699	Poliklinik Mah
662	Poliklinik Komuniti Jalan Putra	700	Poliklinik Manjit
663	Poliklinik Komuniti Jenjarom	701	Poliklinik Maxwell
664	Poliklinik Komuniti Jeram	702	Poliklinik Medic
665	Poliklinik Komuniti Kampong Raja type 3	703	Poliklinik Meor
666	Poliklinik Komuniti Kampung Majidee	704	Poliklinik Merdeka
667	Poliklinik Komuniti Kampung Soeharto	705	Poliklinik Mesra
668	Poliklinik Komuniti Karakit	706	Poliklinik Mulia Jaya
669	Poliklinik Komuniti Ketengah Jaya	707	Poliklinik Mutiara Cawangan Simpang Kuala
670	Poliklinik Komuniti Kg. Bandar	708	Poliklinik Mutiara, Tmn Desa Aman
671	Poliklinik Komuniti Klang	709	Poliklinik Ng
672	Poliklinik Komuniti Kota Sarang Semut	710	Poliklinik Noriha
673	Poliklinik Komuniti Laka Temin	711	Poliklinik Ooi
674	Poliklinik Komuniti Paginatan	712	PoliKlinik P & Lee (Taman Intan)
675	Poliklinik Komuniti Parit Jawa	713	Poliklinik Pakar Dan Surgeri
676	Poliklinik Komuniti Penangah	714	Poliklinik Pan-Medic
677	Poliklinik Komuniti Perancangan	715	Poliklinik Pan-Medic (Farlim)
678	Poliklinik Komuniti Pokok Sena	716	Poliklinik Penawar
679	Poliklinik Komuniti Pontian (Klinik Kesihatan Pontian)	717	Poliklinik Penawar - Felda Tenggaroh 2
680	Poliklinik Komuniti Selayang Baru	718	Poliklinik Penawar - Kg Pasir, Tampoi
681	Poliklinik Komuniti Seri Kembangan	719	Poliklinik Penawar - Kolam Air
682	Poliklinik Komuniti Shah Alam	720	Poliklinik Penawar - Masai
683	Poliklinik Komuniti Sungai Buloh	721	Poliklinik Penawar - Tanjung Sedili
684	Poliklinik Komuniti Sungai Pelek	722	Poliklinik Penawar - Tmn Bintang, Senai
685	Poliklinik Komuniti Telaga	723	Poliklinik Penawar - Tmn Dahlia
686	Poliklinik Komuniti Telok Datok	724	Poliklinik Penawar - Tmn Daya
687	Poliklinik Komuniti Tinangol	725	Poliklinik Penawar - Tmn Istimewa Pandan
688	Poliklinik Komuniti Tongod	726	Poliklinik Penawar - Tmn Rinting
689	Poliklinik Komuniti Tunjang	727	Poliklinik Penawar - Tmn Sri Bahagia
690	Poliklinik Komuniti Ulu Tiram	727	Poliklinik Penawar - Tmn Sri Bahagia
691	Poliklinik Kuan	728	Poliklinik Penawar - Tmn Universiti
692	Poliklinik Kuek	729	Poliklinik Penawar (Felda Kledang)
693	Poliklinik Kumpulan City - Dataran Templer	730	Poliklinik Penawar (Jalan Suasa, Pasir Gudang)
694	Poliklinik Kumpulan City - Sri Damansara	731	Poliklinik Penawar (Pusat Bandar, Bandar Penawar)
		732	Poliklinik Penawar (Tmn Air Biru)

Primary Care Clinics participating in NMUS Survey

No.	Private Clinics	No.	Private Clinics
733	Poliklinik Penawar (Tmn Johor Jaya)	771	Public Poliklinik
734	Poliklinik Penawar (Tmn Kota Masai, Jln Betik)	772	Pusat Pakar Tulang & Sendi Dr. Yew Khoon Seng
735	Poliklinik Penawar (Tmn Tun Sri Lanang)	773	Pusat Perubatan Julia
736	Poliklinik Permai	774	Pusat Rawatan An-Nur (Dr.Rosnani)
737	Poliklinik Permata, Tmn Permata	775	Pusat Tulang Dan Osteoporosis DXA Sdn Bhd
738	Poliklinik Porkodi	776	Rajagopal Specialist Clinic Sdn. Bhd.
739	Poliklinik PTP	777	Reddy Klinik Butterworth
740	Poliklinik Puteri Dan Surgeri (Jln Niaga, Kota Tinggi)	778	Sarawak Specialist Clinic
741	Poliklinik Rakyat - Cawangan Kota Kinabalu	779	Selva Klinik
742	Poliklinik Rakyat - Cawangan Putatan	780	Sentosa Klinik Kuantan
743	Poliklinik Raub & Surgery	781	Sentosa Klinik Taman Tas
744	Poliklinik Ravi	782	Sethu Medical Clinic
745	Poliklinik Reservoir Garden	783	Siburan Union Clinic
746	Poliklinik Rozikin (Masai)	784	Simon Wong Medical Specialist Clinic
747	Poliklinik Salehudin	785	Singapore Children and Family Clinic
748	Poliklinik Sandhu	786	Sinsuran Clinic
749	Poliklinik Sejahtera	787	Specialist Maternity & Fertility Centre
750	Poliklinik Sejahtera Sdn Bhd	788	Taiping Specialist Clinic
751	Poliklinik Seri Iskandar	789	Tang Clinic
752	Poliklinik Sg Jelok	790	Tay & Tan Medicare Sdn Bhd (T & T Clinic)
753	Poliklinik Simpang	791	Tay Specialist Surgical Sdn Bhd
754	Poliklinik Sunli	792	Teng & Ho Clinic Sdn Bhd
755	Poliklinik Sunway	793	Teoh & Tang,Pakar Wanita & Kesuburan,Women Specialist Clinic
756	Poliklinik Suri	794	Teoh Eye Clinic & Surgery
757	Poliklinik Sutera	795	The Merican Dispensary
758	Poliklinik T M Chan	796	The People Dispensary Sdn Bhd (Jln Ibrahim)
759	Poliklinik Taj 24 Jam, Taman Tampoi Utama	797	The People Dispensary Sdn Bhd (Klinik People Masai)
760	Poliklinik Tan	798	Thong Klinik
761	Poliklinik Tan & Wong	799	Ting & Ding Surgery Sdn Bhd
762	Poliklinik Tanjung	800	Titan Inplant Clinic Tg Langsat
763	Poliklinik Taqwa Simpang Pulai	801	Titan P Gudang Inplant Clinic
764	Poliklinik Universiti	802	Union Clinic
765	Poliklinik Utama	803	Union Clinic (S.A)
766	Poliklinik V-Care	804	Wan Lee Seng Specialist Eye Centre Sdn Bhd
767	Poliklinik Wahidah	805	Wee Kidney & Medical Specialist Clinic Sdn Bhd
768	Poliklinik Zakariya	806	Yap Psychiatry Specialist Clinic
769	Premier Polyclinic Kingfisher	807	Yoong Clinic Sdn. Bhd
770	Prince Court Medical Centre		

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
1	51 Avenue Pharmacy Sdn Bhd - Kajang	42	A-Remedy Pharmacy Sdn.Bhd.
2	51 Avenue Pharmacy Sdn Bhd - Sek 8, Bdr Baru Bangi	43	Armanee Pharmacy Sdn Bhd
3	AA Pharmacy Sdn Bhd	44	Axis Pharmacy Sdn.Bhd.
4	Abby Pharmacy	45	B Y Chan Pharmacy Sdn Bhd - Channel road
5	Ace Caring Pharmacy Sdn Bhd	46	B.B. Pharmacy Sdn.Bhd.
6	Activecare Pharmacy Sdn. Bhd.	47	B.J Pharmacy
7	AEON Co (M) Bhd.	48	Bahagia Jingga (M) Sdn. Bhd.
8	Aeon Co. (M) Bhd	49	Bahau Pharmacy SB
9	Aeon Co. (M) Bhd (Aeon Wellness Pharmacy)	50	Bahau Pharmacy Sdn Bhd
10	Aeon Co. (M) Bhd (Wellness Pharmacy)	51	Bahau Pharmacy Sdn. Bhd.
11	Aeon Wellness Pharmacy	52	Balik Pulau Health-Care
12	AG Pharmacy Sdn.Bhd.	53	Baling Pharmacy Sdn. Bhd.
13	AK Pharmacy & Naturopathy Centre	54	Bandar Sunway Pharmacy
14	Alcare Pharmacy Sdn Bhd	55	Bath Pharmacy Sdn. Bhd.
15	Alchemist Pharmacy Sdn Bhd	56	Batu Lintang Pharmacy Sdn. Bhd
16	Alex Pharmacy	57	BB Boss Sdn Bhd
17	Alice Pharmacy Sdn Bhd	58	BB Pharmaceutical
18	Aliph Pharmacy,	59	Be Caring Pharmacy Sdn Bhd - Jalan 14/20
19	All Care Pharmacy	60	Be Caring Sdn Bhd
20	All Health Medical Supplies	61	Be Med Sdn Bhd
21	Allcare Pharmahealth	62	Be Pharmacy - Puchong Perdana
22	Allin Pertama Pharmacy Sdn Bhd	63	Bemed (SP) Sdn Bhd
23	Allin Pharmacy	64	Bemed Lagenda Sdn. Bhd
24	Alpha Clinics Sdn Bhd	65	Bemed Venture Sdn Bhd (Be Pharmacy)
25	Alpha.com (ABC) - Pandan Indah	66	Be-P Pharmacy
26	Alpro Pharmacy (PG) Sdn.Bhd.	67	Berry Pharmacy
27	Alpro Pharmacy Holdings Sdn Bhd	68	Bettercare Pharmacy Sdn Bhd
28	Alpro Pharmacy Holdings Sdn Bhd - Sirusa Jaya, Teluk Kemang	69	Big Bee Pharmacy Sdn Bhd
29	Alpro Pharmacy Sdn Bhd - Oceanic Mall, Port Dickson	70	Bintulu Pharmacy (M) Sdn Bhd - Sg Chua, Kajang
30	Alpro Pharmacy Sdn. Bhd.	71	Bintulu Pharmacy (Semenyih) Sdn Bhd
31	Alsyifaa Farmasi (Jerantut) Sdn Bhd	72	Biocare Pharmacy
32	Alsyifaa Farmasi (Pekan) SB	73	Bio-Care Pharmacy Sdn Bhd
33	Always Pharmacy Sdn Bhd	74	Biochem Pharmacy
34	AM PM Pharmacy Sdn Bhd	75	Biofresh Growth Sdn Bhd
35	Amcal Pharmacy Sdn Bhd	76	Biohealth Pharmacy Sdn Bhd
36	Ancare Pharmacy	77	Biolife Plus Pharmacy Sdn Bhd
37	Ang Pharmacy	78	Biopharma Link Pharmacy Sdn.Bhd.
38	Apex Pharmacy Sdn. Bhd - City Square	79	BM Sentosa Pharmacy
39	Apo's Pharmacy	80	Bond Mega Pharmacy
40	Apple Green Pharmacy	81	Boon Pharmacy Sdn Bhd
41	April Pharmacy	82	Boon Pharmacy Sdn.Bhd.
		83	Borneo Dispensary (2) Sdn Bhd
		84	Borneo Dispensary (Batu 1) Sdn. Bhd

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
85	Borneo Dispensary (Batu 8) Sdn. Bhd.	128	City Medic Pharmacy (M) Sdn Bhd
86	Borneo Dispensary Indah Sdn. Bhd.	129	City Parade Pharmacy
87	Borneo Dispensary Sdn Bhd	130	City Pharmacy
88	Breeds Pharmacy	131	Citycare Pharmacy
89	Breeds Pharmacy Sdn. Bhd.	132	CK Pharmacy
90	Bright Pharmacy Sdn Bhd	133	CL SU Pharmacy Sdn Bhd
91	BrightCare Pharmacy	134	CMCORP Pharmacy (M) Sdn. Bhd.
92	Bukit Baru Pharmacy Sdn Bhd	135	Coco Mart (M) Sdn Bhd
93	Bukit Mertajam Pharmacy Sdn Bhd	136	Complete Wellness Pharmacy SB
94	C S Lo Pharmacy	137	Concept Pharmacy
95	Cameron Pharmacy Sdn Bhd	138	Cp Centrecare Pharmacy Sdn. Bhd.
96	Campbell Pharmacy Sdn.Bhd.	139	Cyntex Marketing & Services
97	CareLink Pharmacy	140	D E Farmasi Sdn Bhd
98	Caremart Pharmacy	141	Dailycare Pharmacy Sdn Bhd
99	Carene Pharmacy	142	Damai Pharmacy (Brighton Hope Sdn Bhd)-Choice Supermall
100	Careplus Pharmacy Sdn. Bhd.	143	Damai Pharmacy (Brighton Hope Sdn Bhd)-Desa Ilmu
101	Caring `N` You Pharmacy Sdn Bhd	144	Damirals Care Pharmacy
102	Caring Belle Sdn Bhd - Jln SS2/67	145	Danau Desa Pharmacy Sdn Bhd
103	Caring Health Solutions Sdn Bhd	146	D'Ansara PharmaShoppe & H'care SB
104	Caring Pharmacy (MSF) Sdn Bhd	147	Darlina Pharmacy
105	Caring Pharmacy (Puchong) Sdn Bhd	148	Darul Intelek Pharma Sdn Bhd
106	Caring Pharmacy Retail Management Sdn. Bhd	149	DE Farmasi (Silibin) Sdn Bhd
107	Caring Pharmacy Sdn Bhd - Bandar Utama	150	De Pharmacy
108	Caring Pharmacy Sdn Bhd - Happy Garden	151	Dekad Pharmacy
109	Caring Pharmacy Sdn Bhd - Hartamas	152	Delima Farmasi Sdn Bhd
110	Caring Pharmacy Sdn Bhd - Sea Park	153	Desa Farmasi Sdn Bhd - Jln Pasar
111	Caring Pharmacy Sdn Bhd - Tmn Kinrara	154	Desa Farmasi Sdn Bhd - Nibong Tebal
112	Caring Pharmacy Sdn Bhd - Tmn Kok Lian	155	Desa Farmasi Sdn Bhd - Sg. Bakap
113	Caring Pharmacy Sdn Bhd - Tmn Muda	156	Desa Farmasi Sdn Bhd - Tmn Mutiara
114	Ce-Link Pharmacy Sdn Bhd	157	Desmaju Sdn Bhd
115	Central Park Pharmacy	158	Desmaju Sdn.Bhd.
116	Central Pharmacy Sdn Bhd	159	Dextro Pharmacy Sdn. Bhd.
117	Centre Point Pharmacys Sdn Bhd	160	Dillons Pharmacy Sdn. Bhd.
118	Century Pharmacy	161	Dispergal (M) Sdn Bhd
119	Century Pharmacy Sdn Bhd	162	D'Lo Concept Sdn Bhd
120	Chen Pharmacy	163	DM Pharmacy
121	Chen Pharmacy	164	Donggongon Pharmacy
122	Cheryl Pharmacy	165	Doses Pharmacy Sdn Bhd
123	Chester Street Pharmacy	166	Doses Pharmacy Sdn. Bhd.
124	Chong Guan Pharmacy	167	Drughouse Supplies
125	Chuan Pharmacy	168	DY Healthcare Sdn.Bhd.
126	City Healthcare Pharmacy (Air Itam)Sdn.Bhd.	169	E & C Pharmacy
127	City Healthcare Pharmacy (Farlim) Sdn.Bhd.		

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
170	E Care Pharmacy	212	Farmasi Ampang
171	E.V. Care Pharmacy	213	Farmasi Ampangan Sdn Bhd
172	Econurture Sdn Bhd	214	Farmasi Ang & Ang
173	EE Syn Pharmacy Sdn Bhd,	215	Farmasi Annees
174	Eennat Pharmacy	216	Farmasi Apollo
175	Ego Pharmacy Sdn Bhd	217	Farmasi Ara Jaya
176	Ego Pharmacy Sdn.Bhd.	218	Farmasi Aries
177	Elim Pharmacy	219	Farmasi Ariv Vision
178	Elite Pharmacy Sdn.Bhd.	220	Farmasi Aslam
179	ESP Life Healthcare Sdn Bhd	221	Farmasi Aslam - Putatan Square
180	Eucare Pharmacy Sdn. Bhd.	222	Farmasi Aslam (Sabah) S/B
181	Evercare Pharmacy	223	Farmasi Asnaf
182	Excelcare Chemist	224	Farmasi Assabil
183	Expertcare Pharmacy Sdn Bhd	225	Farmasi Bagan (BW) Sdn.Bhd.
184	Exquisite Healthcare Sdn. Bhd.	226	Farmasi Bagan Sdn. Bhd.
185	Extra Care Pharmacy Sdn.Bhd	227	Farmasi Bagan Sdn.Bhd.
186	Fable Region Sdn Bhd	228	Farmasi Baiduri Sdn Bhd
187	Famili-Care Pharmacy	229	Farmasi Bajrai,
188	Far East Pharm (LD) Sdn Bhd	230	Farmasi Bakti Sdn. Bhd.
189	Far East Pharmacy Sdn Bhd	231	Farmasi Balakong Sdn Bhd
190	Farmasi Mega Care	232	Farmasi Bandar Baru Klang
191	Farmasi Afid	233	Farmasi Banting - Jln Bunga Pekan, Banting
192	Farmasi Agape	234	Farmasi Barakah
193	Farmasi Aidan	235	Farmasi Batu Berendam
194	Farmasi Aiman	236	Farmasi Batu Maung Sdn.Bhd.
195	Farmasi Ain Nur	237	Farmasi Bentong
196	Farmasi Air Tawar	238	Farmasi Bercham
197	Farmasi Aktif	239	Farmasi Berkat
198	Farmasi Al Iman	240	Farmasi Berlian
199	Farmasi Al-Ahlam	241	Farmasi Bersatu
200	Farmasi Alang Sdn Bhd	242	Farmasi Berseri
201	Farmasi Aldor	243	Farmasi Bertam
202	Farmasi Al-Fatiha	244	Farmasi Bestari
203	Farmasi Alma	245	Farmasi Bintang
204	Farmasi Alpha Gombak	246	Farmasi Budaya Sdn. Bhd.
205	Farmasi Alpha Sdn. Bhd	247	Farmasi Cahaya
206	Farmasi Alychem Sdn. Bhd - Kapar, Klang	248	Farmasi Cahaya Sdn Bhd
207	Farmasi Alychem Sdn. Bhd - Payar Jeras, Sg. Buloh	249	Farmasi Cahaya Timur
208	Farmasi Alychem Sdn. Bhd - Selayang, Batu Caves	250	Farmasi Carrie Sdn Bhd
209	Farmasi Alychem Sdn. Bhd - Sg. Long, Kajang	251	Farmasi Cemara
210	Farmasi Alychem Sdn. Bhd - Suntex, Ulu Langat	252	Farmasi Cemerlang
211	Farmasi Aman	253	Farmasi Cenderawasih
		254	Farmasi Cenderawasih (Bt. 3) SB

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
255	Farmasi Cenderawasih (Pekan) SB	298	Farmasi Goodmedic (Midah) Sdn Bhd
256	Farmasi Center Point	299	Farmasi Goodmedic (Taming Jaya) Sdn Bhd
257	Farmasi Chi Liung	300	Farmasi Goodmedic Sdn Bhd
258	Farmasi Chia	301	Farmasi Greenland
259	Farmasi Country Homes	302	Farmasi Greentree
260	Farmasi D'Care FN Sdn. Bhd	303	Farmasi Gua Musang
261	Farmasi Dama Sdn Bhd	304	Farmasi Haneem
262	Farmasi Damar Laut	305	Farmasi Harmoni
263	Farmasi Darul Iman	306	Farmasi Hata Square
264	Farmasi De JS Sdn. Bhd.	307	Farmasi Hayat
265	Farmasi Delima	308	Farmasi Heal N Care
266	Farmasi Desa	309	Farmasi Hijrah Sdn Bhd
267	Farmasi Dinamik	310	Farmasi Hing Sdn. Bhd.
268	Farmasi Dsafia,	311	Farmasi HKS
269	Farmasi Dunia Sihat Sdn. Bhd.	312	Farmasi Idaman
270	Farmasi Durian Tunggal	313	Farmasi Idaman Sdn. Bhd.
271	Farmasi Duyong	314	Farmasi Ikhlas
272	Farmasi Eckerd	315	Farmasi Ikhtiar
273	Farmasi Econ	316	Farmasi Ilhami
274	Farmasi Ehsan - Jerteh	317	Farmasi Iman
275	Farmasi Ehsan - Machang	318	Farmasi Impian,
276	Farmasi Ehsan Marketing	319	Farmasi Impiana
277	Farmasi Ehsan PC	320	Farmasi Indah
278	Farmasi Ehsan Sdn Bhd - Pasir Puteh	321	Farmasi Iping Sdn.Bhd.
279	Farmasi Ehsan Setiu	322	Farmasi Iqram
280	Farmasi Elcarim Sdn Bhd [Farmasi Alpha.com]	323	Farmasi Ismi
281	Farmasi Eng Ann	324	Farmasi Jati
282	Farmasi Era Baru Sdn. Bhd.	325	Farmasi Jaya
283	Farmasi EV Care	326	Farmasi Jaya Gading
284	Farmasi Evercare	327	Farmasi Jeniang (M) Sdn. Bhd.
285	Farmasi Evergreen Health Sdn Bhd	328	Farmasi Jenjarom
286	Farmasi Excare	329	Farmasi Jerai
287	Farmasi Fajr	330	Farmasi Jerteh
288	Farmasi Famili	331	Farmasi Juara (Segamat) Sdn Bhd
289	Farmasi Fisha	332	Farmasi Juru
290	Farmasi Fitrah	333	Farmasi Kauthar
291	Farmasi Fung	334	Farmasi Kelana Jaya Sdn Bhd
292	Farmasi Gemas	335	Farmasi Kenangan
293	Farmasi Goh - Bdr Puchong Jaya	336	Farmasi Kepala Batas
294	Farmasi Golden Pills	337	Farmasi Kepong - Desa Jaya, Kepong
295	Farmasi Goodmedic (Bkt. Mewah) Sdn Bhd	338	Farmasi Ketereh
296	Farmasi Goodmedic (Indah) Sdn Bhd	339	Farmasi Kita Sdn Bhd
297	Farmasi Goodmedic (KL) Sdn Bhd	340	Farmasi Klang

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
341	Farmasi Klang HealthCare	383	Farmasi Muda Sdn Bhd
342	Farmasi KNZ	384	Farmasi Muhibah
343	Farmasi Komuniti Wawasan	385	Farmasi Murni Marketing Sdn Bhd
344	Farmasi Kota Permai Sdn Bhd	386	Farmasi Murni Marketing Sdn. Bhd.
345	Farmasi Kota Putra	387	Farmasi Mutiara Sdn Bhd
346	Farmasi Kota Sdn. Bhd.	388	Farmasi My-Chemist (BM) Sdn.Bhd.
347	Farmasi Kris	389	Farmasi My-Chemist (R.Uda)Sdn.Bhd.
348	Farmasi Kuala Selangor	390	Farmasi My-Chemist Sdn.Bhd.
349	Farmasi Kuantan	391	Farmasi Naz
350	Farmasi Lawas	392	Farmasi Nazifa
351	Farmasi Lemed Sdn Bhd	393	Farmasi Nazifa (Cawangan Gurun)
352	Farmasi Liew	394	Farmasi Nazri Sdn.Bhd
353	Farmasi Lim	395	Farmasi Neu Setbury
354	Farmasi Lunas	396	Farmasi Nevens Marketing Sdn Bhd
355	Farmasi Makmur	397	Farmasi Nilai
356	Farmasi Makmur Jaya	398	Farmasi Nova
357	Farmasi Manir	399	Farmasi Nur
358	Farmasi Materia Medica - Putrajaya Hospital	400	Farmasi Padang
359	Farmasi Mawar	401	Farmasi Pakar
360	Farmasi Maxheal Sdn. Bhd.	402	Farmasi Pantai Timur
361	Farmasi Maxicare	403	Farmasi Pauh Sdn.Bhd.
362	Farmasi Maxipro (M) Sdn Bhd	404	Farmasi Paya Terubong Sdn Bhd
363	Farmasi Medi Ehsan	405	Farmasi PD
364	Farmasi Medi Mesra	406	Farmasi Penawar
365	Farmasi Medica	407	Farmasi Pendang
366	Farmasi Medi-Nur Sdn. Bhd	408	Farmasi Perdana
367	Farmasi Mediplus	409	Farmasi Peringgit Sdn Bhd
368	Farmasi Medipoint Sdn Bhd	410	Farmasi Permai Sdn. Bhd.
369	Farmasi Medipro	411	Farmasi Permaisuri
370	Farmasi Medisa	412	Farmasi Permaisuri
371	Farmasi Medivita	413	Farmasi Pertama
372	Farmasi Mee Mi	414	Farmasi Petagas
373	Farmasi Meera	415	Farmasi Pharmacy Sdn Bhd
374	Farmasi Mengelembu Baru	416	Farmasi PJ
375	Farmasi Meru Klg	417	Farmasi Plus Care (M) Sdn. Bhd.
376	Farmasi MesraPharma	418	Farmasi Pontian Sdn Bhd
377	Farmasi Mewah	419	Farmasi Prihatin Sdn Bhd
378	Farmasi Millenium (Sri Sentosa) Sdn Bhd - Jln Klang Lama	420	Farmasi Pudu
379	Farmasi Millenium Sdn Bhd - Tmn Megah, PJ	421	Farmasi Pure Sdn Bhd
380	Farmasi MJ (Melaka) Sdn Bhd - Batu Berendam	422	Farmasi QBIZ
381	Farmasi Muammar	423	Farmasi R S Sdn. Bhd.
382	Farmasi Muar	424	Farmasi Rakyat
		425	Farmasi Rapat

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
426	Farmasi Rasah Jaya	469	Farmasi Sri Pulau Sdn.Bhd.
427	Farmasi Rawang - Jln Bandar Rawang 2	470	Farmasi Srimulia Sdn Bhd
428	Farmasi Rawang - Jln Maxwell, Rawang	471	Farmasi Sungai Way
429	Farmasi Rimadex Sdn Bhd - Jln Dusun Muda	472	Farmasi Suria
430	Farmasi Rimadex Sdn Bhd - Pauh Panji	473	Farmasi Suriani
431	Farmasi Rimadex Sdn Bhd - Wakaf Che Yeh	474	Farmasi Sutera (KL) Sdn Bhd
432	Farmasi Rin	475	Farmasi Syaza Sdn Bhd
433	Farmasi Ruby	476	Farmasi Tampin Sdn Bhd
434	Farmasi Saiza	477	Farmasi Tan
435	Farmasi Samudra	478	Farmasi Tan - PJ Old Town
436	Farmasi Saujana	479	Farmasi Tanjong Sepat
437	Farmasi Sayang	480	Farmasi Tanjung
438	Farmasi Sayang Dua	481	Farmasi Tanjung Bungah
439	Farmasi SD	482	Farmasi Tasek Sdn Bhd
440	Farmasi Seberang Jaya	483	Farmasi Taufiq Lim
441	Farmasi Segar Healthcare Sdn Bhd	484	Farmasi Tawakkal
442	Farmasi Sekilau	485	Farmasi Teck Hong
443	Farmasi Seng	486	Farmasi Telok Mas
444	Farmasi Sentosa	487	Farmasi Teratai
445	Farmasi Sentosa Ria Sdn Bhd	488	Farmasi Tesa
446	Farmasi Sentral	489	Farmasi Tiara
447	Farmasi Sentul - Sentul Pasar	490	Farmasi Tiara Sdn Bhd
448	Farmasi Seraya	491	Farmasi Trio Sdn Bhd - Tmn Sentosa
449	Farmasi Seri Melati	492	Farmasi Truecare Sdn Bhd
450	Farmasi Seri Petaling Sdn Bhd	493	Farmasi Tunjang
451	Farmasi Seroja	494	Farmasi Tynehealth
452	Farmasi Setia	495	Farmasi Ubatku Sdn.Bhd.
453	Farmasi Setia Indah	496	Farmasi Ulfah (Vital)
454	Farmasi Sg Ara	497	Farmasi Ultracare
455	Farmasi Sg. Karang	498	Farmasi Ummi
456	Farmasi Sia	499	Farmasi Unidamai
457	Farmasi Sihat	500	Farmasi Unipharm
458	Farmasi Sihat Ria	501	Farmasi Unipharma
459	Farmasi Sikamat	502	Farmasi Utara
460	Farmasi Simpang	503	Farmasi Utara Sdn Bhd
461	Farmasi Sinar Kulim	504	Farmasi Valley
462	Farmasi Sinar Sdn Bhd	505	Farmasi V-Fung Sdn.Bhd.
463	Farmasi Siva	506	Farmasi Vichem & Health Products
464	Farmasi Sri Jempol	507	Farmasi Vista Jelita Sdn Bhd
465	Farmasi Sri Kota	508	Farmasi Vitacare Sdn. Bhd - Carrefour Subang Jaya
466	Farmasi Sri Nibong Sdn.Bhd.	509	Farmasi Vitacare Sdn. Bhd - Tmn Melawati
467	Farmasi Sri Penanti	510	Farmasi Vlmaks
468	Farmasi Sri Pinang		

Pharmacies participating in NMUS survey

No.	Private Pharmacies
511	Farmasi Voon Sdn Bhd
512	Farmasi Walgreene
513	Farmasi Wangsa Sdn. Bhd
514	Farmasi Watan
515	Farmasi Wellness Sdn. Bhd.
516	Farmasi Wu
517	Farmasi Yasmin
518	Farmasi Yeo Sdn Bhd - Jln Besar, Seri Kembangan
519	Farmasi Yeo Sdn Sdn - Tmn Bukit Serdang
520	Farmasi Yogam
521	Farmasi Zaman
522	Farmasi Zhunion (Miri) Sdn Bhd
523	Farmasi ZNZ
524	Farmasi Zuli
525	Farmasi Zuq Sdn Bhd
526	Fawwaz Pharmacy
527	Fazlin Pharmacist Sdn Bhd
528	Ferringgi Pharmacy
529	Firstcare Pharmacy Sdn Bhd
530	Forever Pharmacy
531	Friend`s Pharmacy (My Venture Pharma Sdn Bhd)
532	Garden City Pharmacy Sdn Bhd
533	Gardenia Pharmacy
534	Gaya Pharmacy Supplies
535	GC Grace Pharmacy Sdn.Bhd.
536	Gch (M) Sdn Bhd (Guardian Pharmacy)
537	GCH Retail (M) Sdn Bhd
538	GCH Retail (M) Sdn Bhd - Suria KLCC
539	GCH Retail (M) Sdn.Bhd.
540	GCH Retail (Malaysia) Sdn Bhd
541	GCH Retail (Malaysia) Sdn Bhd [Guardian Pharmacy]
542	GCH Retail (Malaysia) Sdn. Bhd.
543	GCH Retail (Malaysia)Sdn.Bhd.
544	Gerak Utusan Pharmacy Sdn Bhd
545	Glad Hope Pharmacy Sdn.Bhd.
546	Good Master Pharmacy Sdn.Bhd.
547	Good Neighbour Farmasi
548	Goodwill Pharmacy
549	GP Pharmacy
550	Grace Pharmacy
551	Grandeur Healthcare Sdn Bhd
552	Great Maestro Sdn Bhd
553	Green Lane Pharmacy - Kepong Baru
554	Green Park Pharmacy Sdn Bhd
555	Green Pharmacy
556	Guardian GCH Retail (M) Sdn Bhd - Bangsar Baru
557	Guardian Pharmacy
558	Guardian Pharmacy - Jaya Jusco Taman Maluri
559	Guardian Pharmacy (M) Sdn Bhd
560	Guardian Pharmacy (M) Sdn Bhd - Amcorp Mall
561	Guardian Pharmacy (M) Sdn Bhd - Ampang Point
562	Guardian Pharmacy (M) Sdn Bhd - Bangsar Shopping Centre
563	Guardian Pharmacy (M) Sdn Bhd - Bintang Plaza Shopping Complex
564	Guardian Pharmacy (M) Sdn Bhd - Central Square
565	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Bayan Baru
566	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Klang
567	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Kuantan
568	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Plentong
569	Guardian Pharmacy (M) Sdn Bhd - Giant Hypermarket Stadium Shah Alam
570	Guardian Pharmacy (M) Sdn Bhd - Giant Sunway City Ipoh
571	Guardian Pharmacy (M) Sdn Bhd - Gurney Plaza
572	Guardian Pharmacy (M) Sdn Bhd - Holiday Plaza
573	Guardian Pharmacy (M) Sdn Bhd - Ikano Power Centre
574	Guardian Pharmacy (M) Sdn Bhd - Jalan Dato' Sheikh Seremban
575	Guardian Pharmacy (M) Sdn Bhd - Jalan Rahmat
576	Guardian Pharmacy (M) Sdn Bhd - Jalan Satok
577	Guardian Pharmacy (M) Sdn Bhd - Jusco Bukit Raja
578	Guardian Pharmacy (M) Sdn Bhd - Jusco Melaka
579	Guardian Pharmacy (M) Sdn Bhd - KB Mall
580	Guardian Pharmacy (M) Sdn Bhd - Kelana Jaya
581	Guardian Pharmacy (M) Sdn Bhd - KLIA
582	Guardian Pharmacy (M) Sdn Bhd - Kompleks PKNS
583	Guardian Pharmacy (M) Sdn Bhd - Midvalley Megamall

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
584	Guardian Pharmacy (M) Sdn Bhd - OUG Plaza	619	Health-Care Pharmacy
585	Guardian Pharmacy (M) Sdn Bhd - Putrajaya	620	Healthlink Pharmacy
586	Guardian Pharmacy (M) Sdn Bhd - Riverside	621	Healthmax Family Pharmacy
587	Guardian Pharmacy (M) Sdn Bhd - Section 14, PJ	622	HealthQuest Pharmacy Sdn Bhd
588	Guardian Pharmacy (M) Sdn Bhd - Shah Alam Mall	623	Healthspring Sdn Bhd
589	Guardian Pharmacy (M) Sdn Bhd - SS2/64	624	Healthworld Pharmacy Sdn.Bhd.
590	Guardian Pharmacy (M) Sdn Bhd - Sunway Pyramid	625	Herk Chung Pharmacy (K) Sdn Bhd
591	Guardian Pharmacy (M) Sdn Bhd - Taman Pelangi	626	Hock Hai Pharmacy Sdn Bhd
592	Guardian Pharmacy (M) Sdn Bhd - Taman Tun Dr Ismail	627	Hoewell Pharma Sdn Bhd
593	Guardian Pharmacy (M) Sdn Bhd - Terminal 1 Shopping Plaza	628	Holistic Pharmacy Sdn Bhd
594	Guardian Pharmacy (M) Sdn Bhd - Wisma Saberkas	629	Home-Care Pharmacy Sdn Bhd
595	H.T Ong And Choong Medical Services Sdn.Bhd.	630	Honey Pharmacy
596	Haitam Health	631	Hong Ai Pharmacy Sdn Bhd
597	Han's Pharmacy Sdn.Bhd.	632	Hospis Malaysia
598	Happy Pharmacy Sdn. Bhd.	633	Howe Cheang Medical Supply S.B
599	Harmoni Farmasi (KT) Sdn Bhd	634	Hucare Pharmacy Sdn. Bhd.
600	Harmoni Farmasi Kemaman Sdn. Bhd.	635	Hy Pharmacy
601	Harmoni Farmasi Paka Sdn. Bhd.	636	I Medikal Pharmaceutical Sdn. Bhd.
602	Harmoni Farmasi Sdn Bhd	637	Ideal Pharmacy
603	Hasiah Pharmacy	638	IJ Pharmacy (M) Sdn. Bhd.
604	HB Pharmacy	639	Impian Pharmahealth
605	HC Pharmacy	640	Inanam Pharmacy
606	Health Care Pharmacy	641	Innolink Sdn. Bhd.
607	Health Garden Pharmacy (Penang)Sdn.Bhd.	642	Integra Pharmacy Sdn.Bhd
608	Health Lane Family Pharmacy - Kg Baru, Sg Buloh	643	Integriti Premier Malaysia Sdn Bhd
609	Health Lane Family Pharmacy - Selangor Mansion, Jln Masjid India	644	Interpharm (M) Sdn. Bhd.
610	Health Lane Family Pharmacy - Tmn Bkt Maluri, Kepong	645	Irispharm Ventures Sdn Bhd
611	Health Lane Family Pharmacy - Tmn Sri Gambut	646	Island Chemist Sdn.Bhd.
612	Health Lane Family Pharmacy Sdn Bhd - Desa Jaya	647	Island Pharmacy Sdn.Bhd.
613	Health Lifespring Sdn Bhd	648	I-Venture Pharma Sdn Bhd
614	Health Link Pharmacy	649	J & E Pharmacy
615	Health Link Pharmacy Sdn Bhd	650	J S Pharmacy
616	Health Pharm	651	J.O.Y Pharmacy
617	Health Relief Pharmacy	652	Jasa Pharmacy - Bintang Garden Commercial Centre
618	Healthcare Pahrmacy	653	Jasa Pharmacy Sdn Bhd - Jalan Dunlop
		654	Jaya - Iss Farmasi
		655	Jecki Medical Supplies Sdn Bhd
		656	Jian Hong Pharmacy
		657	Jion Pharmacy Sdn Bhd
		658	Jitra Pharmacy Sdn Bhd
		659	Joe Pharmacy,
		660	JOM Pharmacy

Pharmacies participating in NMUS survey

No.	Private Pharmacies
661	Joy & Health Pharmacy Sdn Bhd
662	Joy Pharmacy
663	Joy Pharmacy Sdn Bhd
664	Joy Pharmacy Sdn. Bhd
665	JSM Pharmacy
666	Jumbo Pharmacy
667	K Pharmacy
668	K. P. Farmasi Sdn Bhd
669	K.B. Pharmacy Healthcare Sdn. Bhd.
670	K.K.Care Pharmacy Sdn. Bhd.
671	Kampar Medical Supplies (M) Sdn. Bhd
672	Karak Pharmacy
673	Karamunsing Pharmacy Sdn. Bhd.
674	Karen's Pharmacy Sdn. Bhd.
675	KC & Hazrina Healthcare Sdn Bhd - Bazaar UO
676	KDH Pharmacy S/B
677	Kedai Farmasi Ang Teong
678	Kedai Ubat dan Farmasi Yit Min
679	Kek Lin Seng Sdn Bhd
680	KH Wong Pharmacy
681	Khoo Medical Supplies
682	Kian Farmasi (Kel) Sdn Bhd
683	Kien Fatt (Midland) Pharm Sdn Bhd
684	Kim Yin Pharmacy Sdn. Bhd.
685	Kinabalu Pharmacy (Batu Pahat) Sdn. Bhd.
686	Kinabalu Pharmacy (Donggongon) SB
687	Kinabalu Pharmacy (Donggongon) Sdn Bhd
688	Kinabalu Pharmacy (SP) Sdn Bhd
689	Kinabalu Pharmacy (Tawau) Sdn Bhd
690	Kinabalu Pharmacy Sdn. Bhd.
691	Kindred Pharmacy
692	Kingstown Pharmacy
693	KK Wong Pharmacy
694	KNL Medicare
695	Koperasi Kedai Buku USM Bhd.
696	Kota Kinabalu Dispensary Sdn. Bhd.
697	Kreescare Pharmacy
698	Kris Care Pharmacy
699	KS Hoo Pharmacy
700	KU Pharmacy Sdn.Bhd.
701	Kuala Lumpur Sports Medicine Centre Sdn Bhd (Pharmacy Kuala Lumpur Sports Medicine Centre)
702	Kuantan Medical Centre Sdn Bhd
703	Kuantan Specialist Hospital SB
704	Kuching Specialist Hospital
705	Kulim Pharmacy Sdn. Bhd.
706	Kumpulan Farmasi Vitacare Sdn Bhd - Idaman
707	Kumpulan Farmasi Vitacare Sdn Bhd - KLCC
708	Kumpulan Farmasi Vitacare Sdn Bhd - Setiawangsa
709	Kumpulan Farmasi Vitacare Sdn Bhd - The Mall
710	Kumpulan Farmasi Vitacare Sdn Bhd - Wangsa Maju
711	L J Fung Pharmacy Sdn Bhd
712	L.T Ling Pharmacy Sdn Bhd
713	Labuan Farmasi
714	Laila Pharmacy
715	Lau & Partners Pharmacy Sdn Bhd
716	Lead Pharmacy
717	Lee Farmasi & Baby Centre Sdn Bhd
718	Lee Medihome Pharmacy Sdn Bhd
719	Leo Pharmacy Sdn.Bhd.
720	Life Care Pharmacy
721	Life Care Pharmacy Sdn Bhd
722	Life Pharmacy
723	Life Pharmacy Sdn Bhd
724	Lilian Pharmacy
725	Lim Medical Supplies Sdn Bhd
726	Lim Pharmacy
727	Limbang Pharmacy
728	Lims' Pharmacy
729	Ling Chemist Sdn Bhd
730	Ling Pharmacy
731	Link Pharmacy Sdn Bhd
732	LJ Fung Pharmacy Sdn Bhd
733	Lo Pharmacy
734	Loo Pharmacy
735	Lotus Pharmacy
736	Loviena Pharmacy
737	Ludwig Pro Pharmacy
738	Luyang Pharmacy
739	Lyn Pharmacy Sdn Bhd
740	M.S. Ally Pharma Sdn Bhd
741	MAA Pharmacy
742	Macallum Pharmacy Sdn.Bhd.
743	Macro Health Care
744	Maran PharmaShoppe & H'care SB

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
745	Master Pharmacy Sdn.Bhd.	786	Mercury Pharmacy Sdn. Bhd - Bandar Baru, Jerantut
746	Matang Jaya Pharmacy	787	Mercury Pharmacy Sdn. Bhd - Jln Tengku Bakar
747	MDS PharmacySdn. Bhd	788	Mercury Pharmacy Sdn. Bhd - Raub
748	Medan Farmasi	789	Metro Pharmacy
749	Medan Jaya Pharmacy	790	Metropharm S/B
750	Medica Pharmacy	791	Metropharm Sdn. Bhd
751	Medical Supplies (Labuan) Sdn Bhd	792	Metta-Care Pharmacy Sdn Bhd
752	Medicare Pharmacy	793	MF Pharmaceutikal Sdn Bhd
753	Medicare Utama Pharmacy	794	Min's Pharmacy Sdn.Bhd.
754	Medi-Channel Pharma S/B	795	Mira Pharmacy
755	Medichem Pharmacy (formely known as Medcare Pharmacy)	796	Miri United Healthcare Sdn. Bhd.
756	Medichemie Pharmacy (M) Sdn Bhd - Wakaf Siku	797	Mivita Pharmacy
757	Medichemie Pharmacy (M) Sdn Bhd - Wisma Dewma	798	MN Pharmacy Sdn Bhd - Jln Kuchai
758	Medicine Point Sdn Bhd	799	Moh Heng Pharmacy Sdn Bhd
759	Mediconstant Pharmacy (Ampang) Sdn Bhd - Jalan Ampang	800	Morine Pharmacy
760	Mediconstant Pharmacy (Klang) Sdn Bhd	801	Multicare Health Pharmacy Sdn Bhd
761	Mediconstant Pharmacy (TTDI) Sdn Bhd	802	Multicare Pharmacy (L & L) Sdn Bhd
762	Medi-Home Pharmacy (Bestari) Sdn. Bhd.	803	Multicare Pharmacy (Bahau) SB
763	Medi-Home Pharmacy (Perintis) Sdn. Bhd.	804	Multicare Pharmacy Sdn Bhd
764	Medi-Home Pharmacy (Perling) Sdn. Bhd.	805	Multipurpose Personal & Convenient
765	Medihouse Sdn Bhd	806	My Pharmacy
766	Medi-K Pharmacy Sdn Bhd	807	My Pharmacy – Jalan Wong Ah Fook
767	Mediland Pharmacy	808	My Pharmacy – Taman Suria
768	Mediland Sdn Bhd	809	My Pharmacy (Kulai) Sdn. Bhd. - Taman Tampoi Indah
769	Medilink Pharmacy (Pasir Gudang) Sdn Bhd	810	My Pharmacy (M) Sdn Bhd
770	Medipro Pharmacy Sdn Bhd	811	My Pharmacy (Pandan) Sdn. Bhd.
771	Medisave Pharmacy Sdn Bhd	812	My Pharmacy (Pelangi) Sdn. Bhd
772	Medishop Pharmacy	813	Myfrenz Pharmacy
773	Medishop Pharmacy Sdn Bhd	814	N.S Pharmacy Sdn. Bhd
774	Medishop Trading	815	Nadi Care Pharmacy
775	Medsense Farmasi (PJ) Sdn Bhd	816	Naina Mohamed & Sons (PG) Sdn.Bhd.
776	Medsense Healthcare Sdn Bhd	817	Nasra Pharmacy Sdn Bhd
777	Mega City Pharmacy	818	Natural Healthy Living Sdn Bhd
778	Mega Kulim Pharmacy	819	Nature - Care Pharmacy Sdn.Bhd.
779	Mega Kulim Pharmacy Sdn. Bhd.	820	Nature Pharmacy
780	Mega Pharmacy Sdn. Bhd.	821	Naturokare Resources Sdn Bhd
781	Megacare Pharmacy	822	Neighbourhood Pharmacy (Georgetown) Sdn.Bhd.
782	Megamal Pharmacy Sdn.Bhd.	823	Neighbourhood Pharmacy (Pg)Sdn.Bhd.
783	Meicare Pharmacy	824	Neighbourhood Pharmacy (Sabah) Sdn. Bhd.
784	Menglembu Farmaseutika Enterprise	825	Neighbourhood Pharmacy Sdn.Bhd
785	Mercury Pharmacy Sdn. Bhd	826	Nevens Marketing Sdn Bhd

Pharmacies participating in NMUS survey

No.	Private Pharmacies
827	Ng & Lee Pharmacy (JB) Sdn. Bhd.
828	Nice Pharmacy Sdn Bhd
829	Nilam Pharmacy
830	Normah Medical Specialist Centre,
831	North Park Pharmacy
832	Nur Medichemie Pharmacy
833	Nurina Pharmacy
834	Nutra Healthcare
835	Nutra Pharmacy
836	Nutrimed Pharmacy Enterprise
837	Oasis Pharmacy Sdn Bhd
838	Ocean Pharmacy Sdn. Bhd.
839	Omega Pharmacy
840	One-Stop Pharmacy Sdn Bhd
841	Orange Pharmacy
842	Orange Pharmacy Sdn. Bhd
843	Oriental Pharmacy
844	Orpla Pharmacy SB
845	P J Pharmacy
846	Padawan Pharmacy
847	Pahang Pharmacy Sdn. Bhd - Bentong
848	Pahang Pharmacy Sdn. Bhd - Jln Teluk Sisek
849	Pahang Pharmacy Sdn. Bhd - Kuala Lipis
850	Pahang Pharmacy Sdn. Bhd - Raub
851	Pai Wang Pharmacy Sdn Bhd
852	PAL Pharmacy
853	Palm Pharmacy
854	Panacea Pharmacy Enterprise
855	Pantai Medical Centre Sdn Bhd
856	Park Pharmacy Sdn Bhd
857	PC Murni Pharmacy Sdn Bhd
858	Pearl Pharmacy Sdn Bhd
859	Penrissen Pharmacy
860	People's Pharmacy Sdn Bhd - Jln Bendahara
861	People's Pharmacy Sdn Bhd - Tmn Melaka Raya
862	Perennial Pharmacy Sdn Bhd - Plaza Tasek, Skudai
863	Perennial Pharmacy Sdn Bhd - Tmn Ungku Tun Aminah
864	Pertanian Farmix (M) Sdn Bhd
865	Pharma Consult (Kulim) Sdn. Bhd.
866	Pharma Line Marketing Sdn Bhd
867	Pharma Utama
868	PharmaCARE (Exquisite Healthcare Sdn. Bhd) - Bdr Baru Permas Jaya
869	PharmaCARE (Exquisite Healthcare Sdn. Bhd) - Plaza Kotaraya, JB
870	Pharmacare Medicine Shoppe
871	Pharma-Consult (Ipoh) Sdn Bhd
872	Pharmacopia Sdn Bhd
873	Pharmalink Pharmacy Sdn Bhd
874	Pharmara Bestari Sdn Bhd
875	Pharmasave Pharmacy Sdn Bhd
876	Pharmazat Sdn. Bhd.
877	Pharmcare Sdn Bhd
878	Pharmedic Pharmacy
879	Pharmex Pharma (Sarawak) Sdn Bhd
880	Pharmex Sdn. Bhd.
881	Pills & Poisons Pharmacy Sdn Bhd
882	Pills & Tabs Pharmacy
883	Plaza Pharmacy
884	Plaza Pharmacy Sdn Bhd
885	Pokiong Pharmacy Sdn Bhd
886	Poly Khoo Pharmacy
887	Poly Pharmacy Sdn Bhd
888	Praise Pharmacy Sdn Bhd
889	Prime Pharmacy, Centre
890	Procare Pharmacy
891	Prochem Pharmacy
892	Professional Pharmacy
893	Prosper Pharmacy
894	PT Bumi Sakti Pharma
895	Public Chemist (Penampang) Sdn. Bhd.
896	Public Chemist (Sabah) Sdn. Bhd
897	Publix Pharmacy
898	Pulse Pharmacy
899	Pure Aid Sdn Bhd (Pure Aid Pharmacy)
900	Pure Pharmacy Sdn Bhd
901	Pure Pharmacy Sdn Bhd
902	Pure Pharmacy Sdn.Bhd.
903	Q-Pharma Sdn Bhd
904	Quinpharm (KL) Sdn Bhd
905	Quinpharm (M) Sdn Bhd
906	Radiant Pharmacy Sdn. Bhd.
907	Rantau Pharmacy
908	Rawang Medical Supplies
909	Razzaq Pharmacy

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
910	Region Pharmacy	953	SL Ling Pharmacy
911	Rejang Specialist Hospital Sdn Bhd	954	Smartsons Pharmacy Sdn. Bhd.
912	Remedy Pharmacy	955	Smiles Pharmacy Sdn Bhd
913	Revive Retail (M) Sdn Bhd	956	Softcare Pharmacy
914	Rheco Pharmacy	957	Solia Pharmacy Sdn Bhd
915	Rheco Pharmacy	958	Somada Pharma Sdn Bhd
916	Rini (M) Sdn Bhd	959	Sonshine Pharmacy
917	S.P.U. Pharmacy	960	Sophia Pharmacy
918	Sabah Pharmacy	961	Southern Medicare Sdn Bhd
919	Saga Pharmacy Sdn. Bhd.	962	Southern Pharmacy Sdn. Bhd.
920	Sainuka Habib Sdn Bhd	963	Spectrum Pharmacy
921	Sainuka Habib Sdn Bhd - Batang Berjuntai	964	Spring Care Pharmacy Sdn Bhd
922	Saksama Potensi Sdn Bhd	965	SPS Mutiara Pharmacy Sdn Bhd
923	Sam Pharmacy	966	Sri Medic Pharmacy Sdn Bhd
924	Samex Pharmacy (Sabah) Sdn Bhd	967	Sri Rambai Pharmacy Sdn.Bhd.
925	Satok Pharmacy Sdn Bhd	968	Standard Pharmacy Sdn Bhd
926	Saude Heathcare (Yulex Pharmacy)	969	Standard Select Sdn Bhd (Goodwill Pharmacy)
927	Saveway Farmasi	970	Star Care Pharmacy Sdn Bhd
928	Sejahtera Farma Sdn Bhd (Farmasi PharmaCARE)	971	Stay Caring Sdn Bhd
929	Self Care Pharmacy	972	Stay Caring Sdn Bhd - Tmn Selayang Jaya
930	Sentosa Pharmacy	973	Stay Fit Pharmacy Sdn.Bhd.
931	Seremban Premier Pharmacy Sdn Bhd	974	Stay Well Pharmacy Sdn.Bhd.
932	Seriq Medical Supplies Sdn Bhd - Kepong Baru	975	Sterling Pharmacy Sdn Bhd
933	Servicare Pharmacy Sdn Bhd	976	Straits Pharmacy
934	Setiaraja Pharmacy	977	Straits Pharmacy(Ayer Keroh) Sdn Bhd
935	Shiv Pharmacy Sdn. Bhd.,	978	Summit Co (M) Sdn Bhd
936	Siang Pharmacy	979	Sunbright Pharmacy Sdn Bhd
937	Siang Pharmacy Sdn.Bhd.	980	Sunlight Pharmacy Sdn. Bhd.
938	Sibu Pharmacy Sdn Bhd	981	Sunlight Pharmacy (B) Sdn. Bhd.
939	Sibu Specialist Medical Centre	982	Sunlight Pharmacy (KK) Sdn. Bhd
940	Siburan Pharmacy	983	Sunlight Pharmacy Sdn Bhd
941	Sihat Pharmacy		
942	Sim Healthcare & Farmasi Sdn Bhd	984	Sunshine Pharmacy
943	Sim Pharmacy	985	Sunshine Pharmacy Sdn.Bhd.
944	Sime Darby Medical Centre Subang Jaya Sdn Bhd	986	Supercare Pharmacy
945	Sime Darby Specialist Centre Megah Sdn Bhd	987	Superdrug Pharmacy Sdn Bhd
946	SIMS Pharmacy	988	Supermed Pharmacy Sdn. Bhd.
947	Sincere Care Pharmacy Sdn Bhd	989	Supreme Pharmacy Sdn Bhd
948	Sincere Pharmacy	990	Syarikat M.S. Ally Sdn Bhd
949	Sing Lee Pharmacy	991	T J Chua Pharmacy Sdn Bhd
950	Sinma Pharmacy Sdn Bhd	992	T Town helath Care
951	SJ Healthtoday Pharmacy Sdn. Bhd	993	Tal Pharmacy
952	SJ Pharmacy	994	Taman Desa Pharmacy Sdn Bhd

Pharmacies participating in NMUS survey

No.	Private Pharmacies	No	Private Pharmacies
995	Tampoi Indah Pharmacy Sdn. Bhd.	1037	Virgin Pharma (M) Sdn. Bhd.
996	Tan Pharmacy	1038	Viseutics Pharmacy
997	Tang Pharmacy	1039	Vision Care Pharmacy Sdn Bhd
998	Tangkak Pharmacy	1040	Vision Pharmacy Sdn Bhd
999	Tanjung Medical Sdn Bhd	1041	Vital Oasis Sdn. Bhd.
1000	Target Pharmacy - Sek 9, Shah Alam	1042	Vitamedic Pharmacy Sdn Bhd
1001	Target Pharmacy Sdn Bhd	1043	Vitaplus Enterprise
1002	Teluk kumbar Pharmacy	1044	Viva Caring Pharmacy Sdn Bhd - Jln Barat
1003	Thai Hing Pharmacy Sdn Bhd	1045	Viva Caring Sdn Bhd - Bangsar Village
1004	Thomas Chiang Optometrist & Chiang Pharmacy	1046	Viva Caring Sdn Bhd - The Store
1005	Timberland Pharmacy	1047	Viva Caring Sdn Bhd (Caring Pharmacy) - Jln Radin Anum
1006	Times Pharmacy Sdn Bhd	1048	VK Pharmacy
1007	Tina Pharmaceutical	1049	Vycon Pharmacy Sdn Bhd
1008	TJ Pharmacy	1050	Wah Choi Pharmacy Sdn Bhd
1009	Today Pharmacy	1051	Watson Personal Care Stores Sdn Bhd
1010	Tongod Pharmacy	1052	Watson's Personal Care Stores Sdn. Bhd.
1011	Tonic Pharma Sdn Bhd	1053	Watson's Personal Care Stores Sdn. Bhd. - Jln Pantai, Kota Kinabalu
1012	Top Wellness Pharmacy Sdn Bhd	1054	Watsons Personal Care Stores Sdn Bhd
1013	Total Farmasi	1055	Watson's Personal Care Stores Sdn Bhd
1014	Tuaran Pharmacy	1056	Watson's Personal Care Stores Sdn. Bhd - Alamanda Putrajaya
1015	TWL Marketing Sdn Bhd	1057	Watson's Personal Care Stores Sdn. Bhd - Anjung Precinct 1, Putrajaya
1016	Tyme Resouces	1058	Watson's Personal Care Stores Sdn. Bhd - Jusco Cheras Selatan
1017	U-City Care Pharmacy Sdn. Bhd.	1059	Watson's Personal Care Stores Sdn. Bhd - Jusco Seremban 2
1018	Udacare Pharmacy Sdn. Bhd.	1060	Watson's Personal Care Stores Sdn. Bhd - Jusco Tebrau City
1019	U-Kang Pharmacy Sdn Bhd	1061	Watson's Personal Care Stores Sdn. Bhd - KLCC
1020	UKM Kesihatan Sdn Bhd (UKMSC)	1062	Watson's Personal Care Stores Sdn. Bhd - Sg Wang Plaza
1021	UKM Kesihatan Sdn Bhd.(Pharmacy Komuniti UKM)	1063	Watson's Personal Care Stores Sdn. Bhd - Taman Maluri Cheras
1022	UMH Pharmacy (Kuching) Sdn Bhd	1064	Watson's Personal Care Stores Sdn. Bhd - Tesco Ipoh
1023	UMH Pharmacy Sdn Bhd	1065	Watson's Personal Care Stores Sdn. Bhd - Tesco Penang
1024	Unicare Pharmacy (M) Sdn Bhd	1066	Watsons Personal Care Stores Sdn.Bhd.
1025	Unichem Pharmacy Sdn Bhd	1067	Watson's Personal Care Stores Sdn.Bhd.
1026	United Caring Venture Sdn Bhd	1068	We Care Pharmacy (Kepayan Ridge)
1027	United Medical Hall (1979) Sdn Bhd	1069	We Care Pharmacy Sdn Bhd
1028	Uniwan Pharmacy	1070	Wellcare Pharmacy
1029	V & C Healthy Dispensary		
1030	Vantage Pharmacy		
1031	Vcare Pharmacy		
1032	V-Care Pharmacy		
1033	Vecare Pharmacy (Sg Dua) Sdn Bhd		
1034	Vera Pharmacal Sdn Bhd		
1035	Vertex Pharmacy Sdn. Bhd.		
1036	Vincent Pharmacy		

1071 Wellings Pharmacy Sdn.Bhd.
1072 Wijaya International Medical Centre Sdn Bhd
1073 William Pharmacy
1074 Win-Win Pharmacy Sdn Bhd
1075 Wira Pharmacy
1076 Wise Pharmacy
1077 Wise Pharmacy Sdn.Bhd.
1078 XPLUS ONE Pharmacy Sdn. Bhd.
1079 XPlus Pharmacy Sdn. Bhd.
1080 Y. K. Farmasi Sdn. Bhd.
1081 Y.S.P Industries (M) Sdn.Bhd.
1082 Yee Hong Parmacy Sdn Bhd
1083 Yeung Lok Pharmacy
1084 YHC Berkat Farmasi
1085 Yin Woh Tong Medical Supply Sdn Bhd
1086 YW Yong Farmasi Sdn Bhd
1087 Zenith Pharmacy - Jln Bkt Bintang
1088 Zenith Pharmacy (SS1) Sdn. Bhd. (Formerly known as Etica Pharmacy (KL) Sdn Bhd)
1089 Zhunion Pharma (M) Sdn Bhd (Tabuan Jaya)
1090 Zing Haw Pharmacy
1091 ZMN Pharmacy Sdn Bhd
1092 ZNI Pharmacy Sdn. Bhd.,
1093 Zona Pharmacy Sdn Bhd
1094 Zuera Medic Sdn.Bhd.
1095 Zuffa Pharmacy Pendang Sdn Bhd - Jln Sukamari
1096 Zuffa Pharmacy Sdn Bhd - Bgn Tabung Haji
1097 Zuffa Pharmacy Sdn Bhd - Jln Tingkat Ciku 2
1098 Zuffa Pharmacy Sdn Bhd - Kompleks Seri Awana
1099 Zuffa Pharmacy Sdn Bhd - Tmn Ria Indah