



**Report of
An Audit of Diabetes Control and Management
(DRM-ADCM)
January-December 2009**

EDITORS

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Diabetes Registry Malaysia (DRM)

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- The Medical Departments, Ministry of Health
- The Medical Development Division, Ministry of Health
- The Disease Control Division, Ministry of Health
- Clinical Research Centre, Hospital Kuala Lumpur.

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FOREWORD

We, the Chairpersons of the Governance Board and Chairperson of the Steering Committee of Adult Diabetes Control and Management (ADCM) are pleased to present the second report of the ADCM database.

This Adult Diabetes Control and Management was established to provide a system to collect data required for service and monitoring diabetes. In the future, it will serve as a Diabetes Registry Malaysia, a particularly important development in diabetes care management process in the country. Its web application for notification of cases was first launched on the 1st of April 2008 and is hosted at www.acrm.org.my/adcm.

Data for the 2008 report was mainly from Negeri Sembilan as data collection was piloted in that state. For this second report (2009), the source data providers come from nine states; i.e. 288 health clinics and 15 hospitals in Negeri Sembilan, Selangor, Pahang, Perak, Melaka, Terengganu, Kedah, Pahang and Wilayah Persekutuan. Currently data were mostly collected from MOH facilities and only one private hospital. But the registry will be expanded to involve all health clinics and hospitals in Malaysia.

This report has been the collaborative effort of many individuals, clinics, hospitals and their staff. It contains important information for evaluation and planning of diabetes service in the MOH in general, and quality improvement for individual SDPs, in particular. We hope users find this report resourceful and will translate the findings for advocating action in improving the standard of diabetes care.

On behalf of the ADCM Steering Committee, we would like to express our sincere appreciation and thanks for the ongoing efforts of all those who were involved in this registry including the staff of the hospitals and health clinics concerned. Finally, we hope that this will be the first step to a more comprehensive database that will enable us to improve the quality of diabetes care in Malaysia.

Thank you

Prof Dato' Dr Wan Mohamad Wan Bebakar
Chairperson
ADCM Governance Board

Dr Mastura Ismail
Chairperson
ACDM Steering Committee

ABBREVIATIONS

ADCM	Audit Diabetes Control and Management
BMI	Body Mass Index
CRC	Clinical Research Centre MOH
CRF	Case Report Form
DM	Diabetes Mellitus
DRM	Diabetes Registry Malaysia
DBP	Diastolic Blood Pressure
DBMS	Database Management System
EDC	Electronic Data Capture
FBG	Fasting Blood Glucose
GFR	Glomerular Filtration Rate
ICT	Information and Communication Technology
IT/IS	Information Technology and Information System
HDL	High Density Lipoprotein
HUSM	Hospital Universiti Sains Malaysia
KK	Klinik Kesihatan (Health Clinic)
LDL	Low Density Lipoprotein
MOH	Ministry of Health
MSSQL	MS SQL Server
NCD	Non-Communicable Diseases
OAD	Oral Antidiabetic Therapy
PKD	Pejabat Kesihatan Daerah
PPUKM	Pusat Perubatan Universiti Kebangsaan Malaysia
PPUM	Pusat Perubatan Universiti Malaya
QAP	Quality Assurance Program
RBG	Random Blood Glucose
SBMG	Self Blood Glucose Monitoring
SDP	Source Data Providers
SC	Site Coordinator
SAP	Statistical Analysis Plan
SBP	Systolic Blood Pressure
TC	Total Cholesterol
TG	Triglyceride
2HPP	2 Hours Post Prandial
T2DM	Type 2 Diabetes Mellitus
UNIMAS	Universiti Malaysia Sarawak
UPM	Universiti Putra Malaysia
VPN	Virtual Private Network
WC	Waist Circumference

ABOUT DIABETES REGISTRY MALAYSIA (DRM-ADCM)

Diabetes is a major problem in this country. The situation is predicted to become worse as diabetes care is far from satisfactory as the majority of patients are not achieving clinical goals and the high rate of complications. Serious and urgent efforts are required to address these issues.

New comprehensive approaches for chronic disease management include incorporating a variety of interventions such as case-management, physician feedback, clinical information systems such as disease registries, adoption of clinical practice guidelines, and a focus on patient self-management skills were first developed many years ago. Such a system can improve interaction between health care providers and patients, and in turn, enhance patient outcome. The model proposes a basic road map for combining these elements to achieve optimal patient outcomes. The Ministry of Health facilities operate the largest integrated delivery health care in Malaysia and therefore offers large scale sources for data for understanding diabetes management.

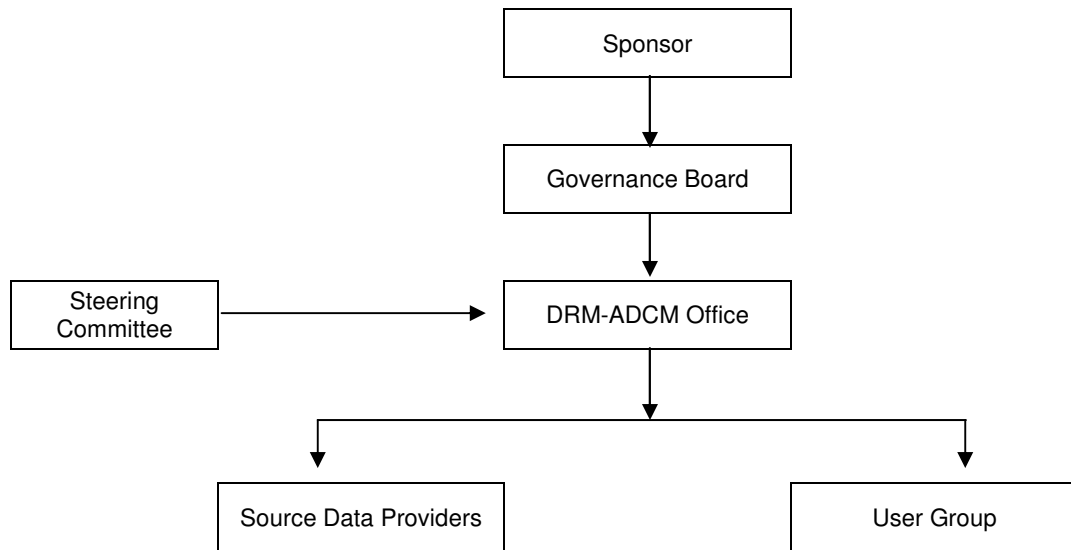
Rationale for the Diabetes Registry Malaysia (DRM-ADCM)

It is high time that we had a diabetes database which includes information on diabetes complications, the outcome of treatment and the economic aspect of treatment. The database will help us to plan and allocate our budget and compare our treatment outcomes with the rest of the world. It can also be used as a tool in diabetes awareness and health education programmes.

The registry's objectives are to:

1. Determine the demographic and epidemiological characteristics of diabetes patients attending MOH healthcare facilities.
2. Determine the clinical profile of diabetes patients.
3. Determine the prevalence of diabetes related complications and related epidemiological characteristics.
4. Determine treatment outcomes of diabetes patients.
5. Facilitate service improvements by providing robust nationally comparable data on diabetes care, for outcome assessment and quality assurance.
6. Stimulate and facilitate diabetes research activities.

Organisation of DRM-ADCM



Sponsors

The DRM-ADCM is sponsored by the Ministry of Health Malaysia (MOH) through the following organisations;

- Medical Department, Ministry of Health
- Medical Development Division, Ministry of Health
- Disease Control Division, Ministry of Health
- Clinical Research Centre, Hospital Kuala Lumpur
- Malaysian Endocrine & Metabolic Society (MEMS)

The DRM Governance Board

A Governance Board was established in April 2009 to oversee the operations of the Diabetes Registry Malaysia (DRM-ADCM). The MOH and universities are represented in this committee to ensure that the DRM-ADCM stays focused on its objectives and its continuing relevance.

Current membership of the board is as follows:

Designation	Name	Organization
Chairperson :	Prof Wan Mohamed Wan Bebakar	Medical Department, Hospital Universiti Sains Malaysia (HUSM)
Members :	Dr Mastura Ismail	Seremban 2 Health Clinic, Pejabat Kesihatan Daerah (PKD) Seremban
	Dr Fuziah Md Zain	Paediatrics Department, Putrajaya Hospital
	Dr Janet Yeow Hua Hong	Paediatrics Department, Putrajaya Hospital
	Prof Wu Loo Ling	Paediatrics Department, Pusat Perubatan Universiti Kebangsaan Malaysia (PPUKM)
	Prof Fatimah Harun	Paediatrics Department, Pusat Perubatan Universiti Malaya (PPUM)
	Prof Dr Chan Siew Pheng	Medical Department, PPUM
	Dr Feisul Idzwan Mustapha	Non-Communicable Diseases (NCD) Unit, MOH Putrajaya
	Dr Hjh. Fatanah Ismail	NCD Unit, MOH Putrajaya
	Dr Lim Teck Onn	Clinical Research Centre, Hospital Kuala Lumpur (HKL)
	Dr Jamaiah Haniff	Clinical Research Centre, HKL
	Dr Zanariah Hussein	Medical Department, Putrajaya Hospital
	Dr G. R. Letchuman a/k Ramanathan	Medical Department, Taiping Hospital
	Dr Lee Ping Yein	Faculty of Medicine and Health Science, University Putra Malaysia (UPM)
	Dr Syed Alwi bin Syed Abdul Rahman	Faculty of Medicine and Health Sciences, UNIMAS
	Dr Sri Wahyu Taher	Simpang Kuala Health Clinic, PKD Kota Setar
	Dr Cheong Ai Theng	Faculty of Medicine and Health Sciences, UPM
	Dr Zaiton Ahmad	Faculty of Medicine and Health Sciences, UPM
	Dr Rozita Zakaria	Pasir Gudang Health Clinic, PKD Johor Bahru
	Dr Siti Harnida Mohd Isa	Faculty of Medicine and Health Sciences, Monash University

DRM-ADCM Steering Committee Members 2008-2009

Dr Mastura Ismail	Dr Rotina Abu Bakar
Dr Feisul Idzwan Mustapha	Dr Cheong Ai Theng
Dr Fatanah Ismail	Dr Zaiton Ahmad
Dr Adibah Hani Haron	Dr Chew Boon How
Dr Zanariah Hussein	Dr Sri Wahyu Taher
Dr Jamaiah Haniff	Dr Mohd Fozi Kamaruddin
Dr G.R Letchuman s/o Ramanathan	Dr Rozita Zakaria
Dr Lee Ping Yein	Dr Asmah Zainal Abidin
Dr Syed Alwi Syed Abdul Rahman	Dr Mazapuspavina Md Yasin

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Registry Associates	Ms Noor Akma Hassim
	Ms Norzaiti Ab Majid

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Clinical Epidemiologist	Dr Jamaiah Haniff
	Ms Gunavathy Selvaraj
Head of ICT Unit	Mrs Celine Tsai Pao Chien
Database Administrator	Ms Lim Jie Ying
	Mr Patrick Lum See Kai
	Mr Sebastian Thoo
Network Administrator	Mr Kevin Ng Hong Heng
	Mr Adlan Ab Rahman
Statistician	Ms Lena Yeap
	Mr Mohamad Adam Hj Bujang
Desktop Publisher	Mrs Azizah Alimat
	Mr Azizi Abdul Rahman

PARTICIPATING CENTRES 2009

No	Participating centres		
1	KK Kuala Pilah	38	Hospital Tuanku Jaafar
2	KK Juasseh	39	Hospital Jelebu
3	KK Johol	40	Hospital Port Dickson
4	KK Terachi	41	Hospital Tampin
5	KK Gunung Pasir	42	Hospital Tuanku Ampuan Najiha
6	KK Seri Menanti	43	KK Desa Sikamat
7	KK Padang Lebar	44	KK Gemencheh
8	KK Bahau	45	KK Selayang Baru
9	KK Bandar Sri Jempol	46	KK Taman Ehsan
10	KK Palong 4,5,6	47	KK Sungai Buluh
11	KK Palong 7,8	48	KK Kuang
12	KK Palong 9,10,11	49	KK Tapah
13	KK Serting Hilir	50	KK Jelai
14	KK Lui Muda	51	Klinik Kesihatan Pantai
15	KK Jelebu	52	Klinik Kesihatan Setapak
16	KK Titi	53	Klinik Kesihatan Sungai Besi
17	KK Pertang	54	KK Sungai Tiang
18	KK Simpang Durian	55	KK Gunung Besaut
19	KK Rembau	56	KK Bandar Jengka
20	KK Pedas	57	KK Karak
21	KK Astana Raja	58	KK Kuala Balah
22	KK Tampin	59	KK Beris Kubor Besar
23	KK Gemas	60	KK Gunung Rapat
24	KK Air Kuning	61	KK Kota Bahru
25	KK Port Dickson	62	KK Bijih Timah
26	KK Bukit Pelanduk	63	KK Taman Selasih
27	KK Linggi	64	KK Pokok Assam
28	KK Pasir Panjang	65	KK Batu Kurau
29	KK Seremban	66	KK Beris Panchor
30	KK Mantin	67	KK Penambang
31	KK Nilai	68	KK Kok Lanas
32	KK Rantau	69	KK Dabong
33	KK Ampangan	70	KK Tok Uban
34	KK Sendayan	71	KK Jeram Tekoh
35	KK Kuarters KLIA	72	KK Gambang
36	KK Lenggeng	73	KK Sg. Tekam Utara
37	KK Permaisuri	74	KK Damak

No Participating centres

75	Hospital Raub	96	KK Sungkai
76	KK Simpang Pelangai	97	KK Gunung Besaut
77	KK Padang Rumbia	98	KK Padang Rengas
78	KK Changkat Kruing	99	KK Seri Langkap
79	KK Pekan Tajau	100	KK Rahmat
80	KK Padang Tengku	101	KK Serdang
81	KK Sungai Koyan	102	KK Lubok Buntar
82	KK Parit	103	KK Changlun
83	KK Bota Kiri	104	KK Tunjang
84	KK Langkap	105	KK Banai
85	KK Cenderung Balai	106	KK Kodiang
86	KK Bagan Datoh	107	KK Laka Temin
87	KK Hutan Melintang	108	KK Kepala Batas
88	KK Selekoh	109	KK Air Hitam
89	KK Sungai Sumun	110	KK Jaya Gading
90	Hospital Kuala Kangsar	111	KK Beserah
91	Hospital Sungai Siput	112	KK Bandar Kuantan
92	Hospital Gerik	113	KK Peramu Jaya
93	KK Tanjung Malim	114	KK Pekan
94	KK Slim River	115	KK Chini
95	KK Bidor	116	KK Tg. Gemok
96	KK Sungkai	117	KK Rompin
97	KK Gunung Besaut	118	KK Maran
98	KK Padang Rengas	119	KK Temerloh
99	KK Seri Langkap	120	KK Bandar Mentakab
83	KK Bota Kiri	121	KK Triang
84	KK Langkap	122	KK Jengka 8
85	KK Cenderung Balai	123	KK Bandar Jengka
86	KK Bagan Datoh	124	KK Bandar Tun Razak
87	KK Hutan Melintang	125	KK Cheroh
88	KK Selekoh	97	KK Gunung Besaut
89	KK Sungai Sumun	98	KK Padang Rengas
90	Hospital Kuala Kangsar	99	KK Seri Langkap
91	Hospital Sungai Siput	100	KK Rahmat
92	Hospital Gerik	101	KK Serdang
93	KK Tanjung Malim	102	KK Lubok Buntar
94	KK Slim River	103	KK Changlun
95	KK Bidor	104	KK Tunjang
105	KK Banai	122	KK Jengka 8

106	KK Kodiang	123	KK Bandar Jengka
107	KK Laka Temin	124	KK Bandar Tun Razak
108	KK Kepala Batas	125	KK Cheroh
109	KK Air Hitam	126	KK Karak
110	KK Jaya Gading	127	KK Lurah Bilut
111	KK Beserah	128	Hospital Sultanah Hajjah Kalsom
112	KK Bandar Kuantan	129	KK Benta
113	KK Peramu Jaya	130	KK Jeli
114	KK Pekan	131	KK Ayer Lanas
115	KK Chini	132	KK Kuala Balah
116	KK Tg. Gemok	133	KK Bandar Kota Bharu
117	KK Rompin	134	KK Badang
118	KK Maran	135	KK Pengkalan Chepa
119	KK Temerloh	136	KK Pahi
120	KK Bandar Mentakab	137	KK Bandar Kuala Krai
121	KK Triang	138	KK Gunong
122	KK Jengka 8	139	KK Bachok
123	KK Bandar Jengka	140	KK Beris Kubor Besar
124	KK Bandar Tun Razak	141	Hospital Machang
125	KK Cheroh	142	KK Pulau Chondong
105	KK Banai	143	KK Batu 30
106	KK Kodiang	144	KK Labok
107	KK Laka Temin	145	KK Bandar Pasir Mas
108	KK Kepala Batas	122	KK Jengka 8
109	KK Air Hitam	123	KK Bandar Jengka
110	KK Jaya Gading	124	KK Bandar Tun Razak
111	KK Beserah	125	KK Cheroh
112	KK Bandar Kuantan	126	KK Karak
113	KK Peramu Jaya	127	KK Lurah Bilut
114	KK Pekan	128	Hospital Sultanah Hajjah Kalsom
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116	KK Tg. Gemok	130	KK Jeli
117	KK Rompin	131	KK Ayer Lanas
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119	KK Temerloh	133	KK Bandar Kota Bharu
120	KK Bandar Mentakab	134	KK Badang
121	KK Triang	135	KK Pengkalan Chepa
136	KK Pahi	142	KK Pulau Chondong
137	KK Bandar Kuala Krai	143	KK Batu 30
138	KK Gunong	144	KK Labok

139	KK Bachok	145	KK Bandar Pasir Mas
140	KK Beris Kubor Besar	146	KK Rantau Panjang
141	Hospital Machang	147	KK Selising
142	KK Pulai Chondong	148	KK Gaal
143	KK Batu 30	149	KK Cherang Ruku
144	KK Labok	150	KK Jeram
145	KK Bandar Pasir Mas	151	KK Batu Gajah
146	KK Rantau Panjang	152	KK Gual Ipoh
147	KK Selising	153	KK Bunohan
148	KK Gaal	154	KK Wakaf Bharu
149	KK Cherang Ruku	155	KK Sg. Pinang
150	KK Jeram	156	KK Bandar Gua Musang
151	KK Batu Gajah	157	KK Aring
136	KK Pahi	158	KK Simee
137	KK Bandar Kuala Krai	159	KK Tjg Tualang
138	KK Gunong	152	KK Gual Ipoh
139	KK Bachok	153	KK Bunohan
140	KK Beris Kubor Besar	154	KK Wakaf Bharu
141	Hospital Machang	155	KK Sg. Pinang
142	KK Pulai Chondong	156	KK Bandar Gua Musang
143	KK Batu 30	157	KK Aring
144	KK Labok	158	KK Simee
145	KK Bandar Pasir Mas	159	KK Tjg Tualang
146	KK Rantau Panjang	152	KK Gual Ipoh
147	KK Selising	153	KK Bunohan
148	KK Gaal	154	KK Wakaf Bharu
149	KK Cherang Ruku	155	KK Sg. Pinang
150	KK Jeram	156	KK Bandar Gua Musang
151	KK Batu Gajah	157	KK Aring
136	KK Pahi	158	KK Simee
137	KK Bandar Kuala Krai	159	KK Tjg Tualang
138	KK Gunong	160	KK Gunung Rapat
139	KK Bachok	161	KK Kota Bahru
140	KK Beris Kubor Besar	162	KK Manjoi
141	Hospital Machang	163	KK Greentown

164	KK Tronoh	178	KK Taman Selasih
165	KK Malim Nawar	179	KK Trong
166	KK Biji Timah	180	KK Pokok Assam
167	KK Kampar	181	KK Sg. Kerang
168	KK Trolak Selatan	182	KK Changkat Jering
169	KK Sanggang	183	KK Redang Panjang
170	KK Lanchang	184	KK Batu Kurau
171	KK Naka	185	KK Kamunting
172	KK Lenggong	186	KK Taiping
173	KK Lawin	187	KK Kuala Sepetang
174	KK Padang Serai	188	KK Sg. Bayur
175	KK Pasir Pinji	189	KK Mahligai
176	KK Bandar Baharu	190	KK Beris Panchor
177	KK Kulim	191	KK Penambang
178	KK Taman Selasih	192	KK Perol
179	KK Trong	193	KK Kedai Lalat
180	KK Pokok Assam	194	KK Ketereh
181	KK Sg. Kerang	195	KK Peringat
182	KK Changkat Jering	196	KK Kubang Kerian
183	KK Redang Panjang	197	KK Kok Lanas
184	KK Batu Kurau	198	KK Lundang Paku
185	KK Kamunting	199	KK Dabong
186	KK Taiping	200	KK Manik Urai
187	KK Kuala Sepetang	201	KK Temangan
164	KK Tronoh	202	KK Chekok
165	KK Malim Nawar	203	KK Meranti
166	KK Biji Timah	178	KK Taman Selasih
167	KK Kampar	179	KK Trong
168	KK Trolak Selatan	180	KK Pokok Assam
169	KK Sanggang	181	KK Sg. Kerang
170	KK Lanchang	182	KK Changkat Jering
171	KK Naka	183	KK Redang Panjang
172	KK Lenggong	184	KK Batu Kurau
173	KK Lawin	185	KK Kamunting
174	KK Padang Serai	186	KK Taiping
175	KK Pasir Pinji	187	KK Kuala Sepetang
176	KK Bandar Baharu	188	KK Sg. Bayur
177	KK Kulim	189	KK Mahligai

190	KK Beris Panchor	207	Hospital Tengku Anis
191	KK Penambang	208	KK Kemahang
192	KK Perol	209	Hospital Tanah Merah
193	KK Kedai Lalat	210	KK Pengkalan Kubor
194	KK Ketereh	211	KK Bandar Tumpat
195	KK Peringat	212	KK Bertam Baru
196	KK Kubang Kerian	213	KK Chiku 3
197	KK Kok Lanas	214	KK Jeram Tekoh
198	KK Lundang Paku	215	KK Gula
199	KK Dabong	216	KK Jalan Baru
200	KK Manik Urai	217	KK Kedai 4
201	KK Temangan	218	KK Kuala Kurau
202	KK Chekok	219	KK Tanjung Piandang
203	KK Meranti	220	KK Teluk Medan
204	KK Tok Uban	221	KK Alor Pongsu
205	KK Tendong	222	KK Bagan Serai
206	KK Kangkong	223	KK Balai
207	Hospital Tengku Anis	224	KK Gung Semanggol
208	KK Kemahang	225	KK Sungai Lembing
209	Hospital Tanah Merah	226	KK Balok
210	KK Pengkalan Kubor	227	KK Gambang
211	KK Bandar Tumpat	228	KK Bukit Goh
212	KK Bertam Baru	229	KK Bukit Ibam
213	KK Chiku 3	230	KK Perantau Damai
214	KK Jeram Tekoh	231	KK Tekek
215	KK Gula	232	KK Chanis
216	KK Jalan Baru	233	KK Pewira Jaya
217	KK Kedai 4	234	KK Bukit Mendi
218	KK Kuala Kurau	235	KK Purun
219	KK Tanjung Piandang	236	KK Bandar 32
220	KK Teluk Medan	237	KK Padang Luas
221	KK Alor Pongsu	238	KK Kuala Tahan
222	KK Bagan Serai	230	KK Perantau Damai
223	KK Balai	231	KK Tekek
224	KK Gung Semanggol	232	KK Chanis
204	KK Tok Uban	233	KK Pewira Jaya
205	KK Tendong	234	KK Bukit Mendi
206	KK Kangkong	235	KK Purun

236	KK Bandar 32	254	KK Mahang
237	KK Padang Luas	255	KK Karangan
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242	KK Kuala Tembeling	260	KK Parit Panjang
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245	KK Jeruas	263	KK Mempaga
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252	KK Lunas	255	KK Karangan
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236	KK Bandar 32	259	KK Malau
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243	KK Dong	266	KK Nenas 1
244	KK Lembah Klau	267	KK Kuala Krau
245	KK Jeruas	268	KK Kota Kuala Muda
246	KK Tersang	269	KK Bakar Arang
247	KK Ulu Gali	270	KK Bandar Sg. Petani
248	Hospital Raub	271	KK Merbok
249	KK Kemayan	272	KK Sungai Lalang
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284	KK Chemor	298	KK Bukit Betong
285	KK Menglembu	299	Damai Medical & Heart Clinic
286	KK Tanjung Rambutan	300	KK Karai
287	KK Gopeng	301	KK Manong
288	KK Pekan Awah	302	KK Sauk
289	KK Chenor	303	KK Lintang

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EXECUTIVE SUMMARY

1. Stock and flow

- 1.1 A total of 72742 patients were notified to the ADCM on-line system from 1st January until 31st December 2009. Of these, 1145 (1.57%) were excluded from analysis due to missing data on basic patient information (date of birth, duration or type of diabetes). The total analysed was 71597.
- 1.2 Majority of the patients with diabetes were from Wilayah Persekutuan Kuala Lumpur (N=21002, 29.3%), Negeri Sembilan (N=16221, 22.7%) and Kelantan (N=10316, 14.4%).

2. Characteristics of type 2 diabetes patients

- 2.1 There were a total of 70889 (99.0%) patients with type 2 diabetes mellitus (T2DM). There were more female (N=41841, 59.0%) than male (N =28939, 40.8%) patients.
- 2.2 Majority of the patients (N= 43902, 61.9%) were Malays, followed by Chinese (N= 13451, 19.0%) and Indians (N=12739, 18.0%). Those categorised as Other Malaysian (N=588, 0.8%) and Non Malaysian (N= 88, 0.1%) were just a small majority of the patient population.
- 2.3 The mean (SD) and median (IQR) ages of the patients with T2DM were 58.32 (11.27) and 58 (15) years respectively.
- 2.4 The mean (SD) and median (IQR) durations of diabetes for the patients with T2DM were 5.86 (5.56) years and 4 (6) years respectively.

3. Clinical information

3.1 Waist circumference

The mean waist circumference of the patients was 91.32 cm (SD 12.27).

3.2 Body mass index

The mean body mass index (BMI) of the patients was 27.28 Kg/m² (SD of 5.96).

3.3 Glycaemic status

Overall glycaemic control was poor. The mean RBS was 10.71 mmol/L (SD 4.41), FBS was 8.59 mmol/L (SD 3.41), 2 HPP was 13.24 mmol (ISD 4.77) and HbA1c was 8.34% (SD 2.20).

3.4 Lipid profiles

The mean total cholesterol was 5.32 mmol/L (SD 1.23); HDL-Cholesterol was 1.3 mmol/L (SD 0.52); mean LDL-Cholesterol was 3.19 mmol/L (SD 1.1); mean triglyceride was 1.94 mmol/L (SD 1.25).

4. Disease condition

4.1 Glycaemic control

The mean RBS was 10.7 mmol/L (SD 4.41), FBS was 8.59 mmol/L (SD 3.41), 2 HPP was 13.24 mmol/L (SD 4.77) and HbA1c was 8.34% (SD 2.20). There were 18.1% of patients who achieved HbA1c < 6.5% and 30.9% achieved < 7.0%.

4.2. Blood pressure control

4.2.1 The mean SBP was higher in the females (137.31 mmHg SD 19.93) than in the males (135.86 mmHg SD 18.87).

4.2.2 The DBP was higher in the males (79.32 mmHg SD 10.45) than in the females (78.40 mmHg SD 10.75).

4.2.3 There were 38.2% patients with blood pressure below or equal to 130/80 mmHg, while 45.0% and 63.9% of patients had good control of systolic (\leq 130 mmHg) and diastolic blood pressures (\leq 80 mmHg) respectively.

4.3 Lipid control

There were 31.0% of patients who achieved LDL \leq 2.6 mmol/L.

4.4 Serum creatinine/ Serum profile

The mean serum creatinine in the study population was 88.45 μ mol/L (SD 49.84).

4.5. Fundus, urine and screening for erectile dysfunction

4.5.1 More than half of the study population had not been tested for urine protein (52.3%), urine microalbumin (64.4%), and electrocardiography (63.7%). And almost three quarters had not had their fundus examined (73.9%).

4.5.2 Only 9.6% of the study's male population had been screened for erectile dysfunction.

4.5.3 Out of those who had their clinical examinations, one-third had abnormal urine microalbumin (29.0%). One-fifth had abnormal urine protein (22.0%), had abnormal fundus (19.9%), and were positive for erectile dysfunction (18.7%).

4.5.4 Less than 10% of the population who had foot examinations (6.1%) and who had tested for electrocardiography (7.9%) had abnormal finding.

4.6 Glomerular filtration rate (GFR)

The GFR in this study was derived from the Cockcroft-Gault formula. One-fifth (18.7%) of the study population had GFR < 60 ml/min.

4.7 Body mass index (BMI) and waist circumference

Out of those tested, only 14.4% achieved normal BMI. About one-third (33.4%) of males had waist circumference less than 90 cm while only 13.8% of females attained their target level of less than 80 cm.

5.0 Diabetes complications

The rates of diabetes complications were quite low i.e retinopathy 4.4%, ischaemic heart disease 3.2%, cerebrovascular disease 0.9%, nephropathy 1% and foot problem 7.3%. However, majority of the patients have not had screenings for diabetes complications.

6.0 Concomitant co – morbidity

The most commonly documented concomitant co-morbidity was hypertension 40659 (57.4%); 21381 (30.2%) had both hypertension and dyslipidaemia and 46072 (65%) had either one.

7.0 Treatment and management

7.1. Management of diabetes

7.1.1 More than three-fourths (76.3%) of the patients in the study were prescribed oral antidiabetic (OAD) therapy, 10.0% insulin and 3.2% diet therapy only.

7.1.2 Biguanides (83.2%) and sulphonylureas (69.9%) were the most frequently prescribed OAD therapies.

7.1.3 Alpha-glucosidase inhibitors were prescribed in only 4.8% of patients.

7.1.4 There was minimal use (< 1%) of other OADs such as thiazolidinediones and meglitinides.

7.2. Management of hypertension

7.2.1 Almost two-thirds of the diabetes patients (58.2%) were prescribed antihypertensive treatment.

7.2.2 The most commonly prescribed antihypertensive agents were angiotensin-converting enzyme inhibitor (ACE-inhibitor) followed by calcium channel blockers, beta blockers, and diuretics (63.9%, 37.0%, 36.5% and 23.4% respectively).

7.3 Management of dyslipidaemia

About 37.8% of the patients had known dyslipidaemia. About 41.6% received lipid lowering therapy, primarily a statin.

7.4 Use of anti-platelet

Only 25.3% patients were prescribed antiplatelet therapy, primarily aspirin.

7.5 Self blood glucose monitoring

The number of patients (2427 patients) performing **self blood glucose monitoring** (SBGM) was very low. Only one in 30 patients (3.4%) in this study practiced this self care behavior.

CHAPTER ONE
1.0 SOCIO DEMOGRAPHICS

DR LEE PING YEIN
DR SYED ALWI SYED ABDUL RAHMAN

1.1 Overall result of DRM-ADCM / Overall types of diabetes

1.1.1 Patients distribution

A total of 72742 patients were notified to the ADCM on-line system from 1st January until 31st December 2009. Of these, 1145 (1.57%) were excluded from analysis due to missing data on basic patient information (date of birth, duration or type of diabetes) and the population analysed was 71597. Majority of the patients have type 2 diabetes mellitus (N=70889, 99.0%). Only 685 (1.0%) patients had type 1 diabetes mellitus and 23 (0%) had other types of diabetes (Table 1.1.1)

Table 1.1.1 Distribution of patients notified with diabetes mellitus by types of diabetes, DRM-ADCM, January 1st – December 31st 2009

No	Type of diabetes	N(%)
1	Type 2	70889(99.0)
2	Type 1	685(1.0)
3	Others	23(0.0)
Total		71597(100.0)

The source of patients were mainly from KK Seremban (N=6680, 9.3%), KK Setapak (N=3194, 4.5%), KK Kampung Pandan (N=2108, 2.9%), KK Tanglin (N=1930,2.7%), KK Petaling Bahagia (N=1890, 2.6%), KK Batu (N=1817, 2.5%), KK Cheras (N=1704, 2.4%), KK Pantai (N=1595, 2.2%), KK Jinjang (N=1430, 2.0%), KK Bandar Tun Razak (N=1356, 1.9%), KK Sungai Besi (N=1223, 1.7%), KK Sentul (N=1030, 1.4%), KK Ampangan (N=1029, 1.4%), KK Kuala Pilah (N=993, 1.4%) , KK Dato' Keramat (N=993, 1.4%), KK Port Dickson (N=986, 1.4%), Damai Medical & Heart Clinic (N=959, 1.3%), KK Nilai (N=855, 1.2%), KK Cheras Baru (N=732, 1.0%), and KK Bandar Kota Bharu (N=681, 1.0%)

Most patients with type 1 diabetes were notified from KK Selising (N=197, 28.8%), KK Gual Ipoh (N=56, 8.2%), KK Beris Panchor (N=41, 6.0%), KK Sungai Koyan (N=35, 5.1%) and KK Batu 30 (N=31, 4.5%). (Table 1.0.2) Patients with other type of diabetes were mainly notified from KK Temangan (N=16, 69.6%), KK Banai (N=2, 8.7%), KK Gulau (N=2, 8.7%), KK Batu (N=1, 4.3%), KK Sg Bayur (N=1, 4.3%) and Damai Medical & Heart Clinic (N=1, 4.3%).

Table 1.1.2 Distribution of patients notified with diabetes by source data providers (SDPs), DRM-ADCM, January 1st – December 31st 2009

No	SDP	Type 2 N=70889 N(%)	Type 1 N=685 N(%)	Total N(%)
1	KK Kuala Pilah	992(1.4)	1(0.1)	993(1.4)
2	KK Juasseh	323(0.5)	0(0.0)	323(0.5)
3	KK Johol	162(0.2)	0(0.0)	162(0.2)
4	KK Terachi	115(0.2)	0(0.0)	115(0.2)
5	KK Gunung Pasir	59(0.1)	0(0.0)	59(0.1)
No	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
6	KK Seri Menanti	61(0.1)	0(0.0)	61(0.1)
7	KK Padang Lebar	192(0.3)	0(0.0)	192(0.3)
8	KK Bahau	171(0.2)	0(0.0)	171(0.2)
9	KK Bandar Sri Jempol	18(0.0)	0(0.0)	18(0.0)
10	KK Palong 4,5,6	103(0.1)	0(0.0)	103(0.1)
11	KK Palong 7,8	76(0.1)	0(0.0)	76(0.1)
12	KK Serting Hilir	39(0.1)	0(0.0)	39(0.1)
13	KK Lui Muda	191(0.3)	0(0.0)	191(0.3)
14	KK Jelebu	279(0.4)	0(0.0)	279(0.4)
15	KK Titi	11(0.0)	0(0.0)	11(0.0)
16	KK Pertang	76(0.1)	0(0.0)	76(0.1)
17	KK Simpang Durian	20(0.0)	0(0.0)	20(0.0)
18	KK Rembau	419(0.6)	0(0.0)	419(0.6)
19	KK Pedas	356(0.5)	0(0.0)	356(0.5)
20	KK Astana Raja	205(0.3)	0(0.0)	205(0.3)
21	KK Tampin	211(0.3)	0(0.0)	211(0.3)
22	KK Gemas	13(0.0)	0(0.0)	13(0.0)
23	KK Air Kuning	27(0.0)	0(0.0)	27(0.0)
24	KK Port Dickson	985(1.4)	1(0.1)	986(1.4)
25	KK Bukit Pelanduk	53(0.1)	0(0.0)	53(0.1)
26	KK Linggi	53(0.1)	0(0.0)	53(0.1)
27	KK Pasir Panjang	27(0.0)	0(0.0)	27(0.0)
28	KK Seremban	6680(9.4)	0(0.0)	6680(9.3)
29	KK Mantin	329(0.5)	0(0.0)	329(0.5)
30	KK Nilai	855(1.2)	0(0.0)	855(1.2)
31	KK Rantau	676(1.0)	0(0.0)	676(0.9)
32	KK Ampangan	1029(1.5)	0(0.0)	1029(1.4)
33	KK Sendayan	83(0.1)	0(0.0)	83(0.1)
34	KK Kuarters KLIA	205(0.3)	0(0.0)	205(0.3)
35	KK Lenggeng	10(0.0)	0(0.0)	10(0.0)
36	KK Permaisuri	157(0.2)	0(0.0)	157(0.2)
37	Hospital Tuanku Jaafar	596(0.8)	4(0.6)	600(0.8)
38	Hospital Port Dickson	13(0.0)	1(0.1)	14(0.0)
39	Hospital Tuanku Ampuan Najiha	23(0.0)	0(0.0)	23(0.0)
40	KK Desa Sikamat	307(0.4)	0(0.0)	307(0.4)
41	KK Gemencheh	105(0.1)	0(0.0)	105(0.1)
42	KK Selayang Baru	28(0.0)	0(0.0)	28(0.0)
43	KK Taman Ehsan	156(0.2)	0(0.0)	156(0.2)
44	KK Tapah	357(0.5)	0(0.0)	357(0.5)
45	KK Jelai	65(0.1)	1(0.1)	66(0.1)
46	KK Simpang Kuala	150(0.2)	0(0.0)	150(0.2)
47	KK Bandar Alor Setar	93(0.1)	0(0.0)	93(0.1)
48	KK Air Hangat	224(0.3)	2(0.3)	226(0.3)
No	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
49	KK Padang Matsirat	221(0.3)	3(0.4)	224(0.3)
50	KK Kuah	205(0.3)	2(0.3)	207(0.3)
51	KK Jerniang	620(0.9)	0(0.0)	620(0.9)
52	Klinik Kesihatan Tanglin	1930(2.7)	0(0.0)	1930(2.7)
53	Klinik Kesihatan Bandar Tun Razak	1354(1.9)	2(0.3)	1356(1.9)
54	Klinik Kesihatan Pantai	1595(2.2)	0(0.0)	1595(2.2)
55	Klinik Kesihatan Batu	1795(2.5)	21(3.1)	1817(2.5)
56	Klinik Kesihatan Cheras	1703(2.4)	1(0.1)	1704(2.4)
57	Klinik Kesihatan Sentul	1030(1.5)	0(0.0)	1030(1.4)
58	Klinik Kesihatan Cheras Baru	731(1.0)	1(0.1)	732(1.0)
59	Klinik Kesihatan Dato' Keramat	993(1.4)	0(0.0)	993(1.4)
60	Klinik Kesihatan Kampung Pandan	2107(3.0)	1(0.1)	2108(2.9)
61	Klinik Kesihatan Jinjang	1427(2.0)	3(0.4)	1430(2.0)
62	Klinik Kesihatan Petaling Bahagia	1890(2.7)	0(0.0)	1890(2.6)
63	Klinik Kesihatan Setapak	3194(4.5)	0(0.0)	3194(4.5)
64	Klinik Kesihatan Sungai Besi	1223(1.7)	0(0.0)	1223(1.7)
65	Klinik Kesihatan Putrajaya	631(0.9)	0(0.0)	631(0.9)
66	KK Pokok Sena	11(0.0)	2(0.3)	13(0.0)
67	KK Simpang Empat	86(0.1)	0(0.0)	86(0.1)
68	KK Jalan Putra	112(0.2)	1(0.1)	113(0.2)
69	KK Kota Sarang Semut	93(0.1)	0(0.0)	93(0.1)
70	KK Langgar	30(0.0)	0(0.0)	30(0.0)
71	KK Guar Chempedak	306(0.4)	0(0.0)	306(0.4)
72	KK Sungai Limau	323(0.5)	8(1.2)	331(0.5)
73	KK Pendang	205(0.3)	3(0.4)	208(0.3)
74	KK Sungai Tiang	206(0.3)	0(0.0)	206(0.3)
75	KK Kubor Panjang	196(0.3)	13(1.9)	209(0.3)
76	KK Jelapang	283(0.4)	1(0.1)	284(0.4)
77	Hospital Batu Gajah	72(0.1)	0(0.0)	72(0.1)
78	KK Kg Gajah	51(0.1)	0(0.0)	51(0.1)
79	KK Changkat Lada	46(0.1)	0(0.0)	46(0.1)
80	KK Ulu Dedap	48(0.1)	0(0.0)	48(0.1)
81	KK Lambor Kiri	29(0.0)	0(0.0)	29(0.0)
82	KK Parit	88(0.1)	0(0.0)	88(0.1)
83	KK Bota Kiri	174(0.2)	1(0.1)	175(0.2)
84	KK Langkap	239(0.3)	0(0.0)	239(0.3)
85	KK Cenderung Balai	171(0.2)	0(0.0)	171(0.2)
86	KK Bagan Datoh	137(0.2)	0(0.0)	137(0.2)
87	KK Hutan Melintang	123(0.2)	0(0.0)	123(0.2)
88	KK Selekoh	128(0.2)	0(0.0)	128(0.2)
89	KK Sungai Sumun	119(0.2)	0(0.0)	119(0.2)
90	Hospital Kuala Kangsar	135(0.2)	2(0.3)	137(0.2)
91	Hospital Sungai Siput	1(0.0)	0(0.0)	1(0.0)
No	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
92	Hospital Gerik	35(0.0)	0(0.0)	35(0.0)
93	KK Tanjung Malim	149(0.2)	0(0.0)	149(0.2)
94	KK Slim River	139(0.2)	1(0.1)	140(0.2)
95	KK Bidor	74(0.1)	0(0.0)	74(0.1)
96	KK Sungkai	100(0.1)	0(0.0)	100(0.1)
97	KK Gunung Besaut	52(0.1)	0(0.0)	52(0.1)
98	KK Padang Rengas	206(0.3)	0(0.0)	206(0.3)
99	KK Seri Langkap	118(0.2)	0(0.0)	118(0.2)
100	KK Rahmat	68(0.1)	0(0.0)	68(0.1)
101	KK Serdang	160(0.2)	2(0.3)	162(0.2)
102	KK Lubok Buntar	10(0.0)	0(0.0)	10(0.0)
103	KK Changlun	97(0.1)	0(0.0)	97(0.1)
104	KK Tunjang	100(0.1)	0(0.0)	100(0.1)
105	KK Banai	100(0.1)	0(0.0)	102(0.1)
106	KK Kodiang	101(0.1)	0(0.0)	101(0.1)
107	KK Laka Temin	101(0.1)	0(0.0)	101(0.1)
108	KK Kepala Batas	111(0.2)	1(0.1)	112(0.2)
109	KK Air Hitam	100(0.1)	0(0.0)	100(0.1)
110	KK Jaya Gading	154(0.2)	0(0.0)	154(0.2)
111	KK Beserah	129(0.2)	0(0.0)	129(0.2)
112	KK Bandar Kuantan	172(0.2)	0(0.0)	172(0.2)
113	KK Peramu Jaya	114(0.2)	0(0.0)	114(0.2)
114	KK Pekan	189(0.3)	2(0.3)	191(0.3)
115	KK Chini	157(0.2)	4(0.6)	161(0.2)
116	KK Tg. Gemok	138(0.2)	1(0.1)	139(0.2)
117	KK Rompin	85(0.1)	1(0.1)	86(0.1)
118	KK Maran	136(0.2)	3(0.4)	139(0.2)
119	KK Temerloh	391(0.6)	0(0.0)	391(0.5)
120	KK Bandar Mentakab	340(0.5)	0(0.0)	340(0.5)
121	KK Triang	251(0.4)	0(0.0)	251(0.4)
122	KK Jengka 8	99(0.1)	0(0.0)	99(0.1)
123	KK Bandar Jengka	140(0.2)	0(0.0)	140(0.2)
124	KK Bandar Tun Razak	100(0.1)	1(0.1)	101(0.1)
125	KK Cheroh	74(0.1)	0(0.0)	74(0.1)
126	KK Karak	337(0.5)	2(0.3)	339(0.5)
127	KK Lurah Bilut	225(0.3)	1(0.1)	226(0.3)
128	Hospital Sultanah Hajjah Kalsom	192(0.3)	0(0.0)	192(0.3)
129	KK Benta	47(0.1)	11(1.6)	58(0.1)
130	KK Jeli	92(0.1)	4(0.6)	96(0.1)
131	KK Ayer Lanas	53(0.1)	1(0.1)	54(0.1)
132	KK Kuala Balah	59(0.1)	3(0.4)	62(0.1)
133	KK Bandar Kota Bharu	681(1.0)	0(0.0)	681(1.0)
134	KK Badang	296(0.4)	1(0.1)	297(0.4)
No	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
135	KK Pengkalan Chepa	300(0.4)	3(0.4)	303(0.4)
136	KK Pahi	90(0.1)	22(3.2)	112(0.2)
137	KK Bandar Kuala Krai	194(0.3)	1(0.1)	195(0.3)
138	KK Gunong	400(0.6)	0(0.0)	400(0.6)
139	KK Bachok	309(0.4)	0(0.0)	309(0.4)
140	KK Beris Kubor Besar	252(0.4)	1(0.1)	253(0.4)
141	Hospital Machang	27(0.0)	3(0.4)	30(0.0)
142	KK Pulai Chondong	272(0.4)	0(0.0)	272(0.4)
143	KK Batu 30	6(0.0)	31(4.5)	37(0.1)
144	KK Labok	246(0.3)	0(0.0)	246(0.3)
145	KK Bandar Pasir Mas	137(0.2)	0(0.0)	137(0.2)
146	KK Rantau Panjang	27(0.0)	0(0.0)	27(0.0)
147	KK Selising	154(0.2)	197(28.8)	351(0.5)
148	KK Gaal	95(0.1)	0(0.0)	95(0.1)
149	KK Cherang Ruku	155(0.2)	1(0.1)	156(0.2)
150	KK Jeram	109(0.2)	3(0.4)	112(0.2)
151	KK Batu Gajah	222(0.3)	0(0.0)	222(0.3)
152	KK Gual Ipoh	205(0.3)	56(8.2)	261(0.4)
153	KK Bunohan	307(0.4)	0(0.0)	307(0.4)
154	KK Wakaf Bharu	413(0.6)	0(0.0)	413(0.6)
155	KK Sg. Pinang	222(0.3)	0(0.0)	222(0.3)
156	KK Bandar Gua Musang	152(0.2)	2(0.3)	154(0.2)
157	KK Aring	2(0.0)	11(1.6)	13(0.0)
158	KK Simee	60(0.1)	3(0.4)	63(0.1)
159	KK Tjg Tualang	50(0.1)	0(0.0)	50(0.1)
160	KK Gunung Rapat	49(0.1)	0(0.0)	49(0.1)
161	KK Kota Bahru	51(0.1)	0(0.0)	51(0.1)
162	KK Manjoi	74(0.1)	22(3.2)	96(0.1)
163	KK Greentown	98(0.1)	0(0.0)	98(0.1)
164	KK Tronoh	132(0.2)	3(0.4)	135(0.2)
165	KK Malim Nawar	51(0.1)	0(0.0)	51(0.1)
166	KK Bijih Timah	110(0.2)	1(0.1)	111(0.2)
167	KK Kampar	51(0.1)	0(0.0)	51(0.1)
168	KK Trolak Selatan	50(0.1)	0(0.0)	50(0.1)
169	KK Sanggang	50(0.1)	0(0.0)	50(0.1)
170	KK Lanchang	101(0.1)	0(0.0)	101(0.1)
171	KK Naka	87(0.1)	0(0.0)	87(0.1)
172	KK Lenggong	57(0.1)	0(0.0)	57(0.1)
173	KK Lawin	241(0.3)	2(0.3)	243(0.3)
174	KK Padang Serai	122(0.2)	1(0.1)	123(0.2)
175	KK Pasir Pinji	56(0.1)	0(0.0)	56(0.1)
176	KK Bandar Baharu	94(0.1)	0(0.0)	94(0.1)
177	KK Kulim	210(0.3)	12(1.8)	222(0.3)
No	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
178	KK Taman Selasih	119(0.2)	2(0.3)	121(0.2)
179	KK Trong	50(0.1)	0(0.0)	50(0.1)
180	KK Pokok Assam	115(0.2)	0(0.0)	115(0.2)
181	KK Sg. Kerang	49(0.1)	0(0.0)	49(0.1)
182	KK Changkat Jering	32(0.0)	1(0.1)	33(0.0)
183	KK Redang Panjang	49(0.1)	1(0.1)	50(0.1)
184	KK Batu Kurau	62(0.1)	1(0.1)	63(0.1)
185	KK Kamunting	77(0.1)	1(0.1)	78(0.1)
186	KK Taiping	233(0.3)	0(0.0)	233(0.3)
187	KK Kuala Sepetang	52(0.1)	0(0.0)	52(0.1)
188	KK Sg. Bayur	47(0.1)	1(0.1)	49(0.1)
189	KK Mahligai	191(0.3)	0(0.0)	191(0.3)
190	KK Beris Panchor	24(0.0)	41(6.0)	65(0.1)
191	KK Penambang	281(0.4)	0(0.0)	281(0.4)
192	KK Perol	117(0.2)	0(0.0)	117(0.2)
193	KK Kedai Lalat	340(0.5)	4(0.6)	344(0.5)
194	KK Ketereh	266(0.4)	1(0.1)	267(0.4)
195	KK Peringat	49(0.1)	0(0.0)	49(0.1)
196	KK Kubang Kerian	60(0.1)	0(0.0)	60(0.1)
197	KK Kok Lanas	113(0.2)	0(0.0)	113(0.2)
198	KK Lundang Paku	17(0.0)	0(0.0)	17(0.0)
199	KK Dabong	52(0.1)	0(0.0)	52(0.1)
200	KK Manik Urai	73(0.1)	0(0.0)	73(0.1)
201	KK Temangan	221(0.3)	3(0.4)	240(0.3)
202	KK Chekok	14(0.0)	0(0.0)	14(0.0)
203	KK Meranti	312(0.4)	0(0.0)	312(0.4)
204	KK Tok Uban	77(0.1)	0(0.0)	77(0.1)
205	KK Tendong	158(0.2)	0(0.0)	158(0.2)
206	KK Kangkong	189(0.3)	1(0.1)	190(0.3)
207	Hospital Tengku Anis	186(0.3)	1(0.1)	187(0.3)
208	KK Kemahang	254(0.4)	3(0.4)	257(0.4)
209	Hospital Tanah Merah	167(0.2)	2(0.3)	169(0.2)
210	KK Pengkalan Kubor	284(0.4)	0(0.0)	284(0.4)
211	KK Bandar Tumpat	333(0.5)	0(0.0)	333(0.5)
212	KK Bertam Baru	69(0.1)	0(0.0)	69(0.1)
213	KK Chiku 3	325(0.5)	0(0.0)	325(0.5)
214	KK Jeram Tekoh	108(0.2)	0(0.0)	108(0.2)
215	KK Gula	34(0.0)	1(0.1)	35(0.0)
216	KK Jalan Baru	41(0.1)	0(0.0)	41(0.1)
217	KK Kedai 4	17(0.0)	0(0.0)	17(0.0)
218	KK Kuala Kurau	59(0.1)	0(0.0)	59(0.1)
219	KK Tanjung Piandang	87(0.1)	0(0.0)	87(0.1)
220	KK Teluk Medan	75(0.1)	0(0.0)	75(0.1)
No.	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
221	KK Alor Pongsu	76(0.1)	0(0.0)	76(0.1)
222	KK Bagan Serai	57(0.1)	0(0.0)	57(0.1)
223	KK Balai	147(0.2)	0(0.0)	147(0.2)
224	KK Gung Semanggol	76(0.1)	0(0.0)	76(0.1)
225	KK Sungai Lembing	28(0.0)	0(0.0)	28(0.0)
226	KK Balok	58(0.1)	0(0.0)	58(0.1)
227	KK Gambang	101(0.1)	0(0.0)	101(0.1)
228	KK Bukit Goh	55(0.1)	0(0.0)	55(0.1)
229	KK Bukit Ibam	43(0.1)	0(0.0)	43(0.1)
230	KK Perantau Damai	40(0.1)	0(0.0)	40(0.1)
231	KK Tekek	94(0.1)	1(0.1)	95(0.1)
232	KK Chanis	17(0.0)	0(0.0)	17(0.0)
233	KK Pewira Jaya	79(0.1)	4(0.6)	83(0.1)
234	KK Bukit Mendi	89(0.1)	0(0.0)	89(0.1)
235	KK Purun	186(0.3)	1(0.1)	187(0.3)
236	KK Bandar 32	116(0.2)	0(0.0)	116(0.2)
237	KK Padang Luas	186(0.3)	1(0.1)	187(0.3)
238	KK Kuala Tahan	19(0.0)	0(0.0)	19(0.0)
239	KK Sg. Tekam Utara	100(0.1)	0(0.0)	100(0.1)
240	KK Leper Utara 4	69(0.1)	1(0.1)	70(0.1)
241	KK Damak	71(0.1)	0(0.0)	71(0.1)
242	KK Kuala Tembeling	50(0.1)	0(0.0)	50(0.1)
243	KK Dong	90(0.1)	11(1.6)	101(0.1)
244	KK Lembah Klau	58(0.1)	0(0.0)	58(0.1)
245	KK Jeruas	53(0.1)	0(0.0)	53(0.1)
246	KK Tersang	71(0.1)	0(0.0)	71(0.1)
247	KK Ulu Gali	36(0.1)	0(0.0)	36(0.1)
248	Hospital Raub	169(0.2)	0(0.0)	169(0.2)
249	KK Kemayan	146(0.2)	3(0.4)	149(0.2)
250	KK Kg. Bantal	3(0.0)	0(0.0)	3(0.0)
251	KK Gulau	294(0.4)	2(0.3)	298(0.4)
252	KK Lunas	123(0.2)	3(0.4)	126(0.2)
253	KK Merbau Pulas	118(0.2)	1(0.1)	119(0.2)
254	KK Mahang	97(0.1)	2(0.3)	99(0.1)
255	KK Karangan	118(0.2)	1(0.1)	119(0.2)
256	KK Kupang	113(0.2)	1(0.1)	114(0.2)
257	KK Kuala Ketil	111(0.2)	0(0.0)	111(0.2)
258	KK Tawar	113(0.2)	0(0.0)	113(0.2)
259	KK Malau	111(0.2)	0(0.0)	111(0.2)
260	KK Parit Panjang	110(0.2)	0(0.0)	110(0.2)
261	KK Kg Lalang	112(0.2)	0(0.0)	112(0.2)
262	KK Simpang Pelangai	562(0.8)	1(0.1)	563(0.8)
263	KK Mempaga	256(0.4)	0(0.0)	256(0.4)
No	SDP	Type 2	Type 1	Total N(%)

		N=70889 N(%)	N=685 N(%)	
264	Hospital Muadzam Shah	59(0.1)	0(0.0)	59(0.1)
265	KK Padang Rumbia	24(0.0)	0(0.0)	24(0.0)
266	KK Nenas 1	60(0.1)	0(0.0)	60(0.1)
267	KK Kuala Krau	126(0.2)	0(0.0)	126(0.2)
268	KK Kota Kuala Muda	73(0.1)	4(0.6)	77(0.1)
269	KK Bakar Arang	24(0.0)	0(0.0)	24(0.0)
270	KK Bandar Sg. Petani	114(0.2)	2(0.3)	116(0.2)
271	KK Merbok	115(0.2)	0(0.0)	115(0.2)
272	KK Sungai Lalang	116(0.2)	0(0.0)	116(0.2)
273	KK Bukit Selambau	45(0.1)	0(0.0)	45(0.1)
274	KK Bedong	118(0.2)	0(0.0)	118(0.2)
275	KK Setiawan	194(0.3)	0(0.0)	194(0.3)
276	KK Changkat Kruing	95(0.1)	21(3.1)	116(0.2)
277	KK Ayer Tawar	147(0.2)	8(1.2)	155(0.2)
278	KK Pantai Remis	132(0.2)	8(1.2)	140(0.2)
279	KK Lekir	79(0.1)	2(0.3)	81(0.1)
280	KK Pulau Pangkor	69(0.1)	0(0.0)	69(0.1)
281	KK Beruas	70(0.1)	0(0.0)	70(0.1)
282	KK Sg. Tong	46(0.1)	0(0.0)	46(0.1)
283	KK Lubuk Merbau	50(0.1)	0(0.0)	50(0.1)
284	KK Chemor	97(0.1)	0(0.0)	97(0.1)
285	KK Menglembu	90(0.1)	10(1.5)	100(0.1)
286	KK Tanjung Rambutan	56(0.1)	0(0.0)	56(0.1)
287	KK Gopeng	93(0.1)	1(0.1)	94(0.1)
288	KK Pekan Awah	108(0.2)	0(0.0)	108(0.2)
289	KK Chenor	67(0.1)	1(0.1)	68(0.1)
290	KK Pekan Tajau	129(0.2)	0(0.0)	129(0.2)
291	KK Jengka 2	243(0.3)	0(0.0)	243(0.3)
292	KK Jengka 22	82(0.1)	0(0.0)	82(0.1)
293	Hospital Jerantut	297(0.4)	1(0.1)	298(0.4)
294	KK Merapoh	38(0.1)	0(0.0)	38(0.1)
295	KK Padang Tengku	221(0.3)	0(0.0)	221(0.3)
296	KK Mela	61(0.1)	0(0.0)	61(0.1)
297	KK Sungai Koyan	116(0.2)	35(5.1)	151(0.2)
298	KK Bukit Betong	48(0.1)	0(0.0)	48(0.1)
299	Damai Medical & Heart Clinic	953(1.3)	5(0.7)	959(1.3)
300	KK Karai	109(0.2)	0(0.0)	109(0.2)
301	KK Manong	81(0.1)	0(0.0)	81(0.1)
302	KK Sauk	0(0.0)	1(0.1)	1(0.0)
303	KK Lintang	144(0.2)	0(0.0)	144(0.2)
Total	70889(100.0)	685(100.0)	71597(100.0)	

Majority of the patients notified with diabetes were from Wilayah Persekutuan Kuala Lumpur (N=21002, 29.3%), Negeri Sembilan (N=16221, 22.7%) and Kelantan (N=10316, 14.4%). For type 2 diabetes, Wilayah Persekutuan Kuala Lumpur had the most number of patients (N=20972, 29.6%), followed by Negeri Sembilan (N=16213, 22.9%), and Kelantan (N=9904, 14.0%). Type 1 diabetes (N=396, 57.8%) and others (N=16, 69.6%) were mainly reported from the state of Kelantan.

Table 1.1.3 Distribution of patients notified with diabetes by state, DRM-ADCM, January 1st – December 31st 2009

No	State	Type 2 N(%)	Type 1 N(%)	Others N(%)	Total N(%)
1	Kedah	6668(9.4)	68(9.9)	4(17.4)	6740(9.4)
2	Kelantan	9904(14.0)	396(57.8)	16(69.6)	10316(14.4)
3	Melaka	953(1.3)	5(0.7)	1(4.3)	959(1.3)
4	Negeri Sembilan	16213(22.9)	8(1.2)	0(0.0)	16221(22.7)
5	Pahang	8145(11.5)	86(12.6)	0(0.0)	8231(11.5)
6	Perak	6830(9.6)	93(13.6)	1(4.3)	6924(9.7)
7	Selangor	184(0.3)	0(0.0)	0(0.0)	184(0.3)
8	Terengganu	389(0.5)	0(0.0)	0(0.0)	389(0.5)
9	W.P. Kuala Lumpur	20972(29.6)	29(4.2)	1(4.3)	21002(29.3)
10	W.P. Putrajaya	631(0.9)	0(0.0)	0(0.0)	631(0.9)
Total		70889(100.0)	685(100.0)	23(100.0)	71597(100.0)

1.2 Type 2 diabetes mellitus

1.2.1 Patient demographic profiles

They were a total of 70889 patients notified with type 2 diabetes mellitus (T2DM) in the ADCM registry from January 1st until December 31st 2009. There were more female (N=41841, 59.0%) than male (N=28939, 40.8%) patients. (Table 1.2.1)

Majority of the patients were Malays (N=43902, 61.9%), followed by Chinese (N=13451, 19.0%) and Indians (N=12739, 18.0%). Those categorized as Other Malaysian (N=588, 0.8%) and Non Malaysian (N=88, 0.1%) constitute very small numbers of the patient population. (Table 1.2.1).

Table 1.2.1 Distribution of patients with T2DM by gender and ethnicity, DRM-ADCM, January 1st-December 31st 2009

Profile	Type 2 N(%)
Gender	70889(100.0)
• Male	28939(40.8)
• Female	41841(59.0)
• Missing	109(0.2)
Ethnicity	70889(100.0)
• Malay	43902(61.9)
• Chinese	13451(19.0)
• Indian	12739(18.0)
• Other Malaysian	588(0.8)
• Non – Malaysian	88(0.1)
• Missing	121(0.2)

The mean (SD) and median (IQR) age of the patients were 58.32 (11.27) and 58 (15) years respectively. The youngest was 18 years old and the oldest was 104 years old.

The mean (SD) and median (IQR) ages of the patients at the age of diagnosis of T2DM were 52.29 (11.10) and 52 (15) years respectively. The youngest was 0 years old and the oldest was 99 years old.

For distribution by age group, majority (N=51569, 72.8%) of the patients were between 45 and 69 years old; with the highest between 55 and 59 years old (N=13105, 18.5%), followed by 60 and 64 years old (N=11694,16.5%) and 50 and 54 years old (N=10773,15.2%). (Table 1.2.2)

**Table 1.2.2 Distribution of patients with T2DM by age group, DRM-ADCM,
January 1st-December 31st 2009**

Age group	Type 2 N(%)
	70889(100.0)
• 18 – 19	40(0.1)
• 20 – 24	148(0.2)
• 25 – 29	413(0.6)
• 30 – 34	881(1.2)
• 35 – 39	1816(2.6)
• 40 - 44	4173(5.9)
• 45 – 49	7451(10.5)
• 50 – 54	10773(15.2)
• 55 – 59	13105(18.5)
• 60 – 64	11694(16.5)
• 65 – 69	8546(12.1)
• 70 – 74	6512(9.2)
• 75 – 79	3271(4.6)
• ≥ 80	2066(2.9)

**Table 1.2.3 Distribution of patients with T2DM by age, DRM-ADCM,
January 1st-December 31st 2009**

Mean (SD) years	Median (IQR) years	Min, max years
58.32(11.27)	58(15)	18,104

**Table 1.2.4 Distribution of patients with T2DM by age at diagnosis, DRM-ADCM,
January 1st-December 31st 2009**

Mean (SD) years	Median (IQR) years	Min, max years
52.29(11.10)	52(15)	0,99

The mean (SD) and median (IQR) duration of diabetes for the patients with Type 2 Diabetes Mellitus were 5.86 (5.56) years and 4 (6) years respectively. The minimum duration was 0 years and the maximum was 59 years. The duration of diabetes was less than 5 years for majority (N=29184, 41.2%) of the patients. The rate was 28.1% (N=19941) for patients with diabetes for 5-10 years and 11.8% (N=8336) for those with diabetes for 5-10 years. The duration was not known in 18.9% (N=13427) of the patients. (Table 1.2.6)

**Table 1.2.5 Distribution of patients with T2DM by duration of diabetes, DRM-ADCM,
January 1st-December 31st 2009**

Mean (SD) years	Median (IQR) years	Min, max years
5.86(5.56)	4(6)	0,59

**Table 1.2.6 Distribution of patients with T2DM by groups of duration of diabetes, DRM-ADCM,
January 1st-December 31st 2009**

Duration of diabetes	Type 2 N(%)
• < 5 years	29184(41.2)
• 5 – 10 years	19942(28.1)
• > 10 years	8336(11.8)
• Missing	13427(18.9)
Total	70889(100.0)

CHAPTER TWO
2.0 CLINICAL PRESENTATION AT COMPLICATIONS

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2.1 Type 2 diabetes mellitus (T2DM)

2.1.1 Clinical information

2.1.1.1 Clinical variable

Generally, the mean waist circumference of the respondents was 91.32 cm (SD 12.27) (Table 2.1.1). The males had larger mean waist circumference i.e. 93.30 cm (SD 12.32) compared with the females whose mean was 90.05 cm (SD 12.07) (Table 2.1.2). In terms of age groups, the mean waist circumference was highest in the 30 – 34 years old age group. It then had a downward trend starting from 50 – 54 years of age (Table 2.1.3). The Indians had a larger mean waist circumference (93.98 cm SD 11.99) compared with the Malays (90.75 cm SD 12.55) and Chinese (90.73 cm SD 11.40) (Table 2.1.4). There was not much difference between the duration of diabetes (less than 5 years, 5 – 10 years or more than 5 years) with waist circumference of respondents (Table 2.1.5).

The mean body mass index (BMI) was 27.28 kg/m² SD of 5.96 (Table 2.1.1). In terms of gender, the mean BMI of females (27.67 kg/m² SD 6.43) was higher than that of the males (26.70 kg/m² SD 5.11) (Table 2.1.2). The mean BMI of the different age groups range from 24.03 kg/m² SD 4.11 (≥ 80 years old group) to 30.34 SD 6.59 kg/m² (30 – 34 years old group) (Table 2.1.3). Similarly, the mean BMI of Malays was the highest (27.66 kg/m² SD 6.27) followed by those of the Indians (27.38 kg/m² SD 5.91) and Chinese (25.97 kg/m² SD 4.71) (Table 2.1.4). Those with duration of diabetes less than 5 years had higher mean BMI (27.79 kg/m² SD 6.60) compared with the durations of 5 – 10 years (27.03 kg/m² SD 5.25) and more than 10 years (26.07 kg/m² SD 4.85) (Table 2.1.5)

The median for systolic blood pressure (SBP) was 134 mmHg and the median for diastolic blood pressure (DBP) was 80 mmHg (Table 2.1.1). The mean SBP was higher in the females (137.31 mmHg SD 19.93) than the males (135.86 mmHg SD 18.87) (Table 2.1.2). However, the DBP was higher in the males (79.32 mmHg SD 10.45) than in the females (78.40 mmHg SD 10.75). Systolic Blood Pressure increased with age (Table 2.1.3). Mean DBP showed an increasing trend from the age groups of 18 – 19 years to 35 – 39 years old; and a decreasing trend from the age group of 50 – 54 years old (Table 2.1.3). The mean SBP were higher for the Malays (137.36 mmHg SD 19.64) and the Chinese (137.02 mmHg SD 19.24) compared with the Indians (134.06 mmHg SD 19.21). The mean DBP was higher for the Malays (79.91 mmHg SD 10.49) followed by the Indians (76.98 mmHg SD 10.57) and the Chinese (76.64 mmHg SD 10.68) (Table 2.1.4). Those with duration of diabetes of more than 10 years had a higher mean SBP (138.25 mmHg SD 20.20) compared with those with the duration of diabetes of 10 years and less (Table 2.1.5).

**Table 2.1.1 Distribution of clinical variables for patients with T2DM, DRM-ADCM,
January 1st – December 31st 2009**

Measurement	N(%)	Missing	Mean (SD)	Median (IQR)	Min, Max
Waist circumference (cm)	26513(37)	13109(18)	91.32(12.27)	91(14)	50,200
BMI (kg/m ²)	53915(76)	13254(19)	27.28(5.96)	27(6)	11,56.1
Systolic BP	56503(80)	13109(18)	136.72(19.53)	134(28)	60,250
Diastolic BP	56503(80)	13109(18)	78.76(10.64)	80(16)	30,150

**Table 2.1.2 Distribution of clinical variables for patients with T2DM by gender, DRM-ADCM,
January 1st – December 31st 2009**

Measurement	Statistics	Male	Female	Missing
Waist circumference	N	10324	16156	33
	No Missing	5733	7358	18
	Mean (SD)	93.30(12.32)	90.05(12.07)	95.39(10.61)
	Min, Max	50.0,200.0	50.0,199.0	74.0,114.0
	Median (IQR)	93.0(14.0)	90.0(15.0)	96.0(13.0)
BMI	N	21436	32406	73
	No Missing	5793	7443	18
	Mean (SD)	26.70(5.11)	27.67(6.43)	28.37(5.35)
	Min, Max	13.4,288.4	10.7,561.3	19.9,42.2
	Median (IQR)	26.2(5.5)	27.0(6.4)	26.6(6.0)
SBP	N	22548	33866	89
	No Missing	5733	7358	18
	Mean (SD)	135.86(18.87)	137.31(19.93)	132.42(18.46)
	Min, Max	60.0,250.0	64.0,250.0	90.0,190.0
	Median (IQR)	133.0(26.0)	135.0(28.0)	130.0(20.0)
DBP	N	22548	33866	89
	No Missing	5733	7358	18
	Mean (SD)	79.32(10.45)	78.40(10.75)	77.19(11.16)
	Min, Max	30.0,150.0	30.0,150.0	40.0,110.0
	Median (IQR)	80.0(15.0)	80.0(15.0)	80.0(13.0)

**Table 2.1.3 Distribution of clinical variables for patients with T2DM by age group, DRM-ADCM,
January 1st – December 31st 2009**

Age group (years)	Statistics	WC	BMI	Systolic (BP)	Diastolic (BP)
18 – 19	N	15	27	27	27
	No Missing	9	9	9	9
	Mean (SD)	91.27(13.84)	30.12(6.66)	121.00(18.46)	74.93(11.51)
	Min, Max	66,107	16,41	84,185	55,97
	Median (IQR)	96(23)	30(10)	120(20)	76(15)

Age group (years)	Statistics	WC	BMI	Systolic (BP)	Diastolic (BP)
20 – 24	N	49	103	108	108
	No Missing	37	37	37	37
	Mean (SD)	89.51(13.85)	29.76(7.61)	126.64(17.26)	79.59(10.81)
	Min, Max	62,130	17,55	90,187	58,110
	Median (IQR)	87(19)	29(10)	127(26)	80(17)
25 – 29	N	144	293	310	310
	No Missing	92	94	92	92
	Mean (SD)	92.40(13.11)	29.85(6.05)	126.24(15.26)	79.24(10.28)
	Min, Max	65,144	15,56	89,187	50,113
	Median (IQR)	90(16)	29(7)	125(20)	80(16)
30 – 34	N	319	643	682	682
	No Missing	181	187	181	181
	Mean (SD)	94.58(13.86)	30.34(6.59)	128.30(16.66)	80.78(10.35)
	Min, Max	50,146	12,56	74,187	40,127
	Median (IQR)	93(16)	30(8)	129(24)	80(15)
35 – 39	N	68	1345	1409	1409
	No Missing	366	373	366	366
	Mean (SD)	93.53(13.26)	29.70(6.51)	128.61(16.87)	80.99(10.56)
	Min, Max	50,168	17,154	90,225	44,141
	Median (IQR)	93(16)	29(7)	128(21)	80(14)
40 – 44	N	1623	3229	3342	3342
	No Missing	761	764	761	761
	Mean (SD)	92.32(12.80)	28.72(5.48)	130.24(17.25)	80.72(10.21)
	Min, Max	50,198	14,98	64,207	40,137
	Median (IQR)	92(14)	28(7)	130(20)	80(15)
45 – 49	N	2889	5813	6019	6019
	No Missing	1300	1319	1300	1300
	Mean (SD)	91.81(12.46)	28.41(5.19)	133.00(18.13)	80.67(10.13)
	Min, Max	50,162	14,90	76,240	30,140
	Median (IQR)	91(15)	28(6)	130(23)	80(15)
50 – 54	N	4191	8423	8744	8744
	No Missing	1856	1878	1856	1856
	Mean (SD)	92.14(12.19)	28.14(5.59)	135.26(18.53)	80.74(10.10)
	Min, Max	50,200	14,252	78,250	30,150
	Median (IQR)	92(14)	28(6)	132(25)	80(15)
55 – 59	N	5137	10223	10687	10687
	No Missing	2237	2268	2237	2237
	Mean (SD)	91.94(12.35)	27.62(5.80)	136.71(18.76)	79.71(10.30)
	Min, Max	50,199	11,288	81,244	31,139
	Median (IQR)	92(15)	27(6)	135(27)	80(15)
60 – 64	N	4459	9161	9550	9550
	No Missing	1975	1995	1975	1975
	Mean (SD)	91.26(11.92)	26.90(4.88)	138.77(19.73)	78.60(10.31)
	Min, Max	50,165	13,174	60,244	30,134

Age group (years)	Statistics	WC	BMI	Systolic (BP)	Diastolic (BP)
65 – 69	Median (IQR)	91(14)	26(6)	138(24)	80(15)
	N	3182	6568	6896	6896
	No Missing	1518	1531	1518	1518
	Mean (SD)	90.24(11.87)	26.26(8.69)	140.30(20.10)	76.85(10.71)
	Min, Max	50,189	12,561	85,250	30,142
70 – 74	Median (IQR)	90(15)	26(6)	140(23)	78(13)
	N	2199	4620	4932	4932
	No Missing	1427	1437	1427	1427
	Mean (SD)	89.50(11.90)	25.44(4.29)	140.53(20.90)	75.78(10.69)
	Min, Max	50,180	14,67	70,230	42,123
75 – 79	Median (IQR)	90(14)	25(5)	140(26)	76(11)
	N	1040	2218	2391	2391
	No Missing	782	788	782	782
	Mean (SD)	89.49(11.65)	24.86(4.30)	140.45(21.29)	73.91(11.11)
	Min, Max	50,127	15,68	72,244	37,118
≥ 80	Median (IQR)	90(15)	24(5)	140(25)	73(13)
	N	588	1249	1406	1406
	No Missing	568	574	568	568
	Mean (SD)	87.07(11.70)	24.03(4.11)	141.71(21.72)	72.38(11.69)
	Min, Max	50,137	14,48	75,218	30,150
	Median (IQR)	87(15)	24(5)	140(28)	70(15)

Table 2.1.4 Distribution of clinical variables for patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Statistics	Waist circumference	BMI	Systolic (BP)	Diastolic (BP)
Malay	N	16093	33686	35181	35181
	No Missing	8100	8191	8100	8100
	Mean (SD)	90.75(12.55)	27.66(6.27)	137.36(19.64)	79.91(10.49)
	Min, Max	50,200	11,561	60,250	30,150
	Median (IQR)	90(15)	27(6)	135(27)	80(16)
Chinese	N	5513	10463	11051	11051
	No Missing	2153	2170	2153	2153
	Mean (SD)	90.73(11.40)	25.97(4.71)	137.02(19.24)	76.64(10.68)
	Min, Max	50,165	12,205	70,244	30,130
	Median (IQR)	90(14)	26(5)	135(27)	78(13)
Indian	N	4633	9165	9627	9627
	No Missing	2718	2755	2718	2718
	Mean (SD)	93.98(11.99)	27.38(5.91)	134.06(19.21)	76.98(10.57)
	Min, Max	50,198	12,252	70,246	34,141
	Median (IQR)	93(14)	27(6)	131(26)	78(13)
Other Malaysian	N	219	459	479	479
	No Missing	100	100	100	100
	Mean (SD)	91.86(11.36)	27.23(4.91)	137.90(20.08)	78.89(9.76)

Ethnicity	Statistics	Waist circumference	BMI	Systolic (BP)	Diastolic (BP)
	Min, Max	50,130	16,47	99,203	30,104
	Median (IQR)	92(14)	27(6)	135(28)	80(16)
Non Malaysian	N	26	72	79	79
	No Missing	7	7	7	7
	Mean (SD)	93.73(12.24)	27.02(4.68)	133.81(18.99)	80.10(10.05)
	Min, Max	76,137	19,40	90,175	60,105
	Median (IQR)	93(16)	27 (6)	130(28)	80(19)
Missing	N	29	70	86	86
	No Missing	31	31	31	31
	Mean (SD)	95.90(10.48)	28.47(5.27)	133.35(18.46)	78.41(12.10)
	Min, Max	76,114	21,42	100,200	40,110
	Median (IQR)	94(13)	27(7)	130(25)	80(15)

Table 2.1.5 Distribution of clinical variables for patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of Diabetes (years)	Statistics	Waist circumference	BMI	Systolic (BP)	Diastolic (BP)
< 5	N	14195	27330	28704	28704
	Missing	0	84	0	0
	Mean (SD)	91.44(12.63)	27.79(6.60)	136.34(19.24)	79.86(10.52)
	Min,Max	50,200	12,561	70,250	30,150
	Median (IQR)	91(15)	27(6)	134(27)	80(16)
5 – 10	N	8612	18858	19528	19528
	Missing	0	38	0	0
	Mean (SD)	91.08(11.91)	27.03(5.25)	136.65(19.60)	78.30(10.50)
	Min,Max	50,194	11,252	64,247	34,138
	Median (IQR)	91(14)	27(6)	134(28)	80(15)
>10	N	3555	7430	7962	7962
	Missing	0	22	0	0
	Mean (SD)	91.47(11.65)	26.07(4.85)	138.25(20.20)	75.89(10.79)
	Min,Max	50,199	13,152	70,250	30,150
	Median (IQR)	91(14)	26(6)	137(26)	77(12)
Missing	N	151	297	309	309
	Missing	13109	13110	13109	13109
	Mean (SD)	91.07(12.40)	27.25(5.02)	138.01(21.81)	80.01(11.18)
	Min,Max	50,130	14,47	60,225	36,110
	Median (IQR)	91(14)	27(6)	136(29)	80(16)

2.1.1.2 Diabetic control

Overall, diabetic control was poor with a mean RBS of 10.7 mmol/L (SD 4.41), FBS of 8.59 mmol/L (SD 3.41), 2 HPP of 13.24 mmol/L (SD 4.77) and HbA1c of 8.34% (SD 2.20) (Table 2.1.6). Similarly, the control was also poor for both genders (Table 2.1.7), in all age groups (Table 2.1.8), all ethnic groups (Table 2.1.9) and across the different durations of diabetes (Table 2.1.10).

Table 2.1.6 Distribution of diabetes control for patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Measurement	N(%)	Missing	Mean (SD)	Median (IQR)	Min, max
Random Blood Glucose (mmol/L)	44676(63)	13109(18)	10.71(4.41)	10(6)	2,40
Fasting blood glucose (mmol/L)	37947(54)	13109(18)	8.59(3.41)	8(4)	2,40
2 hrs Post-prandial (mmol/L)	9325(13)	13109(18)	13.24(4.77)	13(6)	2,38
HbA1c (%)	37263(53)	13109(18)	8.34(2.20)	8(3)	4,20

Table 2.1.7 Distribution of diabetes control for patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Measurement	Statistics	Male	Female	Missing
Random blood glucose	N	17786	26856	34
	No Missing	5733	7358	18
	Mean (SD)	10.72(4.44)	10.70(4.38)	9.40(3.60)
	Min, Max	2.0,40.0	2.0,40.0	3.9,21.5
	Median (IQR)	9.9(5.6)	9.8(5.6)	8.1(5.3)
Fasting blood glucose	N	15113	22772	62
	No Missing	5733	7358	18
	Mean (SD)	8.44(3.36)	8.69(3.44)	9.30(4.68)
	Min, Max	2.0,38.4	2.0,40.0	3.8,30.6
	Median (IQR)	7.6(3.7)	7.9(4.0)	8.5(4.7)
2 hrs Post-prandial	N	3723	5578	24
	No Missing	5733	7358	18
	Mean (SD)	13.26(4.77)	13.22(4.78)	13.28(3.99)
	Min, Max	2.0,33.2	2.0,38.0	6.3,22.7
	Median (IQR)	12.7(6.2)	12.6(6.3)	12.4(5.1)
HbA1c	N	14573	22621	69
	No Missing	5733	7358	18
	Mean (sd)	8.24(2.18)	8.41(2.20)	8.86(2.31)
	Min, Max	4.0,20.0	4.0,20.0	5.3,16.9
	Median (IQR)	7.7(2.7)	7.9(2.9)	8.3(3.0)

Table 2.1.8 Distribution of clinical information on diabetes control in patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Age group (years)	Statistics	RBG	FBG	2HPP	HbA1c
18 – 19	N	21	17	3	11
	No Missing	9	9	9	9
	Mean (SD)	11.54(5.38)	8.62(3.19)	18.47(8.27)	9.68(2.55)
	Min, Max	5.2,23.6	5.0,14.9	9.5,25.8	7.0,13.6
	Median (IQR)	8.9(6.0)	7.5(5.6)	20.1(16.3)	9.0(4.5)
20 – 24	N	83	72	16	67
	No Missing	37	37	37	37
	Mean (SD)	11.62(4.89)	9.57(4.15)	14.77(6.26)	9.49(2.92)
	Min, Max	4.1,24.6	3.6,24.4	4.6,25.5	5.0,17.8
	Median (IQR)	10.8(7.2)	8.9(6.2)	13.9(8.4)	8.8(4.0)
25 – 29	N	252	192	48	189
	No Missing	92	92	92	92
	Mean (SD)	11.78(5.28)	10.36(3.85)	15.95(5.83)	9.49(2.51)
	Min, Max	4.1,40.0	2.7,23.1	2.9,33.2	4.5,16.3
	Median (IQR)	10.8(6.1)	9.9(5.9)	15.6(7.4)	9.5(3.7)
30 – 34	N	537	445	129	390
	No Missing	181	181	181	181
	Mean (SD)	11.22(4.75)	9.67(4.01)	14.60(5.72)	9.05(2.57)
	Min, Max	3.2,40.0	3.1,30.6	4.3,28.8	4.0,20.0
	Median (IQR)	10.4(6.5)	8.8(5.7)	13.9(7.6)	8.8(3.6)
35 – 39	N	1114	949	247	843
	No Missing	366	366	366	366
	Mean (SD)	11.49(4.51)	9.59(3.51)	14.32(4.55)	9.05(2.34)
	Min, Max	2.8,40.0	2.0,23.2	6.3,28.1	4.1,18.9
	Median (IQR)	10.9(6.3)	9.0(4.8)	14.2(6.8)	8.7(3.4)
40 – 44	N	2648	2245	619	2107
	No Missing	761	761	761	761
	Mean (SD)	11.11(4.47)	9.32(3.48)	13.78(4.97)	8.77(2.25)
	Min, Max	2.6,40.0	2.2,28.6	2.9,35.8	4.0,19.0
	Median (IQR)	10.3(5.9)	8.5(4.4)	13.3(6.6)	8.4(3.2)
45 – 49	N	4733	4073	980	3887
	No Missing	1300	1300	1300	1300
	Mean (SD)	11.06(4.36)	9.11(3.44)	13.72(4.77)	8.70(2.25)
	Min, Max	2.6,40.0	2.5,28.2	2.0,34.3	4.0,20.0
	Median (IQR)	10.3(5.7)	8.3(4.4)	13.2(6.5)	8.3(3.0)
50 – 54	N	6826	5894	1457	5740
	No Missing	1856	1856	1856	1856
	Mean (SD)	11.04(4.48)	9.06(3.53)	13.82(5.09)	8.73(2.29)
	Min, Max	2.7,40.0	2.0,28.4	3.0,34.7	4.0,20.0

Age group (years)	Statistics	RBG	FBG	2HPP	HbA1c
	Median (IQR)	10.2(5.8)	8.2(4.2)	13.0(6.9)	8.2(3.1)
55 – 59	N	8459	7245	1783	7209
	No Missing	2237	2237	2237	2237
	Mean (SD)	10.82(4.51)	8.74(3.48)	13.20(4.78)	8.50(2.24)
	Min, Max	2.5,40.0	2.0,40.0	2.9,38.0	4.0,20.0
	Median (IQR)	9.9(5.7)	7.9(3.9)	12.7(6.2)	8.0(3.0)
60 – 64	N	7560	6509	1569	6451
	No Missing	1975	1975	1975	1975
	Mean (SD)	10.56(4.38)	8.36(3.27)	12.89(4.67)	8.27(2.13)
	Min, Max	2.3,40.0	2.0,27.5	2.0,31.9	4.0,20.0
	Median (IQR)	9.7(5.5)	7.6(3.5)	12.2(6.1)	7.7(2.7)
65 – 69	N	5492	4646	1138	4656
	No Missing	1518	1518	1518	1518
	Mean (SD)	10.33(4.31)	8.03(3.13)	12.62(4.51)	7.91(1.99)
	Min, Max	2.0,40.0	2.0,29.0	3.0,34.0	4.0,19.8
	Median (IQR)	9.4(5.2)	7.3(3.3)	12.2(5.8)	7.4(2.3)
70 – 74	N	3922	3241	738	3252
	No Missing	1427	1427	1427	1427
	Mean (SD)	10.20(4.15)	7.82(3.11)	12.45(4.18)	7.74(1.90)
	Min, Max	2.8,40.0	2.1,27.0	4.3,30.5	4.0,19.4
	Median (IQR)	9.3(5.1)	7.1(3.2)	12.0(5.3)	7.3(2.0)
75 – 79	N	1898	1569	386	1576
	No Missing	782	782	782	782
	Mean (SD)	9.93(4.07)	7.50(3.05)	12.45(4.34)	7.47(1.73)
	Min, Max	2.0,40.0	2.1,31.0	4.6,29.9	4.0,17.0
	Median (IQR)	9.1(5.1)	6.9(3.0)	12.0(5.1)	7.0(1.9)
≥80	N	1131	850	212	885
	No Missing	568	568	568	568
	Mean (SD)	10.08(4.05)	7.38(3.08)	12.87(4.46)	7.23(1.74)
	Min, Max	2.0,29.7	2.0,38.4	4.7,27.4	4.0,17.5
	Median (IQR)	9.3(5.3)	6.7(2.9)	12.3(5.3)	6.8(1.7)

RBG – Random blood glucose, FBG – Fasting blood glucose, 2HPP – 2 hours post prandial, HbA1c – Hemoglobin A1c

Table 2.1.9 Distribution of diabetes control in patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Statistics	RBG	FBG	2HPP	HbA1c
Malay	N	27443	23630	5392	23006
	No Missing	8100	8100	8100	8100
	Mean (SD)	11.10(4.63)	8.85(3.50)	13.38(4.89)	8.52(2.31)
	Min, Max	2.0,40.0	2.0,40.0	2.0,38.0	4.0,20.0
	Median (IQR)	10.2(5.8)	8.0(4.1)	12.7(6.5)	8.0(3.1)
Chinese	N	8954	7554	2142	7429
	No Missing	2153	2153	2153	2153
	Mean (SD)	9.95(3.83)	7.80(2.96)	12.79(4.46)	7.75(1.82)

Ethnicity	Statistics	RBG	FBG	2HPP	HbA1c
	Min, Max	2.0,40.0	2.0,31.0	2.9,34.3	4.0,19.6
	Median (IQR)	9.2(5.0)	7.2 (3.2)	12.3(5.9)	7.3(2.1)
Indian	N	7806	6304	1699	6393
	No Missing	2718	2718	2718	2718
	Mean (SD)	10.23(4.08)	8.53(3.41)	13.31(4.77)	8.38(2.07)
	Min, Max	2.0,40.0	2.0,29.0	4.0,32.3	4.0,20.0
	Median (IQR)	9.4(5.2)	7.7(3.9)	12.7(6.1)	7.9(2.8)
Other Malaysian	N	386	347	56	322
	No Missing	100	100	100	100
	Mean (SD)	10.43(3.91)	8.77(3.48)	13.52(4.94)	8.42(2.24)
	Min, Max	3.6,30.4	2.4,25.8	4.1,23.4	4.6,20.0
	Median (IQR)	9.9(5.5)	8.1(3.9)	13.6(8.1)	7.9(2.9)
Non Malaysian	N	61	51	13	49
	No Missing	7	7	7	7
	Mean (SD)	10.51(4.62)	9.23(2.87)	15.02(4.35)	8.75(2.00)
	Min, Max	3.9,26.9	4.7,15.3	8.2,24.4	4.6,12.9
	Median (IQR)	9.4(7.4)	8.7(4.0)	14.9 (4.5)	8.6 (3.0)
Missing	N	26	61	23	64
	No Missing	31	31	31	31
	Mean (SD)	9.60(3.88)	9.57(4.79)	13.80(3.70)	8.83(2.36)
	Min, Max	3.9,21.5	3.8,30.6	6.7,22.7	5.3,16.9
	Median (IQR)	8.8(4.3)	8.5(4.4)	13.2(5.1)	8.4(3.2)

Table 2.1.10 Distribution of diabetes control in patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes	Statistics	RBG	FBG	2HPP	HbA1c
< 5 years	N	22352	19496	5116	17679
	Missing	0	0	0	0
	Mean (SD)	10.47(4.37)	8.48(3.27)	13.24(4.84)	8.11(2.17)
	Min,Max	2.3,40.0	2.0,31.0	2.4,38.0	4.0,20.0
	Median (IQR)	9.5(5.4)	7.6(3.7)	12.5(6.2)	7.5(2.7)
5 - 10 years	N	15486	12917	2754	13702
	Missing	0	0	0	0
	Mean (SD)	10.98(4.45)	8.77(3.50)	13.04(4.68)	8.54(2.21)
	Min,Max	2.0,40.0	2.0,40.0	2.0,34.7	4.0,20.0
	Median (IQR)	10.2(5.7)	8.0(4.1)	12.5(6.3)	8.1(3.0)
>10 years	N	6592	5325	1416	5671
	Missing	0	0	0	0
	Mean (SD)	10.87(4.38)	8.61(3.66)	13.64(4.73)	8.59(2.16)
	Min,Max	2.0,40.0	2.0,28.7	3.5,34.0	4.0,20.0
	Median (IQR)	10.1(5.6)	7.9(4.4)	13.1(6.3)	8.2(2.8)
Missing	N	246	209	39	211
	Missing	13109	13109	13109	13109
	Mean (SD)	10.79(4.44)	8.15(3.41)	12.39(4.23)	8.53(2.43)
	Min,Max	3.1,29.0	3.2,21.8	6.3,23.2	4.1,18.2
	Median (IQR)	9.9(5.5)	7.3(3.6)	11.8(7.0)	7.9(3.2)

2.1.1.3 Lipid profiles

The mean HDL-Cholesterol was 1.30 mmol/L (SD 0.52) and this was the only cholesterol that was better than its recommended level of ≥ 1.1 mmol/L. This was across genders (Table 2.1.12), in all age groups (Table 2.1.13), among all ethnic groups (Table 2.1.14) and irrespective of disease duration (Table 2.1.15). The reverse occurred for LDL-Cholesterol. The mean was 3.19 mmol/L (SD 1.10) and none of the genders, age groups, ethnic groups or diabetic duration had mean LDL lower than 2.6 mmol/L. The Patients who were Chinese and patients who had diabetes for more than 10 years had the best LDL levels in their classes, i.e. 3.06 mmol/L (SD 1.15) and 3.14 mmol/L (SD 1.16) respectively. Mean triglyceride was also generally higher than its recommended level of < 1.7 mmol/L except in the elderly (age > 80 years old) which was 1.66 mmol/L (SD 1.12). The Indians and patients with diabetes of more than 10 years had the lowest means in their classes, 1.78 mmol/L and 1.83 mmol/L respectively.

Table 2.1.11 Distribution of lipid profile for patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Measurement	Not done (%)	N (%)	Missing	Mean (SD)	Median (IQR)	Min, Max
Total cholesterol (mmol/L)	11491(16)	46289(65)	13109(18)	5.32(1.23)	5(2)	3,20
Triglyceride(mmol/L)	12063(17)	45717(64)	13109(18)	1.94(1.25)	2(1)	0,15
HDL (mmol/L)	18503(26)	39277(55)	13109(18)	1.30(0.52)	1(0)	1,6
LDL (mmol/L)	18932(27)	38848(55)	13109(18)	3.19(1.10)	3(1)	1,10

Table 2.1.12 Distribution of lipid profile for patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Measurement	Statistics	Male	Female	Missing
Total cholesterol	N	18258	27955	76
	Missing	5733	7358	18
	Mean (sd)	5.15(1.19)	5.43(1.24)	4.81(1.00)
	Min, Max	2.50,18.00	2.50,20.00	3.20,7.60
	Median (IQR)	5.00(1.40)	5.30(1.50)	4.50(1.45)
Triglyceride	N	18019	27622	76
	Missing	5733	7358	18
	Mean (sd)	1.97(1.31)	1.92(1.20)	1.70(1.04)
	Min, Max	0.10,15.00	0.10,15.00	0.50,7.47
	Median (IQR)	1.60(1.12)	1.60(1.09)	1.50(0.81)
HDL	N	15441	23763	73
	Missing	5733	7358	18
	Mean (SD)	1.22(0.53)	1.35(0.51)	1.14(0.29)
	Min, Max	0.50,6.00	0.50,6.00	0.65,2.33

Measurement	Statistics	Male	Female	Missing
	Median (IQR)	1.10(0.33)	1.25(0.42)	1.11(0.29)
LDL	N	15257	23519	72
	Missing	5733	7358	18
	Mean (SD)	3.09(1.07)	3.26(1.11)	2.84(0.77)
	Min, Max	0.50,10.00	0.50,10.00	1.36,4.65
	Median (IQR)	3.00(1.30)	3.20(1.40)	2.70(0.93)

Table 2.1.13 Distribution of lipid profile for patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Age group (years)	Statistics	TC	TG	HDL	LDL
18 – 19	N	20	18	14	15
	Missing	9	9	9	9
	Mean (SD)	4.98(1.19)	1.46(0.84)	1.22(0.21)	3.25(1.19)
	Min, Max	3.20,7.80	0.40,3.19	0.90,1.60	1.80,6.10
	Median (IQR)	4.76(1.30)	1.45(1.23)	1.20(0.20)	3.00(1.60)
20 – 24	N	75	75	59	58
	Missing	37	37	37	37
	Mean (SD)	5.18(1.06)	1.75(1.27)	1.36(0.71)	3.15(0.90)
	Min, Max	3.20,9.00	0.50,9.83	0.50,4.63	1.01,5.30
	Median (IQR)	5.20(0.90)	1.40(1.03)	1.21(0.40)	3.20(0.90)
25 – 29	N	230	227	206	203
	Missing	92	92	92	92
	Mean (SD)	5.34(1.11)	2.00(1.34)	1.25(0.66)	3.22 (1.14)
	Min, Max	2.50,8.98	0.44,10.81	0.50,5.20	0.50,7.08
	Median (IQR)	5.30(1.30)	1.70(1.20)	1.10(0.40)	3.20(1.40)
30 – 34	N	516	504	436	428
	Missing	181	181	181	181
	Mean (SD)	5.50(1.42)	2.20(1.50)	1.24(0.55)	3.22(1.16)
	Min, Max	2.50,15.50	0.45,12.50	0.50,4.85	0.50,9.40
	Median (IQR)	5.36(1.60)	1.70(1.30)	1.10(0.45)	3.18(1.40)
35 – 39	N	1122	1109	948	943
	Missing	366	366	366	366
	Mean (SD)	5.41(1.22)	2.11(1.50)	1.22(0.50)	3.31(1.10)
	Min, Max	2.60,13.80	0.10,15.00	0.50,6.00	0.50,8.50
	Median (IQR)	5.30(1.50)	1.78(1.29)	1.10(0.34)	3.20(1.39)
40 – 44	N	2726	2686	2328	2301
	Missing	761	761	761	761
	Mean (SD)	5.33(1.17)	2.00(1.29)	1.26(0.54)	3.22(1.08)
	Min, Max	2.50,15.70	0.10,14.46	0.50,6.00	0.50,8.80
	Median (IQR)	5.20(1.50)	1.65(1.20)	1.15(0.40)	3.20(1.40)
45 – 49	N	4982	4927	4235	4191
	Missing	1300	1300	1300	1300

Age group (years)	Statistics	TC	TG	HDL	LDL
	Mean (SD)	5.35(1.21)	2.04(1.43)	1.26(0.49)	3.24(1.09)
	Min, Max	2.50,16.90	0.27,15.00	0.50,5.50	0.50,10.00
	Median (IQR)	5.20(1.50)	1.67(1.20)	1.18(0.40)	3.20(1.30)
50 – 54	N	7198	7106	6139	6061
	Missing	1856	1856	1856	1856
	Mean (SD)	5.42(1.26)	2.04(1.33)	1.29(0.52)	3.25(1.12)
	Min, Max	2.50,16.49	0.20,15.00	0.50,6.00	0.50,10.00
	Median (IQR)	5.30(1.50)	1.70(1.20)	1.20(0.40)	3.20(1.40)
55 – 59	N	8844	8749	7510	7426
	Missing	2237	2237	2237	2237
	Mean (SD)	5.40(1.22)	1.98(1.25)	1.30(0.53)	3.24(1.10)
	Min, Max	2.50,17.50	0.12,15.00	0.50,6.00	0.50,10.00
	Median (IQR)	5.30(1.50)	1.68(1.12)	1.20(0.40)	3.20(1.40)
60 – 64	N	7933	7845	6662	6579
	Missing	1975	1975	1975	1975
	Mean (SD)	5.34(1.26)	1.93 (1.19)	1.31(0.54)	3.19(1.09)
	Min, Max	2.50,20.00	0.10,14.70	0.50,6.00	0.50,9.30
	Median (IQR)	5.20(1.50)	1.60(1.10)	1.20(0.41)	3.10(1.30)
65 – 69	N	5691	5625	4837	4788
	Missing	1518	1518	1518	1518
	Mean (SD)	5.23(1.24)	1.82(1.12)	1.31(0.50)	3.12(1.10)
	Min, Max	2.50,16.20	0.10,15.00	0.50,6.00	0.50,10.00
	Median (IQR)	5.10(1.50)	1.53(1.00)	1.20(0.48)	3.00(1.31)
70 – 74	N	3964	3914	3353	3327
	Missing	1427	1427	1427	1427
	Mean (SD)	5.17(1.16)	1.77(1.04)	1.33(0.52)	3.06(1.04)
	Min, Max	2.50,13.40	0.10,13.40	0.50,6.00	0.50,8.50
	Median (IQR)	5.10(1.46)	1.51(1.00)	1.20(0.50)	3.00(1.30)
75 – 79	N	1933	1900	1654	1638
	Missing	782	782	782	782
	Mean (SD)	5.06(1.10)	1.72(0.98)	1.33 (0.52)	3.02(1.05)
	Min, Max	2.50,10.00	0.10,14.00	0.50,5.10	0.50,10.00
	Median (IQR)	5.00(1.40)	1.50(0.90)	1.20(0.50)	2.90(1.30)
≥ 80	N	1055	1032	896	890
	Missing	568	568	568	568
	Mean (SD)	5.07(1.17)	1.66(1.12)	1.36(0.56)	3.00(1.08)
	Min, Max	2.50,10.10	0.10,14.60	0.50,5.70	0.50,8.00
	Median (IQR)	4.90(1.50)	1.40(0.98)	1.24(0.49)	2.90(1.43)

TC – Total cholesterol, TG. – Triglyceride, HDL – High Density Lipoprotein, LDL – Low Density Lipoprotein

Table 2.1.14 Distribution of lipid profile for patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Statistics	TC	TG	HDL	LDL
Malay	N	28633	28261	23539	23276
	Missing	8100	8100	8100	8100
	Mean (SD)	5.51(1.28)	2.00(1.27)	1.32(0.53)	3.33(1.14)
	Min, Max	2.50,20.00	0.10,15.00	0.50,6.00	0.50,10.00
	Median (IQR)	5.40(1.52)	1.70(1.20)	1.20(0.44)	3.30(1.40)
Chinese	N	9177	9031	8065	7960
	Missing	2153	2153	2153	2153
	Mean (SD)	5.01(1.08)	1.86(1.27)	1.33(0.50)	2.92(0.99)
	Min, Max	2.50,12.90	0.10,15.00	0.50,6.00	0.50,10.00
	Median (IQR)	4.90(1.30)	1.52(1.10)	1.21(0.45)	2.81(1.20)
Indian	N	7927	7881	7179	7125
	Missing	2718	2718	2718	2718
	Mean (SD)	4.98(1.04)	1.78(1.09)	1.19(0.49)	3.02(0.95)
	Min, Max	2.50,15.50	0.12,15.00	0.50,6.00	0.50,9.10
	Median (IQR)	4.90(1.30)	1.50(1.00)	1.10(0.38)	3.00(1.20)
Other Malaysian	N	414	410	368	365
	Missing	100	100	100	100
	Mean (SD)	5.39(1.26)	2.12(1.36)	1.29(0.56)	3.26(1.12)
	Min, Max	2.50,9.50	0.44,9.37	0.50,5.64	0.50,7.90
	Median (IQR)	5.20(1.70)	1.80(1.29)	1.20(0.42)	3.17(1.30)
Non Malaysian	N	66	62	57	54
	Missing	7	7	7	7
	Mean (SD)	5.06(1.29)	1.67(0.86)	1.27(0.44)	2.92(1.06)
	Min, Max	2.88,8.70	0.66,5.49	0.74,3.30	1.00,6.00
	Median (IQR)	4.90(1.78)	1.50(0.80)	1.20(0.39)	2.75(1.40)
Missing	N	72	72	69	68
	Missing	31	31	31	31
	Mean (SD)	4.69(0.98)	1.77(1.11)	1.17(0.31)	2.70(0.82)
	Min, Max	2.80,7.60	0.50,7.47	0.65,2.33	0.79,4.47
	Median (IQR)	4.50(1.25)	1.50(0.99)	1.12(0.27)	2.69(1.10)

Table 2.1.15 Distribution of lipid profile for patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of Diabetes (years)	Statistics	TC	TG	HDL	LDL
< 5	N	23023	22753	19280	19071
	Missing	0	0	0	0
	Mean (SD)	5.40(1.22)	1.96(1.26)	1.30(0.53)	3.26(1.11)
	Min, Max	2.50,16.90	0.10,15.00	0.50,6.00	0.50,10.00
	Median (IQR)	5.30(1.50)	1.63(1.10)	1.20(0.40)	3.20(1.40)
5-10	N	16391	16183	13844	13676
	Missing	0	0	0	0
	Mean (SD)	5.30(1.22)	1.95(1.24)	1.30(0.52)	3.16(1.09)
	Min, Max	2.50,20.00	0.10,15.00	0.50,6.00	0.50,10.00

Duration of Diabetes (years)	Statistics	TC	TG	HDL	LDL
	Median (IQR)	5.20(1.50)	1.60(1.10)	1.20(0.41)	3.10(1.36)
>10	N	6618	6526	5935	5885
	Missing	0	0	0	0
	Mean (SD)	5.09(1.24)	1.83(1.24)	1.28(0.51)	3.01(1.04)
	Min, Max	2.50,18.00	0.10,15.00	0.50,6.00	0.50,9.90
	Median (IQR)	4.90(1.40)	1.50(1.09)	1.20(0.40)	2.90(1.28)
Missing	N	257	255	218	216
	Missing	13109	13109	13109	13109
	Mean (SD)	5.40(1.13)	1.83(0.89)	1.29(0.41)	3.37(1.07)
	Min, Max	2.90,10.30	0.40,5.00	0.50,3.30	0.90,7.90
	Median (IQR)	5.26(1.30)	1.60(0.98)	1.20(0.32)	3.22(1.28)

2.1.1.4 Disease control

There were 18.1% patients who achieved HbA1c < 6.5% and 30.0% who achieved < 7.0%. More male patients achieved target HbA1c than the females (Table 2.1.17). The registry showed an increasing trend of more successfully controlled disease with age, from 11.9% for the 20-24 years age group with HbA1c < 6.5% to as high as 36.6% for those > 80 years old. The Chinese, when compared with Malays and Indians, had the most number of patients that achieved HbA1c < 7.0% (39.9%) and < 6.5%, (23.3%) (Table 2.1.19). Expectedly, the longer the duration of disease, the lower the proportion of patients who achieved the recommended targets (Table 2.1.20).

There were 38.2% of patients with blood pressure below or equal to 130/80 mmHg, while 45.0% of patients had good control of SBP (\leq 130 mmHg) and 63.9% had good control of DBP (\leq 80 mmHg) (Table 2.1.16). Both genders were comparable in these aspects (Table 2.1.17). However, there was a trend of inverse relationship between the proportion of those achieving target SBP and DBP and age; older patients attained target DBP while younger patients achieved target SBP (Table 2.1.18). Similarly, for the proportion of patients achieving target SBP and DBP for duration of diabetes, the longer the duration of diabetes, the higher the proportion of patients who have DBP control. There was a higher proportion of patients with shorter duration of diabetes who achieved SBP control.

There were 31.0% of patients who achieved LDL-Cholesterol \leq 2.6 mmol/L. More males, older age-groups and those who had longer duration of diabetes seem to have achieved target LDL-C. The Chinese had the highest proportion (41.0%) of patients with LDL \leq 2.6 mmol/L compared with the Malays (26.6%), which had the lowest. Table 2.31 showed the older the patients, the higher the proportion of patients achieving target control for HDL-Cholesterol and triglyceride levels. The Chinese had the highest proportion of patients that attained target HDL and the Indians had the highest proportion of patients that achieved target triglyceride (Table 2.1.19).

**Table 2.1.16 Distribution of clinical information based on cut-off points in patients with T2DM,
DRM-ADCM, January 1st – December 31st 2009**

Clinical information	Test done N	Achieved N(%)	Not achieved N(%)
HbA1c (<7.0%)	37263	11510(30.9)	25753(69.1)
HbA1c (<6.5%)	37263	6754(18.1)	30509(81.9)
Systolic Blood Pressure (≤130mmHg)	56503	25426(45.0)	31077(55.0)
Diastolic Blood Pressure (≤80 mmHg)	56503	36109(63.9)	20394(36.1)
Blood Pressure (≤130/80 mmHg)	56503	21610(38.2)	34893(61.8)
Cholesterol (< 4.5 mmol/l)	46289	11101(24.0)	35188(76.0)
Triglyceride (≤1.7 mmol/l)	45717	23962(52.4)	21755(47.6)
HDL (≥1.1 mmol/l)	39277	26492(67.4)	12785(32.6)
LDL (≤2.6 mmol/l)	38848	12028(31.0)	26820(69.0)

**Table 2.1.17 Distribution of clinical information based on cut-off points in patients with T2DM by gender,
DRM-ADCM, January 1st – December 31st 2009**

Gender	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (< 4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
Male	Achieved N(%)	4792(32.9)	2872(19.7)	10485(46.5)	14050(62.3)	8818(39.1)	5194(28.4)	9325(51.8)	8827(57.2)	5185(34.0)
	Not achieved N(%)	9781(67.1)	11701(80.3)	12063(53.5)	8498(37.7)	13730(60.9)	13064(71.6)	8694(48.2)	6614(42.8)	10072(66.0)
	Test done N(%)	14573(100.0)	14573(100.0)	22548(100.0)	22548(100.0)	22548(100.0)	18258(100.0)	18019(100.0)	15441(100.0)	15257(100.0)
Female	Achieved N(%)	6704(29.6)	3872(17.1)	14892(44.0)	21993(64.9)	12746(37.6)	5872(21.0)	14590(52.8)	17626(74.2)	6814(29.0)
	Not achieved N(%)	15917(70.4)	18749(82.9)	18974(56.0)	11873(35.1)	21120(62.4)	22083(79.0)	13032(47.2)	6137(25.8)	16705(71.0)
	Test done N(%)	22621(100.0)	22621(100.0)	33866(100.0)	33866(100.0)	33866(100.0)	27955(100.0)	27622(100.0)	23763(100.0)	23519(100.0)
Missing	Achieved N(%)	14(20.3)	10(14.5)	49(55.1)	66(74.2)	46(51.7)	35(46.1)	47(61.8)	39(53.4)	29(40.3)
	Not Achieved N(%)	55(79.7)	59(85.5)	40(44.9)	23(25.8)	43(48.3)	41(53.9)	29(38.2)	34(46.6)	43(59.7)
	Test done N(%)	69(100.0)	69(100.0)	89(100.0)	89(100.0)	89(100.0)	76(100.0)	76(100.0)	73(100.0)	72(100.0)

**Table 2.1.18 Distribution of clinical information based on cut-off points in patients with T2DM by age group,
DRM-ADCM, January 1st – December 31st 2009**

Age group (years)	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (<4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
18 – 19	Achieved N(%)	0(0.0)	0(0.0)	20(74.1)	21(77.8)	18(66.7)	9(45.0)	11(61.1)	11(78.6)	7(46.7)
	Not achieved N(%)	11(100.0)	11(100.0)	7(25.9)	6(22.2)	9(33.3)	11(55.0)	7(38.9)	3(21.4)	8(53.3)
	Test done N(%)	11(100.0)	11(100.0)	27(100.0)	27(100.0)	27(100.0)	20(100.0)	18(100.0)	14(100.0)	15(100.0)
20 – 24	Achieved N(%)	14(20.9)	8(11.9)	69(63.9)	67(62.0)	56(51.9)	17(22.7)	45(60.0)	34(57.6)	14(24.1)
	Not achieved N(%)	53(79.1)	59(88.1)	39(36.1)	41(38.0)	52(48.1)	58(77.3)	30(40.0)	25(42.4)	44(75.9)
	Test done N(%)	67(100.0)	67(100.0)	108(100.0)	108(100.0)	108(100.0)	75(100.0)	75(100.0)	59(100.0)	58(100.0)
25 – 29	Achieved N(%)	37(19.6)	23(12.2)	210(67.7)	189(61.0)	158(51.0)	45(19.6)	111(48.9)	114(55.3)	56(27.6)
	Not achieved N(%)	152(80.4)	166(87.8)	100(32.3)	121(39.0)	152(49.0)	185(80.4)	116(51.1)	92(44.7)	147(72.4)
	Test done N(%)	189(100.0)	189(100.0)	310(100.0)	310(100.0)	310(100.0)	230(100.0)	227(100.0)	206(100.0)	203(100.0)
30 – 34	Achieved N(%)	95(24.4)	53(13.6)	418(61.3)	390(57.2)	310(45.5)	111(21.5)	235(46.6)	252(57.8)	127(29.7)
	Not achieved	295(75.6)	337(86.4)	264(38.7)	292(42.8)	372(54.5)	405(78.5)	269(53.4)	184(42.2)	301(70.3)

Age group (years)	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (<4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
	N(%)									
	Test done									
	N(%)	390(100.0)	390(100.0)	682(100.0)	682(100.0)	682(100.0)	516(100.0)	504(100.0)	436(100.0)	428(100.0)
35 – 39	Achieved									
	N(%)	177(21.0)	104(12.3)	887(63.0)	798(56.6)	682(48.4)	226(20.1)	510(46.0)	555(58.5)	257(27.3)
	Not achieved									
35 – 39	N(%)	666(79.0)	739(87.7)	522(37.0)	611(43.4)	727(51.6)	896(79.9)	599(54.0)	393(41.5)	686(72.7)
	Test done									
	N(%)	843(100.0)	843(100.0)	1409(100.0)	1409(100.0)	1409(100.0)	1122(100.0)	1109(100.0)	948(100.0)	943(100.0)
40 – 44	Achieved									
	N(%)	496(23.5)	301(14.3)	1960(58.6)	1885(56.4)	1545(46.2)	619(22.7)	1362(50.7)	1448(62.2)	652(28.3)
	Not achieved									
40 – 44	N(%)	1611(76.5)	1806(85.7)	1382(41.4)	1457(43.6)	1797(53.8)	2107(77.3)	1324(49.3)	880(37.8)	1649(71.7)
	Test done									
	N(%)	2107(100.0)	2107(100.0)	3342(100.0)	3342(100.0)	3342(100.0)	2726(100.0)	2686(100.0)	2328(100.0)	2301(100.0)
45 – 49	Achieved									
	N(%)	923(23.7)	534(13.7)	3200(53.2)	3448(57.3)	2572(42.7)	1123(22.5)	2483(50.4)	2727(64.4)	1172(28.0)
	Not Achieved									
45 – 49	N(%)	2964(76.3)	3353 (86.3)	2819(46.8)	2571(42.7)	3447(57.3)	3859(77.5)	2444(49.6)	1508(35.6)	3019(72.0)
	Test done									
	N(%)	3887(100.0)	3887(100.0)	6019(100.0)	6019(100.0)	6019(100.0)	4982(100.0)	4927(100.0)	4235(100.0)	4191(100.0)
50 – 54	Achieved									
	N(%)	1404(24.5)	786(13.7)	4129(47.2)	4980(57.0)	3368(38.5)	1500(20.8)	3491(49.1)	4093(66.7)	1723(28.4)

Age group (years)	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (<4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
	Not achieved N(%)	4336(75.5)	4954(86.3)	4615(52.8)	3764(43.0)	5376(61.5)	5698(79.2)	3615(50.9)	2046(33.3)	4338(71.6)
	Test done N(%)	5740(100.0)	5740(100.0)	8744(100.0)	8744(100.0)	8744(100.0)	7198(100.0)	7106(100.0)	6139(100.0)	6061(100.0)
55 – 59	Achieved N(%)	2032(28.2)	1147(15.9)	4781(44.7)	6511(60.9)	4076(38.1)	1914(21.6)	4405(50.3)	5114(68.1)	2143(28.9)
	Not achieved N(%)	5177(71.8)	6062(84.1)	5906(55.3)	4176(39.1)	6611(61.9)	6930(78.4)	4344(49.7)	2396(31.9)	5283(71.1)
	Test done N(%)	7209(100.0)	7209(100.0)	10687(100.0)	10687(100.0)	10687(100.0)	8844(100.0)	8749(100.0)	7510(100.0)	7426(100.0)
60 – 64	Achieved N(%)	2010(31.2)	1147(17.8)	3870(40.5)	6241(65.4)	3418(35.8)	1926(24.3)	4100(52.3)	4553(68.3)	2032(30.9)
	Not achieved N(%)	4441(68.8)	5304(82.2)	5680(59.5)	3309(34.6)	6132(64.2)	6007(75.7)	3745(47.7)	2109(31.7)	4547(69.1)
	Test done N(%)	6451(100.0)	6451(100.0)	9550(100.0)	9550(100.0)	9550(100.0)	7933(100.0)	7845(100.0)	6662(100.0)	6579(100.0)
65 – 69	Achieved N(%)	1777(38.2)	1061(22.8)	2576(37.4)	4874(70.7)	2330(33.8)	1548(27.2)	3177(56.5)	3442(71.2)	1676(35.0)
	Not achieved N(%)	2879(61.8)	3595(77.2)	4320(62.6)	2022(29.3)	4566(66.2)	4143(72.8)	2448(43.5)	1395(28.8)	3112(65.0)
	Test done N(%)	4656(100.0)	4656(100.0)	6896(100.0)	6896(100.0)	6896(100.0)	5691(100.0)	5625(100.0)	4837(100.0)	4788(100.0)
70 – 74	Achieved	1309(40.3)	811(24.9)	1896(38.4)	3689(74.8)	1747(35.4)	1136(28.7)	2230(57.0)	2351(70.1)	1192(35.8)

Age group (years)	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (<4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
	N(%)									
	Not achieved N(%)	1943(59.7)	2441(75.1)	3036(61.6)	1243(25.2)	3185(64.6)	2828(71.3)	1684(43.0)	1002(29.9)	2135(64.2)
	Test done N(%)	3252(100.0)	3252(100.0)	4932(100.0)	4932(100.0)	4932(100.0)	3964(100.0)	3914(100.0)	3353(100.0)	3327(100.0)
75 – 79	Achieved N(%)	755(47.9)	455(28.9)	900(37.6)	1874(78.4)	843(35.3)	584(30.2)	1141(60.1)	1154(69.8)	623(38.0)
	Not achieved N(%)	821(52.1)	1121(71.1)	1491(62.4)	517(21.6)	1548(64.7)	1349(69.8)	759(39.9)	500(30.2)	1015(62.0)
	Test done N(%)	1576(100.0)	1576(100.0)	2391(100.0)	2391(100.0)	2391(100.0)	1933(100.0)	1900(100.0)	1654(100.0)	1638(100.0)
≥80	Achieved N(%)	481(54.4)	324(36.6)	510(36.3)	1142(81.2)	487(34.6)	343(32.5)	661(64.1)	644(71.9)	354(39.8)
	Not achieved N(%)	404(45.6)	561(63.4)	896(63.7)	264(18.8)	919(65.4)	712(67.5)	371(35.9)	252(28.1)	536(60.2)
	Test done N(%)	885(100.0)	885(100.0)	1406(100.0)	1406(100.0)	1406(100.0)	1055(100.0)	1032(100.0)	896(100.0)	890(100.0)

**Table 2.1.19 Distribution of clinical information based on cut-off points in patients with T2DM by ethnicity,
DRM-ADCM, January 1st – December 31st 2009**

Ethnicity	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (<4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
Malay	Achieved N(%)	6641(28.9)	3950(17.2)	15556(44.2)	21323(60.6)	12948(36.8)	5507(19.2)	13968(49.4)	16535(70.2)	6199(26.6)
	Not achieved N(%)	16365(71.1)	19056(82.8)	19625(55.8)	13858(39.4)	22233(63.2)	23126(80.8)	14293(50.6)	7004(29.8)	17077(73.4)
	Test done N(%)	23006(100.0)	23006(100.0)	35181(100.0)	35181(100.0)	35181(100.0)	28633(100.0)	28261(100.0)	23539(100.0)	23276(100.0)
Chinese	Achieved N(%)	2917(39.3)	1734(23.3)	4824(43.7)	7739(70.0)	4251(38.5)	2914(31.8)	5094(56.4)	5833(72.3)	3262(41.0)
	Not achieved N(%)	4512(60.7)	5695(76.7)	6227(56.3)	3312(30.0)	6800(61.5)	6263(68.2)	3937(43.6)	2232(27.7)	4698(59.0)
	Test done N(%)	7429(100.0)	7429(100.0)	11051(100.0)	11051(100.0)	11051(100.0)	9177(100.0)	9031(100.0)	8065(100.0)	7960(100.0)
Indian	Achieved N(%)	1834(28.7)	1000(15.6)	4739(49.2)	6628(68.8)	4144(43.0)	2526(31.9)	4630(58.7)	3806(53.0)	2414(33.9)
	Not achieved N(%)	4559(71.3)	5393(84.4)	4888(50.8)	2999(31.2)	5483(57.0)	5401(68.1)	3251(41.3)	3373(47.0)	4711(66.1)
	Test done	6393(100.0)	6393(100.0)	9627(100.0)	9627(100.0)	9627(100.0)	7927(100.0)	7881(100.0)	7179(100.0)	7125(100.0)

	N(%)									
Other Malaysian	Achieved N(%)	95(29.5)	54(16.8)	217(45.3)	312(65.1)	183(38.2)	94(22.7)	185(45.1)	239(64.9)	100(27.4)
	Not achieved N(%)	227(70.5)	268(83.2)	262(54.7)	167(34.9)	296(61.8)	320(77.3)	225(54.9)	129(35.1)	265(72.6)
	Test done N(%)	322(100.0)	322(100.0)	479(100.0)	479(100.0)	479(100.0)	414(100.0)	410(100.0)	368(100.0)	365(100.0)
Non Malaysian	Achieved N(%)	10(20.4)	6(12.2)	41(51.9)	48(60.8)	38(48.1)	25(37.9)	43(69.4)	39(68.4)	22(40.7)
	Not achieved N(%)	39(79.6)	43(87.8)	38(48.1)	31(39.2)	41(51.9)	41(62.1)	19(30.6)	18(31.6)	32(59.3)
	Test done N(%)	49(100.0)	49(100.0)	79(100.0)	79(100.0)	79(100.0)	66(100.0)	62(100.0)	57(100.0)	54(100.0)
Missing	Achieved N(%)	13(20.3)	10(15.6)	49(57.0)	59(68.6)	46(53.5)	35(48.6)	42(58.3)	40(58.0)	31(45.6)
	Not achieved N(%)	51(79.7)	54(84.4)	37(43.0)	27(31.4)	40(46.5)	37(51.4)	30(41.7)	29(42.0)	37(54.4)
	Test done N(%)	64(100.0)	64(100.0)	86(100.0)	86(100.0)	86(100.0)	72(100.0)	72(100.0)	69(100.0)	68(100.0)

Table 2.1.20 Distribution of clinical information based on cut-off points in patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	Status	HbA1c (<7.0%)	HbA1c (<6.5%)	SBP (≤130mmHg)	DBP (≤80 mmHg)	BP (≤130/80 mmHg)	Cholesterol (<4.5 mmol/l)	Triglyceride (≤1.7 mmol/l)	HDL (≥1.1 mmol/l)	LDL (≤2.6 mmol/l)
< 5	Achieved N(%)	6399(36.2)	3828(21.7)	13101(45.6)	17214(60.0)	10832(37.7)	4945(21.5)	11668(51.3)	13000(67.4)	5407(28.4)
	Not achieved N(%)	11280(63.8)	13851(78.3)	15603(54.4)	11490(40.0)	17872(62.3)	18078(78.5)	11085(48.7)	6280(32.6)	13664(71.6)
	Test done N(%)	17679(100.0)	17679(100.0)	28704(100.0)	28704(100.0)	28704(100.0)	23023(100.0)	22753(100.0)	19280(100.0)	19071(100.0)
5 – 10	Achieved N(%)	3682 (26.9)	2116 (15.4)	8902 (45.6)	12924 (66.2)	7678 (39.3)	4014 (24.5)	8447 (52.2)	9386 (67.8)	4363(31.9)
	Not achieved N(%)	10020 (73.1)	11586 (84.6)	10626 (54.4)	6604 (33.8)	11850(60.7)	12377(75.5)	7736(47.8)	4458(32.2)	9313(68.1)
	Test done N(%)	13702(100.0)	13702(100.0)	19528(100.0)	19528(100.0)	19528(100.0)	16391(100.0)	16183(100.0)	13844(100.0)	13676(100.0)
> 10	Achieved N(%)	1359(24.0)	778(13.7)	3285(41.3)	5783(72.6)	2986(37.5)	2095(31.7)	3710(56.8)	3944(66.5)	2214(37.6)
	Not achieved N(%)	4312(76.0)	4893(86.3)	4677(58.7)	2179(27.4)	4976(62.5)	4523(68.3)	2816(43.2)	1991(33.5)	3671(62.4)

	Test done N(%)	5671(100.0)	5671(100.0)	7962(100.0)	7962(100.0)	7962(100.0)	6618(100.0)	6526(100.0)	5935(100.0)	5885(100.0)
Missing	Achieved N(%)	70(33.2)	32(15.2)	138(44.7)	188(60.8)	114(36.9)	47(18.3)	137(53.7)	162(74.3)	44(20.4)
	Not achieved N(%)	141(66.8)	179(84.8)	171(55.3)	121(39.2)	195(63.1)	210(81.7)	118(46.3)	56(25.7)	172(79.6)
	Test done N(%)	211(100.0)	211(100.0)	309(100.0)	309(100.0)	309(100.0)	257(100.0)	255(100.0)	218(100.0)	216(100.0)

2.1.1.5 Serum creatinine/ Serum profile

The mean serum creatinine in the study population was 88.45 $\mu\text{mol/L}$ with standard deviation of 49.84 $\mu\text{mol/L}$. The mean serum creatinine for males (102.92 \pm 56.00 $\mu\text{mol/L}$) was higher than for females (79.01 \pm 42.86 $\mu\text{mol/L}$). There was an increasing trend of serum creatinine in the age groups of 30 years and above (Table 2.1.23). Among the Malaysians, Malays had the highest mean serum creatinine (103.19 \pm 83.60 $\mu\text{mol/L}$); followed by Chinese (100.91 \pm 82.52 $\mu\text{mol/L}$), Indians (85.75 \pm 53.88 $\mu\text{mol/L}$) and other Malaysian (85.59 \pm 20.53 $\mu\text{mol/L}$). The longer the duration of disease, the higher the mean of serum creatinine is (Table 2.1.25).

Table 2.1.21 Distribution of serum profile for patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Measurement	Not done (%)	N (%)	Missing	Mean (SD)	Median (IQR)	Min, Max
Serum creatinine($\mu\text{mol/L}$)	11659(16)	46121(65)	13109(18)	88.45(49.84)	80(33)	301,322

Table 2.1.22 Distribution of serum profile for patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Measurement	Statistics	Male	Female	Missing
Serum creatinine	N	18170	27874	77
	Missing	5733	7358	18
	Mean (SD)	102.92(56.00)	79.01(42.86)	88.48(36.78)
	Min, Max	30.0,1322.0	30.0,1126.0	40.0,225.0
	Median (IQR)	93.0(30.0)	70.0(26.0)	83.0(40.0)

Table 2.1.23 Distribution of serum profile for patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Serum profile	Age group (years)	Not done (%)	N(%)	Missing (%)	Mean (SD)	Median (IQR)	Min, Max
Serum creatinine	18 – 19	10(25)	21(53)	9(23)	72.33(15.98)	70(25)	52,109
	20 – 24	31(21)	80(54)	37(25)	71.67(26.49)	65(22)	38,165
	25 – 29	96(23)	225(54)	92(22)	67.20(16.35)	67(20)	33,121
	30 – 34	205(23)	495(56)	181(21)	74.51(36.90)	68(25)	30,429
	35 – 39	335(18)	1115(61)	366(20)	75.04(47.22)	67(25)	30,958
	40 – 44	729(17)	2683(64)	761(18)	76.10(46.57)	70(26)	30,907
	45 – 49	1240(17)	4911(66)	1300(17)	78.36(40.79)	72(28)	30,823
	50 – 54	1771(16)	7146(66)	1856(17)	83.11(53.99)	75(29)	301,322
	55 – 59	2070(16)	8798(67)	2237(17)	86.85(48.88)	79(31)	301,160
	60 – 64	1822(16)	7897(68)	1975(17)	91.95(47.76)	84(34)	30,840
	65 – 69	1373(16)	5655(66)	1518(18)	95.23(49.77)	86(34)	301,038
	70 – 74	1062(16)	4023(62)	1427(22)	98.95(50.33)	89(38)	30,907
	75 – 79	515(16)	1974(60)	782(24)	105.05(56.05)	93(40)	30,821
\geq 80	400(19)	1098(53)	568(27)	108.48(58.14)	97(41)	30,882	

Table 2.1.24 Distribution of serum profile for patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Serum profile	Ethnicity	Not done (%)	N(%)	Missing (%)	Mean (SD)	Median (IQR)	Min, Max
Serum creatinine	Malay	2475(27)	2109(23)	4523(50)	103.19(83.60)	83(36)	301,322
	Chinese	2475(45)	1555(29)	1420(26)	100.91(82.52)	82(37)	321,012
	Indian	2475(38)	1942(30)	2044(32)	85.75(53.88)	76(27)	35,891
	Other Malaysian	2475(98)	10(0)	30(1)	85.59(20.53)	86(33)	61,121
	Non Malaysian	2475(100)	3(0)	1(0)	49.33(16.74)	59(29)	30,59
	Missing	2475(96)	71(3)	30(1)	103.11(67.09)	89(49)	40,380

Table 2.1.25 Distribution of serum profile for patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Serum profile	Duration of diabetes (years)	Not done (%)	N (%)	Missing (%)	Mean (SD)	Median (IQR)	Min, Max
Serum creatinine	<5	6345(22)	22839(78)	0(0)	84.19(42.03)	77(31)	301,160
	5 – 10	3615(18)	16327(82)	0(0)	89.30(47.58)	81(35)	30,973
	> 10	1638(20)	6698(80)	0(0)	100.94(72.79)	85(39)	301,322
	Missing	61(0)	257(2)	13109(98)	86.42(34.60)	81(33)	31,366

2.1.1.6 Clinical examinations

More than half of the study population had not tested their urine protein (52.3%), urine microalbumin (64.4%) and electrocardiography (63.7%) and had not had their fundus examined (73.9%). Only 9.6% of the study's male population had been screened for erectile dysfunction. Half of the study populations (53.7%) have had their foot examined.

Table 2.1.26 Distribution of clinical examination for patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Clinical examination	Done N(%)	Not done N(%)
Profile renal		
Urine microalbumin	25208(35.6)	45681(64.4)
Urine protein	33815(47.7)	37074(52.3)
Fundus examination	18526(26.1)	52363(73.9)
Foot examination	38036(53.7)	32853(46.3)
Electrocardiography	25765(36.3)	45124(63.7)

Table 2.1.27 Distribution of screening for erectile dysfunction for patients (male) with T2DM, DRM-ADCM, January 1st – December 31st 2009

Clinical examination	Done N(%)	Not done N(%)
Screening for erectile dysfunction	2786(9.6)	68103(90.4)

Out of those who had clinical examinations, one-third had abnormal urine microalbumin (29.0%). One-fifth had abnormal urine protein (22.0%), abnormal finding in their fundus examination (19.9%), and were positive for erectile dysfunction (18.7%). Less than 10% of the population who had examined their foot (6.1%) and tested for electrocardiography (7.9%) had abnormal finding.

Table 2.1.28 Distribution of clinical examination test for patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Clinical examination	Done		
	Negative N(%)	Positive N(%)	Total
Profile renal			
Urine microalbumin	17895(71.0)	7313(29.0)	25208
Urine protein	26375(78.0)	7440(22.0)	33815
Fundus examination	14839(80.1)	3687(19.9)	18526
Foot examination	35715(93.9)	2321(6.1)	38036
Electrocardiography	23726(92.1)	2039(7.9)	25765

Table 2.1.29 Distribution of screening for erectile dysfunction for patients (male) with T2DM, DRM-ADCM, January 1st – December 31st 2009

Clinical examination	Done		
	Negative N(%)	Positive N(%)	Total
Screening for erectile dysfunction	2264(81.3)	522(18.7)	2786

The proportion of males and females with abnormal findings in the parameters mentioned above were not much different. The proportion of males who had abnormal finding in electrocardiography was 9.2% compared with 7.0% in females.

Table 2.1.30 Distribution of clinical examination test for patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Gender	Status	Urine micro. N(%)	Urine protein N(%)	Fundus Exam. N(%)	Foot exam. N(%)	ECG N(%)	ED N(%)
Male	Negative	6916(69.5)	9904(75.1)	5693(79.0)	13903(93.6)	9402(90.8)	2264(81.3)
	Positive	3042(30.5)	3291(24.9)	1510(21.0)	953(6.4)	957(9.2)	522(18.7)
	Done	9958(100.0)	13195(100.0)	7203(100.0)	14856(100.0)	10359(100.0)	2786(100.0)
Female	Negative	10973(72.0)	16454(79.9)	9132(80.9)	21779(94.1)	14310(93.0)	NA
	Positive	4266(28.0)	4140(20.1)	2161(19.1)	1356(5.9)	1076(7.0)	NA
	Done	15239(100.0)	20594(100.0)	11293(100.0)	23135(100.0)	15386(100.0)	NA
Missing	Negative	6(54.5)	17(65.4)	14(46.7)	33(73.3)	14(70.0)	NA
	Positive	5(45.5)	9(34.6)	16(53.3)	12(26.7)	6(30.0)	NA
	Done	11(100.0)	26(100.0)	30(100.0)	45(100.0)	20(100.0)	NA

For urine microalbuminuria, fundus examination, foot examination and electrocardiography test, the proportion of abnormal findings increased in the older age group. One-fifth of the males aged 45 and above had abnormal findings when screened for erectile dysfunction. However, the reported erectile dysfunction reduced to 13% in those aged 80 years and above.

Table 2.1.31 Distribution of clinical examination test for patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Age group (years)	Status	Urine microalbumin N(%)	Urine protein N(%)	Fundus exam. N(%)	Foot exam. N(%)	ECG N(%)	ED* N(%)
18 – 19	Negative	7(77.8)	15(75.0)	9(90.0)	17(100.0)	11(100.0)	0(0.0)
	Positive	2(22.2)	5(25.0)	1(10.0)	0(0.0)	0(0.0)	0(0.0)
	Done	9(100.0)	20(100.0)	10(100.0)	17(100.0)	11(100.0)	0(0.0)
20 – 24	Negative	28(73.7)	51(79.7)	32(78.0)	66(93.0)	44(97.8)	4(80.0)
	Positive	10(26.3)	13(20.3)	9(22.0)	5(7.0)	1(2.2)	1(20.0)
	Done	38(100.0)	64(100.0)	41(100.0)	71(100.0)	45(100.0)	5(100.0)
25 – 29	Negative	87(68.5)	149(76.4)	96(91.4)	201(97.1)	115(93.5)	11(100.0)
	Positive	40(31.5)	46(23.6)	9(8.6)	6(2.9)	8(6.5)	0(0.0)
	Done	127(100.0)	195(100.0)	105(100.0)	207(100.0)	123(100.0)	11(100.0)
30 – 34	Negative	194(73.5)	310(78.5)	175(92.1)	433(97.3)	267(97.4)	27(87.1)

Age group (years)	Status	Urine microalbumin N(%)	Urine protein N(%)	Fundus exam. N(%)	Foot exam. N(%)	ECG N(%)	ED* N(%)
	Positive	70(26.5)	85(21.5)	15(7.9)	12(2.7)	7(2.6)	4(12.9)
	Done	264(100.0)	395(100.0)	190(100.0)	445(100.0)	274(100.0)	31(100.0)
35 – 39	Negative	415(73.6)	647(77.8)	403(90.2)	928(97.0)	549(96.1)	43(84.3)
	Positive	149(26.4)	185(22.2)	44(9.8)	29(3.0)	22(3.9)	8(15.7)
	Done	564(100.0)	832(100.0)	447(100.0)	957(100.0)	571(100.0)	51(100.0)
40 – 44	Negative	1100(73.5)	1588(78.7)	1024(90.6)	2215(95.9)	1449(95.4)	129(84.9)
	Positive	397(26.5)	431(21.3)	106(9.4)	95(4.1)	70(4.6)	23(15.1)
	Done	1497(100.0)	2019(100.0)	1130(100.0)	2310(100.0)	1519(100.0)	152(100.0)
45 – 49	Negative	1945(72.7)	2799(78.3)	1845(87.7)	3996(95.6)	2618(95.0)	217(79.5)
	Positive	731(27.3)	774(21.7)	258(12.3)	182(4.4)	138(5.0)	56(20.5)
	Done	2676(100.0)	3573(100.0)	2103(100.0)	4178(100.0)	2756(100.0)	273(100.0)
50 – 54	Negative	2866(72.6)	4056(78.3)	2525(84.3)	5618(94.4)	3904(93.6)	372(83.2)
	Positive	1084(27.4)	1123(21.7)	470(15.7)	336(5.6)	267(6.4)	75(16.8)
	Done	3950(100.0)	5179(100.0)	2995(100.0)	5954(100.0)	4171(100.0)	447(100.0)
55 – 59	Negative	3427(70.3)	5087(78.6)	2983(82.4)	6935(94.7)	4581(93.1)	444(81.2)
	Positive	1449(29.7)	1388(21.4)	639(17.6)	389(5.3)	340(6.9)	103(18.8)
	Done	4876(100.0)	6475(100.0)	3622(100.0)	7324(100.0)	4921(100.0)	547(100.0)
60 – 64	Negative	3062(70.2)	4537(78.2)	2473(76.8)	6110(93.6)	4000(92.1)	399(81.3)
	Positive	1298(29.8)	1267(21.8)	746(23.2)	419(6.4)	343(7.9)	92(18.7)
	Done	4360(100.0)	5804(100.0)	3219(100.0)	6529(100.0)	4343(100.0)	491(100.0)
65 – 69	Negative	2181(70.4)	3227(77.2)	1624(74.2)	4256(92.7)	2812(89.7)	294(82.8)
	Positive	917(29.6)	954(22.8)	565(25.8)	334(7.3)	323(10.3)	61(17.2)
	Done	3098(100.0)	4181(100.0)	2189(100.0)	4590(100.0)	3135(100.0)	355(100.0)
70 – 74	Negative	1541(70.2)	2255(77.1)	1036(69.4)	2874(91.4)	1968(88.5)	185(73.1)
	Positive	654(29.8)	670(22.9)	456(30.6)	269(8.6)	256(11.5)	68(26.9)
	Done	2195(100.0)	2925(100.0)	1492(100.0)	3143(100.0)	2224(100.0)	253(100.0)
75 – 79	Negative	683(68.3)	1039(76.5)	396(62.4)	1327(89.9)	923(86.1)	92(79.3)
	Positive	317(31.7)	320(23.5)	239(37.6)	149(10.1)	149(13.9)	24(20.7)
	Done	1000(100.0)	1359(100.0)	635(100.0)	1476(100.0)	1072(100.0)	116(100.0)
≥ 80	Negative	359(64.8)	615(77.5)	218(62.6)	739(88.5)	485(80.8)	47(87.0)
	Positive	195(35.2)	179(22.5)	130(37.4)	96(11.5)	115(19.2)	7(13.0)
	Done	554(100.0)	794(100.0)	348(100.0)	835(100.0)	600(100.0)	54(100.0)

* ED is for male patients only.

The proportions of abnormal findings for fundus urine microalbumin and urine protein were comparable among the Malays, Chinese and Indians. The Chinese had the highest proportion of abnormal findings in fundus examination and electrocardiography followed by Indians and Malays. Indians had the highest proportion of abnormal finding during foot examination (9.3%) while Malays had the highest proportion of abnormal finding when screened for erectile dysfunction (23.1%).

Table 2.1.32 Distribution of clinical examination for patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Status	Urine microalbumin N(%)	Urine protein N(%)	Fundus exam. N(%)	Foot exam. N(%)	ECG N(%)	ED* N(%)
Malay	Negative	11132(71.1)	16631(76.7)	9670(82.6)	23854(95.1)	15068(93.5)	1266(76.9)
	Positive	4529(28.9)	5042(23.3)	2036(17.4)	1232(4.9)	1050(6.5)	381(23.1)
	Done	15661(100.0)	21673(100.0)	11706(100.0)	25086(100.0)	16118(100.0)	1647(100.0)
Chinese	Negative	3609(68.9)	5356(79.1)	2599(74.4)	6298(92.4)	4427(88.6)	605(89.6)
	Positive	1628(31.1)	1417(20.9)	895(25.6)	519(7.6)	569(11.4)	70(10.4)
	Done	5237(100.0)	6773(100.0)	3494(100.0)	6817(100.0)	4996(100.0)	675(100.0)
Indian	Negative	3017(73.3)	4066(82.2)	2415(77.2)	5186(90.7)	3994(91.2)	368(85.0)
	Positive	1098(26.7)	880(17.8)	713(22.8)	533(9.3)	384(8.8)	65(15.0)
	Done	4115(100.0)	4946(100.0)	3128(100.0)	5719(100.0)	4378(100.0)	433(100.0)
Other Malaysian	Negative	115(72.8)	255(77.5)	120(82.2)	306(94.7)	200(90.9)	24(82.8)
	Positive	43(27.2)	74(22.5)	26(17.8)	17(5.3)	20(9.1)	5(17.2)
	Done	158(100.0)	329(100.0)	146(100.0)	323(100.0)	220(100.0)	29(100.0)
Non Malaysian	Negative	16(59.3)	49(77.8)	22(91.7)	38(82.6)	25(73.5)	1(50.0)
	Positive	11(40.7)	14(22.2)	2(8.3)	8(17.4)	9(26.5)	1(50.0)
	Done	27(100.0)	63(100.0)	24(100.0)	46(100.0)	34(100.0)	2(100.0)
Missing	Negative	6(60.0)	18(58.1)	13(46.4)	33(73.3)	12(63.2)	0(0.0)
	Positive	4(40.0)	13(41.9)	15(53.6)	12(26.7)	7(36.8)	0(0.0)
	Done	10(100.0)	31(100.0)	28(100.0)	45(100.0)	19(100.0)	0(0.0)

* ED is for male patients only.

The longer the duration of diabetes, the higher is the proportion of study population with abnormal findings for urine microalbumin, urine protein, fundus examination, foot examination and electrocardiography. The proportion of abnormal findings from erectile dysfunction screening was comparable for those with disease duration <5 years and those with disease duration 5 to 10 years. Those with disease duration of more than 10 years had the least rate of abnormal findings for erectile dysfunction (14.4%).

Table 2.1.33 Distribution of clinical examination for patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	Status	Urine microalbumin N(%)	Urine protein N(%)	Fundus exam. N(%)	Foot exam. N(%)	ECG N(%)	ED* N(%)
< 5	Negative	9208(74.3)	13785(81.1)	7752(86.0)	18723(95.2)	12076(93.6)	1193(81.2)
	Positive	3183(25.7)	3217(18.9)	1266(14.0)	938(4.8)	829(6.4)	277(18.8)
	Done	12391(100.0)	17002(100.0)	9018(100.0)	19661(100.0)	12905(100.0)	1470(100.0)
5 – 10	Negative	6320(69.9)	8942(76.3)	5399(78.7)	12537(94.2)	8363(91.9)	689(79.3)
	Positive	2720(30.1)	2784(23.7)	1462(21.3)	770(5.8)	734(8.1)	180(20.7)
	Done	9040(100.0)	11726(100.0)	6861(100.0)	13307(100.0)	9097(100.0)	869(100.0)
> 10	Negative	2268(62.2)	3501(71.4)	1599(63.2)	4258(87.6)	3157(87.1)	369(85.6)
	Positive	1376(37.8)	1399(28.6)	930(36.8)	604(12.4)	466(12.9)	62(14.4)
	Done	3644(100.0)	4900(100.0)	2529(100.0)	4862(100.0)	3623(100.0)	431(100.0)
Missing	Negative	99(74.4)	147(78.6)	89(75.4)	197(95.6)	130(92.9)	13(81.3)
	Positive	34(25.6)	40(21.4)	29(24.6)	9(4.4)	10(7.1)	3(18.8)
	Done	133(100.0)	187(100.0)	118(100.0)	206(100.0)	140(100.0)	16(100.0)

* ED is for male patients only.

2.1.1.7 Glomerular filtration rate (GFR)

The GFR in this study was derived from the Cockcroft-Gault formula.

About one-fifth (18.7%) of the study population had GFR<60ml/min. The proportion of females (19.7%) who had GFR<60ml/min was higher than the proportion of males (17.4%). The proportion of patients who had GFR<60ml/min was increased in the older age group. The ethnic group with the highest proportion of patients who had GFR<60ml/min was the Chinese (24.1%), followed by the Malays (18.9%) and the Indians (12.9%). The proportion of patients who had GFR<60ml/min increased with age.

Table 2.1.34 Distribution of glomerular filtration rate (GFR) based on cut-off points in patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

	GFR(<60ml/min) N(%)	GFR(≥60ml/min) N(%)	Missing N(%)
GFR	13276(18.7)	31786(44.8)	2582(36.4)

Table 2.1.35 Distribution of glomerular filtration rate (GFR) based on cut-off points in patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Gender	GFR(<60ml/min) N(%)	GFR(≥60ml/min) N(%)	Missing N(%)
Male	5045(17.4)	12680(43.8)	11214(38.8)
Female	8231(19.7)	19106(45.7)	14504(34.7)

Table 2.1.36 Distribution of glomerular filtration rate (GFR) based on cut-off points in patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Age group (years)	GFR(<60ml/min) N(%)	GFR(≥60ml/min) N(%)	Missing N(%)
18 – 19	0(0.0)	19(47.5)	21(52.5)
20 – 24	3(2.0)	75(50.7)	70(47.3)
25 – 29	2(0.5)	216(52.3)	195(47.2)
30 – 34	18(2.0)	465(52.8)	398(45.2)
35 – 39	32(1.8)	1058(58.3)	726(40.0)
40 – 44	95(2.3)	2544(61.0)	1534(36.8)
45 – 49	298(4.0)	4524(60.7)	2629(35.3)
50 – 54	744(6.9)	6273(58.2)	3756(34.9)
55 – 59	1644(12.5)	6969(53.2)	4492(34.3)
60 – 64	2557(21.9)	5193(44.4)	3944(33.7)
65 – 69	2739(32.1)	2791(32.7)	3016(35.3)
70 – 74	2641(40.6)	1256(19.3)	2615(40.2)
75 – 79	1555(47.5)	328(10.0)	1388(42.4)
≥80	948(45.9)	75(3.6)	1043(50.5)

Table 2.1.37 Distribution of glomerular filtration rate (GFR) based on cut-off points in patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	GFR(<60ml/min) N(%)	GFR(≥60ml/min) N(%)	Missing N(%)
Malay	8280(18.9)	19720(44.9)	15902(36.2)
Chinese	3235(24.1)	5696(42.3)	4520(33.6)
Indian	1640(12.9)	6013(47.2)	5086(39.9)
Other Malaysian	106(18.0)	296(50.3)	186(31.6)
Non Malaysian	9(10.2)	56(63.6)	23(26.1)
Missing	6(5.0)	5(4.1)	110(90.9)

Table 2.1.38 Distribution of glomerular filtration rate (GFR) based on cut-off points in patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	GFR(<60ml/min) N(%)	GFR(≥60ml/min) N(%)	Missing N(%)
< 5 years	5298(18.2)	17141(58.7)	6745(23.1)
5 – 10 years	5146(25.8)	10857(54.4)	3939(19.8)
> 10 years	2760(33.1)	3608(43.3)	1968(23.6)
Missing	72(0.5)	180(1.3)	13175(98.1)

2.1.1.8 Body mass index (BMI) and waist circumference

There were 53915 subjects with their BMI measured but only 16.4% had normal BMI (Table 2.1.39). The proportion of females with normal BMI was 15.6% and it was slightly higher in males (17.5%). (Table 2.1.40)

More elderly patients above the age of 65 years were within the normal BMI range (Table 2.1.41). The Chinese had a higher percentage of patients with normal BMI at 22.1% than the Indians 16.9% and Malays 14.5%. Those with duration of diabetes of more than 10 years had the highest rate of normal BMI at 23.1% in contrast to only 14.2% of those with diabetes less than 5 years.

For waist circumference, 10324 males and 16156 females were measured. For males, 35.9% (n=3711) had waist circumference of less than 90 cm while for females, only 16.6% (n=2681) attained target level of less than 80 cm. Similar to BMI, the elderly of above the age of 65 years had higher percentages of normal waist circumference for both males and females. The Malay males had higher normal waist circumference (38.0%) compared with the Chinese (36.3%) and Indians (28.7%). Eighteen percent of the Malay and Chinese females and 10.4% of the Indian females had normal waist circumference. The number of subjects with normal waist circumference slightly increased with the duration of diabetes as shown in Table 2.1.48.

Table 2.1.39 Distribution of body mass index (BMI) based on cut-off points in patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Clinical information	n(%)
Underweight < 18.5 kg/m ²	893(1.7)
Normal 18.5 – 22.9 kg/m ²	8834(16.4)
Overweight ≥ 23.0	44188(82.0)
Pre-obese 23.0 – 27.4 kg/m ²	20952(38.9)
Obese I 27.5 – 34.9 kg/m ²	19421(36.0)
Obese II 35.0 – 39.9 kg/m ²	2829(5.2)
Obese III ≥40 kg/m ²	986(1.8)
Test Done	53915(100.0)

* BMI classification is based on the Malaysian Clinical Practice Guideline for Obesity 2004

Table 2.1.40 Distribution of body mass index (BMI) on cut-off points in patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Gender	Test done for BMI N	BMI (kg/m ²)						
		Underweight < 18.5	Normal 18.5 – 22.9	Overweight ≥ 23.0	Pre-obese 23.0 – 27.4	Obese I 27.5 – 34.9	Obese II 35.0 – 39.9	Obese III ≥40
Male N(%)	21436	347(1.6)	3755(17.5)	17334(80.9)	9184(42.8)	7165(33.4)	754(3.5)	231(1.1)
Female N(%)	32406	546(1.7)	5068(15.6)	26792(82.7)	11741(36.2)	12231(37.7)	2067(6.4)	753(2.3)
Missing N(%)	73	0(0.0)	11(15.1)	62(84.9)	27(37.0)	25(34.2)	8(11.0)	2(2.7)

Table 2.1.41 Distribution of body mass index (BMI) based on cut-off points in patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Age group (years)	Test done for BMI N	BMI (kg/m ²)						
		Underweight <18.5	Normal 18.5 – 22.9	Overweight ≥ 23.0	Pre-obese 23.0 – 27.4	Obese I 27.5 – 34.9	Obese II 35.0 – 39.9	Obese III ≥40
18 – 19 N(%)	27	2(7.4)	2(7.4)	23(85.2)	5(18.5)	11(40.7)	6(22.2)	1(3.7)
20 – 24 N(%)	103	3(2.9)	16(15.5)	84(81.6)	22(21.4)	41(39.8)	12(11.7)	9(8.7)
25 – 29 N(%)	293	3(1.0)	29(9.9)	261(89.1)	66(22.5)	151(51.5)	29(9.9)	15(5.1)
30 – 34 N(%)	643	12(1.9)	53(8.2)	578(89.9)	169(26.3)	276(42.9)	74(11.5)	59(9.2)
35 – 39 N(%)	1345	7(0.5)	112(8.3)	1226(91.2)	389(28.9)	635(47.2)	138(10.3)	64(4.8)
40 – 44 N(%)	3229	37(1.1)	301(9.3)	2891(89.5)	1107(34.3)	1414(43.8)	264(8.2)	106(3.3)
45 – 49 N(%)	5813	53(0.9)	592(10.2)	5168(88.9)	2145(36.9)	2410(41.5)	465(8.0)	148(2.5)
50 – 54	8423	69(0.8)	1026(12.2)	7328(87.0)	3083(36.6)	3454(41.0)	599(7.1)	192(2.3)

N(%)								
55 – 59 N(%)	10223	134(1.3)	1477(14.4)	8612(84.2)	3879(37.9)	3982(39.0)	570(5.6)	181(1.8)
60 – 64 N(%)	9161	118(1.3)	1521(16.6)	7522(82.1)	3907(42.6)	3117(34.0)	383(4.2)	115(1.3)
65 – 69 N(%)	6568	148(2.3)	1428(21.7)	4992(76.0)	2728(41.5)	2042(31.1)	166(2.5)	56(0.9)
70 – 74 N(%)	4620	133(2.9)	1179(25.5)	3308(71.6)	2016(43.6)	1176(25.5)	91(2.0)	25(0.5)
75 – 79 N(%)	2218	90(4.1)	670(30.2)	1458(65.7)	921(41.5)	504(22.7)	24(1.1)	9(0.4)
≥80 N(%)	1249	84(6.7)	428(34.3)	737(59.0)	515(41.2)	208(16.7)	8(0.6)	6(0.5)

Table 2.1.42 Distribution of body mass index (BMI) based on cut-off points in patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Test done for BMI N	BMI (kg/m ²)						
		Underweight < 18.5	Normal 18.5 – 22.9	Overweight ≥ 23.0	Pre-obese 23.0 – 27.4	Obese I 27.5 – 34.9	Obese II 35.0 – 39.9	Obese III ≥40
Malay N(%)	33686	542(1.6)	4874(14.5)	28270(83.9)	12615(37.4)	12946(38.4)	2014(6.0)	695(2.1)
Chinese N(%)	10463	222(2.1)	2314(22.1)	7927(75.8)	4598(43.9)	2994(28.6)	255(2.4)	80(0.8)
Indian N(%)	9165	121(1.3)	1552(16.9)	7492(81.7)	3500(38.2)	3270(35.7)	520(5.7)	202(2.2)
Other Malaysian N(%)	459	8(1.7)	69(15.0)	382(83.2)	184(40.1)	162(35.3)	30(6.5)	6(1.3)
Non Malaysian N(%)	72	0(0.0)	16(22.2)	56(77.8)	29(40.3)	23(31.9)	3(4.2)	1(1.4)
Missing N(%)	70	0(0.0)	9(12.9)	61(87.1)	26(37.1)	26(37.1)	7(10.0)	2(2.9)

Table 2.1.43 Distribution of body mass index (BMI) based on cut-off points in patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	Test done for BMI N	BMI (kg/m ²)						
		Underweight < 18.5	Normal 18.5 – 22.9	Overweight ≥ 23.0	Pre-obese 23.0 – 27.4	Obese I 27.5 – 34.9	Obese II 35.0 – 39.9	Obese III ≥40
< 5 N(%)	27330	422(1.5)	3870(14.2)	23038(84.3)	10112(37.0)	10571(38.7)	1724(6.3)	631(2.3)
5 – 10 N(%)	18858	298(1.6)	3202(17.0)	15358(81.4)	7633(40.5)	6593(35.0)	848(4.5)	284(1.5)
> 10 N(%)	7430	166(2.2)	1719(23.1)	5545(74.6)	3091(41.6)	2149(28.9)	239(3.2)	66(0.9)
Missing N(%)	297	7(2.4)	43(14.5)	247(83.2)	116(39.1)	108(36.4)	18(6.1)	5(1.7)

Table 2.1.44 Distribution of waist circumference based on cut-off points in patients with T2DM, DRM-ADCM, January 1st – December 31st 2009

Clinical information	Test done N	Achieved N(%)	Not achieved N(%)
Waist circumference <90cm (Male)	10324	3711(36)	6613(64)
Waist circumference <80cm (Female)	16156	2681(17)	13475(83)

Table 2.1.45 Distribution of waist circumference based on cut-off points in patients with T2DM by gender, DRM-ADCM, January 1st – December 31st 2009

Gender	Status	Waist circumference <90cm (Male)	Waist circumference <80cm (Female)
Male	Achieved N(%)	3711(35.9)	
	Not achieved N(%)	6613(64.1)	
	Test done N(%)	10324(100.0)	
Female	Achieved N(%)		2681(16.6)
	Not achieved N(%)		13475(83.4)
	Test done N(%)		16156(100.0)

Achieved waist circumference for male is <90cm and female <80cm

Table 2.1.46 Distribution of waist circumference based on cut-off points in patients with T2DM by age group, DRM-ADCM, January 1st – December 31st 2009

Age group (years)	Status	Waist circumference <90cm (Male)	Waist circumference <80cm (Female)
18 – 19	Achieved N(%)	0(0.0)	3(25.0)
	Not achieved N(%)	3(100.0)	9(75.0)
	Test done N(%)	3(100.0)	12(100.0)
20 – 24	Achieved N(%)	6(46.2)	9(25.7)
	Not achieved N(%)	7(53.8)	26(74.3)
	Test done N(%)	13(100.0)	35(100.0)
25 – 29	Achieved N(%)	16(37.2)	15(15.0)
	Not achieved N(%)	27(62.8)	85(85.0)
	Test done N(%)	43(100.0)	100(100.0)
30 – 34	Achieved N(%)	38(29.5)	21(11.2)
	Not achieved N(%)	91(70.5)	167(88.8)
	Test done N(%)	129(100.0)	188(100.0)
35 – 39	Achieved N(%)	64(31.2)	68(14.4)
	Not achieved N(%)	141(68.8)	403(85.6)
	Test done N(%)	205(100.0)	471(100.0)
40 – 44	Achieved N(%)	190(33.4)	151(14.3)
	Not achieved N(%)	379(66.6)	902(85.7)
	Test done N(%)	569(100.0)	1053(100.0)
45 – 49	Achieved N(%)	354(34.2)	300(16.2)
	Not achieved N(%)	680(65.8)	1552(83.8)
	Test done N(%)	1034(100.0)	1852(100.0)
50 – 54	Achieved N(%)	507(33.1)	395(14.9)
	Not achieved N(%)	1025(66.9)	2261(85.1)
	Test done N(%)	1532(100.0)	2656(100.0)
55 – 59	Achieved N(%)	675(33.3)	510(16.4)
	Not achieved N(%)	1354(66.7)	2592(83.6)
	Test done N(%)	2029(100.0)	3102(100.0)

Age group (years)	Status	Waist circumference <90cm (Male)	Waist circumference <80cm (Female)
60 – 64	Achieved N(%)	645(34.7)	421(16.2)
	Not achieved N(%)	1213(65.3)	2171(83.8)
	Test done N(%)	1858(100.0)	2592(100.0)
65 – 69	Achieved N(%)	531(39.5)	314(17.1)
	Not achieved N(%)	814(60.5)	1522(82.9)
	Test done N(%)	1345(100.0)	1836(100.0)
70 – 74	Achieved N(%)	380(42.4)	258(19.8)
	Not achieved N(%)	516(57.6)	1043(80.2)
	Test done N(%)	896(100.0)	1301(100.0)
75 – 79	Achieved N(%)	171(40.0)	118(19.3)
	Not achieved N(%)	257(60.0)	492(80.7)
	Test done N(%)	428(100.0)	610(100.0)
≥80	Achieved N(%)	134(55.8)	98(28.2)
	Not achieved N(%)	106(44.2)	250(71.8)
	Test done N(%)	240(100.0)	348(100.0)

Achieved waist circumference for male is <90cm and female <80cm

Table 2.1.47 Distribution of waist circumference based on cut-off points in patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Status	Waist circumference <90cm(Male)	Waist circumference <80cm(Female)
Malay	Achieved N(%)	2249(38.0)	1828(18.0)
	Not achieved N(%)	3666(62.0)	8347(82.0)
	Test done N(%)	5915(100.0)	10175(100.0)
Chinese	Achieved N(%)	916(36.3)	537(18.0)
	Not achieved N(%)	1610(63.7)	2448(82.0)
	Test done N(%)	2526(100.0)	2985(100.0)
Indian	Achieved N(%)	509(28.7)	297(10.4)
	Not achieved N(%)	1262(71.3)	2561(89.6)
	Test done N(%)	1771(100.0)	2858(100.0)
Other Malaysian	Achieved N(%)	32(31.7)	18(15.4)
	Not achieved N(%)	69(68.3)	99(84.6)
	Test done N(%)	101(100.0)	117(100.0)
Non Malaysian	Achieved N(%)	5(50.0)	1(6.3)
	Not achieved N(%)	5(50.0)	15(93.8)
	Test done N(%)	10(100.0)	16(100.0)
Missing	Achieved N(%)	0(0.0)	0(0.0)
	Not achieved N(%)	1(100.0)	5(100.0)
	Test done N(%)	1(100.0)	5(100.0)

Table 2.1.48 Distribution of waist circumference based on cut-off points in patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	Status	Waist circumference <90cm(Male)	Waist circumference <80cm(Female)
< 5	Achieved N(%)	2008(36.0)	1443(16.8)
	Not achieved N(%)	3567(64.0)	716(83.2)
	Test done N(%)	5575(100.0)	8607(100.0)
5 – 10	Achieved N(%)	1129(35.4)	905(16.7)
	Not achieved N(%)	2060(64.6)	4512(83.3)
	Test done N(%)	3189(100.0)	5417(100.0)
> 10	Achieved N(%)	552(37.0)	318(15.5)
	Not achieved N(%)	941(63.0)	1730(84.5)
	Test done N(%)	1493(100.0)	2048(100.0)
Missing	Achieved N(%)	22(32.8)	15(17.9)
	Not achieved N(%)	45(67.2)	69(82.1)
	Test done N(%)	67(100.0)	84(100.0)

2.1.2 Complications

2.1.2.1 Diabetes complications

Slightly more than a quarter of subjects were screened for diabetes complications; 26.1 % (N=18526) for retinopathy and 53.7 % (N=8036) for foot problems. (Table 3.1.(a)) However, the pickup rates for complications were generally low.

Only 4.4% (N=70889) of total patients registered had documented retinopathy, 9.0% (N=1659) had nephropathy and 7.3% (N=70889) had foot problems. A study of diabetes control and complications in private primary healthcare in Malaysia found high complication rates with nephropathy (43.3%; albuminuria: 22.9% and microalbuminuria: 20.4%) as the most common. This was followed by neuropathy (30.1%) and background retinopathy (23.5%).¹ These results were partly due to lack of patients who were screened as well as poor complication assessment at busy primary care clinics.

In terms of gender, more males suffered from complications such as ischaemic heart disease (4.1%; N=28939) and nephropathy (8.4%; N=2424) compared with the female diabetics 2.6% (N=1108) and 6.6% (N=2752) respectively (Table 2.1.50). The elderly of more than 60 years old had higher rate of complications as shown in Table 2.1.51. Among the three major races in Malaysia, the Chinese seem to have suffered the highest rates across all evaluated complications (Table 2.1.52). Table 2.1.53 shows the distribution of complications according to duration of illness. More subjects with diabetes more than 10 years had retinopathy (11.2%) compared with only 3.2% in the group with less than 5 years of diabetes. Other complications also increased with longer duration.

**Table 2.1.49 Documented complications at notification for patients with T2DM, DRM-ADCM,
January 1st – December 31st 2009**

Complications	Status	N(%)
Retinopathy	Yes	3113(4.4)
	No	31433(44.3)
	Not known	23234(32.8)
	Missing	13109(18.5)
	Total	70889(100.0)
Ischaemic heart disease	Yes	2302(3.2)
	No	38755(54.7)
	Not known	16723(23.6)
	Missing	13109(18.5)
	Total	70889(100.0)
Cerebrovascular disease – Stroke / TIA	Yes	623(0.9)
	No	43294(61.1)
	Not known	13863(19.6)
	Missing	13109(18.5)
	Total	70889(100.0)
Nephropathy	Yes	5176(7.3)
	No	36279(51.2)
	Not known	29325(41.4)
	Missing	109(0.15)
	Total	70889(100.0)
Diabetes foot problem	Yes	5187(7.3)
	No	36337(51.3)
	Not known	16256(22.9)
	Missing	13109(18.5)
	Total	70889(100.0)

**Table 2.1.50 Documented complications at notification for patients with T2DM by gender, DRM-ADCM,
January 1st – December 31st 2009**

Gender	Status	Retinopathy	Ischaemic heart disease	Cerebrovascular disease	Nephropathy	Diabetes foot problem
Male	Yes N(%)	1283(4.4)	1180(4.1)	310(1.1)	2424(8.4)	1052(3.6)
	No N(%)	12220(42.2)	15033(51.9)	16892(58.4)	13836(47.8)	16843(58.2)
	Not known N(%)	15436(53.3)	12726(44.0)	11737(40.6)	12679(43.8)	11044(38.2)
	Total N(%)	28939(100.0)	28939(100.0)	28939(100.0)	28939(100.0)	28939(100.0)
Female	Yes N(%)	1808(4.3)	1108(2.6)	311(0.7)	2752(6.6)	1426(3.4)
	No N(%)	19169(45.8)	23664(56.6)	26331(62.9)	22443(53.6)	25885(61.9)
	Not known N(%)	20864(49.9)	17069(40.8)	15199(36.3)	16646(39.8)	14530(34.7)
	Total N(%)	41841(100.0)	41841(100.0)	41841(100.0)	41841(100.0)	41841(100.0)
Missing	Yes N(%)	22(20.2)	14(12.8)	2(1.8)	11(10.1)	13(11.9)
	No N(%)	44(40.4)	58(53.2)	71(65.1)	58(53.2)	59(54.1)
	Not known N(%)	43(39.4)	37(33.9)	36(33.0)	40(36.7)	37(33.9)
	Total N(%)	109(100.0)	109(100.0)	109(100.0)	109(100.0)	109(100.0)

**Table 2.1.51 Documented complications at notification for patients with T2DM by age group, DRM-ADCM,
January 1st – December 31st 2009**

Age Group (years)	Status	Retinopathy	Ischaemic heart Disease	Cerebrovascular disease	Nephropathy	Diabetes foot problem
18 – 19	Yes N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	No N(%)	7(58.3)	6(50.0)	8(66.7)	8(66.7)	7(58.3)
	Not known N(%)	5(41.7)	6(50.0)	4(33.3)	4(33.3)	5(41.7)
	Total N(%)	12(100.0)	12(100.0)	12(100.0)	12(100.0)	12(100.0)

Age Group (years)	Status	Retinopathy	Ischaemic heart Disease	Cerebrovascular disease	Nephropathy	Diabetes foot problem
20 – 24	Yes N(%)	1(2.4)	0(0.0)	0(0.0)	3(7.3)	0(0.0)
	No N(%)	20(48.8)	26(63.4)	30(73.2)	25(61.0)	29(70.7)
	Not known N(%)	20(48.8)	15(36.6)	11(26.8)	13(31.7)	12(29.3)
	Total N(%)	41(100.0)	41(100.0)	41(100.0)	41(100.0)	41(100.0)
25– 29	Yes N(%)	4(3.7)	0(0.0)	0(0.0)	3(2.8)	2(1.9)
	No N(%)	63(58.3)	78(72.2)	82(75.9)	77(71.3)	84(77.8)
	Not known N(%)	41(38.0)	30(27.8)	26(24.1)	28(25.9)	22(20.4)
	Total N(%)	108(100.0)	108(100.0)	108(100.0)	108(100.0)	108(100.0)
30 – 34	Yes N(%)	8(3.5)	4(1.8)	0(0.0)	5(2.2)	1(0.4)
	No N(%)	124(54.6)	161(70.9)	170(74.9)	150(66.1)	178(78.4)
	Not known N(%)	95(41.9)	62(27.3)	57(25.1)	72(31.7)	48(21.1)
	Total N(%)	227(100.0)	227(100.0)	227(100.0)	227(100.0)	227(100.0)
35– 39	Yes N(%)	14(2.6)	15(2.8)	2(0.4)	38(7.1)	8(1.5)
	No N(%)	281(52.2)	358(66.5)	391(72.7)	326(60.6)	392(72.9)
	Not known N(%)	243(45.2)	165(30.7)	145(27.0)	174(32.3)	138(25.7)
	Total N(%)	538(100.0)	538(100.0)	538(100.0)	538(100.0)	538(100.0)
40 – 44	Yes N(%)	11(1.0)	34(3.0)	7(0.6)	71(6.2)	17(1.5)
	No N(%)	662(57.7)	796(69.3)	843(73.4)	742(64.6)	865(75.3)
	Not known N(%)	475(41.4)	318(27.7)	298(26.0)	335(29.2)	266(23.2)
	Total N(%)	1148(100.0)	1148(100.0)	1148(100.0)	1148(100.0)	1148(100.0)
45– 49	Yes N(%)	48(2.4)	105(5.2)	14(0.7)	145(7.1)	42(2.1)
	No N(%)	1127(55.4)	1368(67.3)	1499(73.7)	1297(63.8)	1577(77.6)
	Not known N(%)	858(42.2)	560(27.5)	520(25.6)	591(29.1)	414(20.4)
	Total N(%)	2033(100.0)	2033(100.0)	2033(100.0)	2033(100.0)	2033(100.0)
50 – 54	Yes N(%)	105(3.6)	184(6.4)	45(1.6)	220(7.6)	73(2.5)
	No N(%)	1575(54.6)	1902(65.9)	2097(72.7)	1844(63.9)	2208(76.5)

55– 59	Yes N(%)	170(5.0)	274(8.1)	58(1.7)	296(8.8)	92(2.7)
	No N(%)	1795(53.2)	2186(64.8)	2490(73.8)	2160(64.0)	2574(76.3)
	Not known N(%)	1408(41.7)	913(27.1)	825(24.5)	917(27.2)	707(21.0)
	Total N(%)	3373(100.0)	3373(100.0)	3373(100.0)	3373(100.0)	3373(100.0)
60 –64	Yes N(%)	142(5.4)	228(8.7)	67(2.6)	284(10.9)	88(3.4)
	No N(%)	1356(51.8)	1662(63.5)	1874(71.6)	1588(60.7)	1948(74.4)
	Not known N(%)	1119(42.8)	727(27.8)	676(25.8)	745(28.5)	581(22.2)
	Total N(%)	2617(100.0)	2617(100.0)	2617(100.0)	2617(100.0)	2617(100.0)
65– 69	Yes N(%)	136(6.1)	241(10.8)	65(2.9)	234(10.5)	77(3.5)
	No N(%)	1134(51.0)	1362(61.3)	1546(69.6)	1341(60.4)	1611(72.5)
	Not known N(%)	952(42.8)	619(27.9)	611(27.5)	647(29.1)	534(24.0)
	Total N(%)	2222(100.0)	2222(100.0)	2222(100.0)	2222(100.0)	2222(100.0)
60 –64	Yes N(%)	89(5.2)	178(10.3)	45(2.6)	192(11.2)	66(3.8)
	No N(%)	862(50.1)	1041(60.5)	1199(69.7)	1014(58.9)	1228(71.4)
	Not known N(%)	770(44.7)	502(29.2)	477(27.7)	515(29.9)	427(24.8)
	Total N(%)	1721(100.0)	1721(100.0)	1721(100.0)	1721(100.0)	1721(100.0)
65– 69	Yes N(%)	66(7.3)	105(11.6)	28(3.1)	108(12.0)	40(4.4)
	No N(%)	406(45.0)	523(57.9)	605(67.0)	503(55.7)	628(69.5)
	Not known N(%)	431(47.7)	275(30.5)	270(29.9)	292(32.3)	235(26.0)
	Total N(%)	903(100.0)	903(100.0)	903(100.0)	903(100.0)	903(100.0)
≥ 80	Yes N(%)	37(7.3)	74(14.5)	18(3.5)	60(11.8)	30(5.9)
	No N(%)	213(41.8)	266(52.3)	337(66.2)	268(52.7)	334(65.6)
	Not known N(%)	259(50.9)	169 (33.2)	154 (30.3)	181(35.6)	145(28.5)
	Total N(%)	509(100.0)	509 (100.0)	509 (100.0)	509(100.0)	509(100.0)

**Table 2.1.52 Documented complications at notification for patients with T2DM by ethnicity, DRM-ADCM,
January 1st – December 31st 2009**

Ethnicity	Status	Retinopathy	Ischaemic heart disease	Cerebrovascular disease	Nephropathy	Diabetes foot problem
Malay	Yes N(%)	1720(3.9)	1258(2.9)	323(0.7)	3023(6.9)	1546(3.5)
	No N(%)	20856(47.5)	25432(57.9)	28205(64.2)	24195(55.1)	28192(64.2)
	Not known N(%)	21326(48.6)	17212(39.2)	15374(35.0)	16684(38.0)	14164(32.3)
	Total N(%)	43902(100.0)	43902(100.0)	43902(100.0)	43902(100.0)	43902(100.0)
Chinese	Yes N(%)	756(5.6)	559(4.2)	226(1.7)	1305(9.7)	497(3.7)
	No N(%)	5574(41.4)	7014(52.1)	7972(59.3)	6305(46.9)	7775(57.8)
	Not known N(%)	7121(52.9)	5878(43.7)	5253(39.1)	5841(43.4)	5179(38.5)
	Total N(%)	13451(100.0)	13451(100.0)	13451(100.0)	13451(100.0)	13451(100.0)
Indian	Yes N(%)	587(4.6)	448(3.5)	67(0.5)	780(6.1)	404(3.2)
	No N(%)	4660(36.6)	5868(46.1)	6630(52.0)	5423(42.6)	6351(49.9)
	Not known N(%)	7492(58.8)	6423(50.4)	6042(47.4)	6536(51.3)	5984(47.0)
	Total N(%)	12739(100.0)	12739(100.0)	12739(100.0)	12739(100.0)	12739(100.0)
Other Malaysian	Yes N(%)	25(4.3)	20(3.4)	5(0.9)	46(7.8)	22(3.7)
	No N(%)	258(43.9)	335(57.0)	361(61.4)	320(54.4)	356(60.5)
	Not known N(%)	305(51.9)	233(39.6)	222(37.8)	222(37.8)	210(35.7)
	Total N(%)	588(100.0)	588(100.0)	588(100.0)	588(100.0)	588(100.0)
Non Malaysian	Yes N(%)	3(3.4)	2(2.3)	1(1.1)	18(20.5)	9(10.2)
	No N(%)	41(46.6)	45(51.1)	56(63.6)	39(44.3)	57(64.8)
	Not known N(%)	44(50.0)	41(46.6)	31(35.2)	31(35.2)	22(25.0)
	Total N(%)	88(100.0)	88(100.0)	88(100.0)	88(100.0)	88(100.0)
Missing	Yes N(%)	22(18.2)	15(12.4)	1(0.8)	15(12.4)	13(10.7)
	No N(%)	44(36.4)	61(50.4)	70(57.9)	55(45.5)	56(46.3)
	Not known N(%)	55(45.5)	45(37.2)	50(41.3)	51(42.1)	52(43.0)
	Total N(%)	121(100.0)	121(100.0)	121(100.0)	121(100.0)	121(100.0)

**Table 2.1.53 Documented complications at notification for patients with T2DM by groups of duration of diabetes, DRM-ADCM,
January 1st – December 31st 2009**

Duration of diabetes (years)	Status	Retinopathy	Ischaemic heart disease	Cerebrovascular disease	Nephropathy	Diabetes foot problem
< 5	Yes N(%)	926(3.2)	847(2.9)	227(0.8)	1721(5.9)	925(3.2)
	No N(%)	17193(58.9)	20461(70.1)	22603(77.4)	19670(67.4)	22691(77.8)
	Not known N(%)	11065(37.9)	7876(27.0)	6354(21.8)	7793(26.7)	5568(19.1)
	Total N(%)	29184(100.0)	29184(100.0)	29184(100.0)	29184(100.0)	29184(100.0)
5 – 10	Yes N(%)	1223(6.1)	858(4.3)	204(1.0)	2000(10.0)	853(4.3)
	No N(%)	10655(53.4)	13186(66.1)	14743(73.9)	12245(61.4)	14682(73.6)
	Not known N(%)	8064(40.4)	5898(29.6)	4995(25.0)	5697(28.6)	4407(22.1)
	Total N(%)	19942(100.0)	19942(100.0)	19942(100.0)	19942(100.0)	19942(100.0)
> 10	Yes N(%)	937(11.2)	585(7.0)	189(2.3)	1442(17.3)	701(8.4)
	No N(%)	3413(40.9)	4884(58.6)	5708(68.5)	4197(50.3)	5165(62.0)
	Not known N(%)	3986(47.8)	2867(34.4)	2439(29.3)	2697(32.4)	2470(29.6)
	Total N(%)	8336(100.0)	8336(100.0)	8336(100.0)	8336(100.0)	8336(100.0)
Missing	Yes N(%)	27(0.2)	12(0.1)	3(0.0)	24(0.2)	12(0.1)
	No N(%)	172(1.3)	224(1.7)	240(1.8)	225(1.7)	249(1.9)
	Not known N(%)	13228(98.5)	13191(98.2)	13184(98.2)	13178(98.1)	13166(98.1)
	Total N(%)	13427(100.0)	13427(100.0)	13427(100.0)	13427(100.0)	13427(100.0)

2.1.2.2 Complication from Diabetes foot problem

A total of 71597 subjects were notified with diabetes mellitus in the Audit Diabetes Control and Management 2009. More than half (58%; 41524) of the subjects had foot assessment; out of this, 5187 (12.5%) subjects had foot problems. The majority 87.5% had no foot problems. Foot problems were recorded in 3.6% of males and 3.4% of females. There was no difference for foot problems between these two groups even though there were slightly more (59%) females in the total number of subjects audited.

Females had more peripheral neuropathy (62%) compared with the males (56.7%). There were more amputations among the males (13.3%) compared with the females (8.8%). There were not much difference in the observed prevalence among the 3 ethnic groups (Malay 3.5%, Chinese 3.7% and Indians 3.2%). Surprisingly, 10.2% of foot problems were among non Malaysians. As the data did not depict details of the non Malaysian group, it is difficult to analyse which of the citizens contributed to the high percentage.

The Malays had an 11.3% amputation rate and this is the highest among all ethnic groups. The rate of peripheral neuropathy was highest among the Chinese (73%). Among Malaysians, Indians had the highest rate of peripheral vascular disease (22.8%), foot deformity (12.4%) and current foot ulcer (18.6%). Those categorised as other Malaysians recorded 18.2% of amputations.

Foot complications were seen to be more prevalent with age and duration of diabetes. There were more foot problems documented in the subjects with diabetes of more than 10 years duration. And among this group, peripheral neuropathy and amputation were most prevalent i.e. 67% and 16.1% respectively. However, among the subjects with diabetes duration of less than 5 years, 17.9% had peripheral vascular disease and 17.8% had current foot ulcers. These observations were the highest compared with other foot problems. Foot deformity was high in the 5 – 10 years diabetes duration (7.6%).

Distribution of foot problems varies according to age group. Peripheral neuropathy was most common in the 75 – 79 years age group while peripheral vascular disease was highest among the subjects of ages 80 years and above. Foot deformity was seen more in the 40 – 44 years age group and foot ulcers were seen highest (29%) in the younger age group (35 – 39 years). This could be because of their active lifestyle and high mobility which may lead to the formation of ulcers. In addition to this, the age group 55 – 59 years documented a 14.9% amputation among the subjects. There is no obvious explanation for this observation.

**Table 2.1.54 Distribution of complications from diabetes foot problem for patients with T2DM,
DRM-ADCM, January 1st – December 31st 2009**

Complications	N(%)
Peripheral neuropathy	1492(59.9)
Peripheral vascular disease	368(14.8)
Foot deformity	155(6.2)
Ulcer (current)	419(16.8)
Amputation	265(10.6)

**Table 2.1.55 Distribution of complications from diabetes foot problem for patients with T2DM by gender,
DRM-ADCM, January 1st – December 31st 2009**

Gender	Status	Peripheral neuropathy	Peripheral vascular disease	Foot deformity	Ulcer (current)	Amputation
Male	Yes N(%)	596(56.7)	142(13.5)	60(5.7)	211(20.1)	140(13.3)
	No N(%)	456(43.3)	910(86.5)	992(94.3)	841(79.9)	912(86.7)
	Diabetic foot N(%)	1052(100.0)	1052(100.0)	1052(100.0)	1052(100.0)	1052(100.0)
Female	Yes N(%)	884(62.0)	226(15.8)	95(6.7)	207(14.5)	125(8.8)
	No N(%)	542(38.0)	1200(84.2)	1331(93.3)	1219(85.5)	1301(91.2)
	Diabetic foot N(%)	1426(100.0)	1426(100.0)	1426(100.0)	1426(100.0)	1426(100.0)
Missing	Yes N(%)	12(92.3)	0(0.0)	0(0.0)	1(7.7)	0(0.0)
	No N(%)	1(7.7)	13(100.0)	13(100.0)	12(92.3)	13(100.0)
	Diabetic foot N(%)	13(100.0)	13(100.0)	13(100.0)	13(100.0)	13(100.0)

**Table 2.1.56 Distribution of complications from diabetes foot problem for patients with T2DM by age group,
DRM-ADCM, January 1st – December 31st 2009**

Age group (years)	Status	Peripheral neuropathy	Peripheral vascular disease	Foot deformity	Ulcer (current)	Amputation
18 – 19	Yes N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	No N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Diabetic foot N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
20 – 24	Yes N(%)	3(75.0)	3(75.0)	0(0.0)	0(0.0)	0(0.0)
	No N(%)	1(25.0)	1(25.0)	4(100.0)	4(100.0)	4(100.0)
	Diabetic foot N(%)	4(100.0)	4(100.0)	4(100.0)	4(100.0)	4(100.0)
25 – 29	Yes N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	No N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Diabetic foot N(%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
30 – 34	Yes N(%)	8(53.3)	0(0.0)	1(6.7)	4(26.7)	2(13.3)
	No N(%)	7(46.7)	15(100.0)	14(93.3)	11(73.3)	13(86.7)
	Diabetic foot N(%)	15(100.0)	15(100.0)	15(100.0)	15(100.0)	15(100.0)
35 – 39	Yes N(%)	18(58.1)	3(9.7)	0(0.0)	9(29.0)	2(6.5)
	No N(%)	13(41.9)	28(90.3)	31(100.0)	22(71.0)	29(93.5)
	Diabetic foot N(%)	31(100.0)	31(100.0)	31(100.0)	31(100.0)	31(100.0)
40 – 44	Yes N(%)	47(52.2)	10(11.1)	12(13.3)	21(23.3)	13(14.4)
	No N(%)	43(47.8)	80(88.9)	78(86.7)	69(76.7)	77(85.6)
	Diabetic foot N(%)	90(100.0)	90(100.0)	90(100.0)	90(100.0)	90(100.0)
45 – 49	Yes N(%)	95(49.2)	23(11.9)	12(6.2)	43(22.3)	22(11.4)
	No N(%)	98(50.8)	170(88.1)	181(93.8)	150(77.7)	171(88.6)
	Diabetic Foot N(%)	193(100.0)	193 (100.0)	193(100.0)	193(100.0)	193(100.0)
50 – 54	Yes N(%)	202(56.3)	51(14.2)	24(6.7)	74(20.6)	33(9.2)
	No N(%)	157(43.7)	308(85.8)	335(93.3)	285(79.4)	326(90.8)

Age group (years)	Status	Peripheral neuropathy	Peripheral vascular disease	Foot deformity	Ulcer (current)	Amputation
	Diabetic foot N(%)	359(100.0)	359(100.0)	359(100.0)	359(100.0)	359(100.0)
55 – 59	Yes N(%)	241(54.5)	70(15.8)	25(5.7)	66(14.9)	66(14.9)
	No N(%)	201(45.5)	372(84.2)	417(94.3)	376(85.1)	376(85.1)
	Diabetic foot N(%)	442(100.0)	442(100.0)	442(100.0)	442(100.0)	442(100.0)
60 – 64	Yes N(%)	277(58.1)	76(15.9)	30(6.3)	85(17.8)	49(10.3)
	No N(%)	200(41.9)	401(84.1)	447(93.7)	392(82.2)	428(89.7)
	Diabetic foot N(%)	477(100.0)	477(100.0)	477(100.0)	477(100.0)	477(100.0)
65 – 69	Yes N(%)	234(66.3)	49(13.9)	24(6.8)	48(13.6)	32(9.1)
	No N(%)	119(33.7)	304(86.1)	329(93.2)	305(86.4)	321(90.9)
	Diabetic foot N(%)	353(100.0)	353(100.0)	353(100.0)	353(100.0)	353(100.0)
70 – 74	Yes N(%)	174(67.2)	35(13.5)	11(4.2)	37(14.3)	25(9.7)
	No N(%)	85(32.8)	224(86.5)	248(95.8)	222(85.7)	234(90.3)
	Diabetic foot N(%)	259(100.0)	259(100.0)	259(100.0)	259(100.0)	259(100.0)
75 – 79	Yes N(%)	109(73.2)	21(14.1)	9(6.0)	18(12.1)	11(7.4)
	No N(%)	40(26.8)	128(85.9)	140(94.0)	131(87.9)	138(92.6)
	Diabetic foot N(%)	149(100.0)	149(100.0)	149(100.0)	149(100.0)	149(100.0)
≥80	Yes N(%)	84(70.6)	27(22.7)	7(5.9)	14(11.8)	10(8.4)
	No N(%)	35(29.4)	92(77.3)	112(94.1)	105(88.2)	109(91.6)
	Diabetic foot N(%)	119(100.0)	119(100.0)	119(100.0)	119(100.0)	119(100.0)

**Table 2.1.57 Distribution of complications from diabetes foot problem for patients with T2DM by ethnicity,
DRM-ADCM, January 1st – December 31st 2009**

Ethnicity	Status	Peripheral neuropathy	Peripheral vascular disease	Foot deformity	Ulcer (current)	Amputation
Malay	Yes N(%)	910(58.9)	197(12.7)	84(5.4)	280(18.1)	175(11.3)
	No N(%)	636(41.1)	1349(87.3)	1462(94.6)	1266(81.9)	1371(88.7)
	Diabetic foot N(%)	1546(100.0)	1546(100.0)	1546(100.0)	1546(100.0)	1546(100.0)
Chinese	Yes N(%)	363(73.0)	73(14.7)	19(3.8)	57(11.5)	42(8.5)
	No N(%)	134(27.0)	424(85.3)	478(96.2)	440(88.5)	455(91.5)
	Diabetic foot N(%)	497(100.0)	497(100.0)	497(100.0)	497(100.0)	497(100.0)
Indian	Yes N(%)	191(47.3)	92(22.8)	50(12.4)	75(18.6)	43(10.6)
	No N(%)	213(52.7)	312(77.2)	354(87.6)	329(81.4)	361(89.4)
	Diabetic foot N(%)	404(100.0)	404(100.0)	404(100.0)	404(100.0)	404(100.0)
Other Malaysian	Yes N(%)	7(31.8)	4(18.2)	2(9.1)	5(22.7)	4(18.2)
	No N(%)	15(68.2)	18(81.8)	20(90.9)	17(77.3)	18(81.8)
	Diabetic foot N(%)	22(100.0)	22(100.0)	22(100.0)	22(100.0)	22(100.0)
Non Malaysian	Yes N(%)	8(88.9)	2(22.2)	0(0.0)	2(22.2)	1(11.1)
	No N(%)	1(11.1)	7(77.8)	9(100.0)	7(77.8)	8(88.9)
	Diabetic foot N(%)	9(100.0)	9(100.0)	9(100.0)	9(100.0)	9(100.0)
Missing	Yes N(%)	13(100.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	No N(%)	0(0.0)	13(100.0)	13(100.0)	13(100.0)	13(100.0)
	Diabetic foot N(%)	13(100.0)	13(100.0)	13(100.0)	13(100.0)	13(100.0)

Table 2.1.58 Distribution of complications from diabetes foot problem for patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	Status	Peripheral neuropathy	Peripheral vascular disease	Foot deformity	Ulcer (current)	Amputation
< 5	Yes N(%)	505(54.6)	166(17.9)	65(7.0)	165(17.8)	72(7.8)
	No N(%)	420(45.4)	759(82.1)	860(93.0)	760(82.2)	853(92.2)
	Diabetic foot N(%)	925(100.0)	925(100.0)	925(100.0)	925(100.0)	925(100.0)
5 – 10	Yes N(%)	511(59.9)	119(14.0)	65(7.6)	138(16.2)	79(9.3)
	No N(%)	342(40.1)	734(86.0)	788(92.4)	715(83.8)	774(90.7)
	Diabetic foot N(%)	853(100.0)	853(100.0)	853(100.0)	853(100.0)	853(100.0)
> 10	Yes N(%)	470(67.0)	83(11.8)	25(3.6)	111(15.8)	113(16.1)
	No N(%)	231 (33.0)	618(88.2)	676(96.4)	590(84.2)	588(83.9)
	Diabetic foot N(%)	701(100.0)	701(100.0)	701(100.0)	701(100.0)	701(100.0)
Missing	Yes N(%)	6(50.0)	0(0.0)	0(0.0)	5(41.7)	1(8.3)
	No N(%)	6(50.0)	12(100.0)	12(100.0)	7(58.3)	11(91.7)
	Diabetic foot N(%)	12(100.0)	12(100.0)	12(100.0)	12(100.0)	12(100.0)

2.1.3 Concomitant co-morbidity

Four concomitant co-morbid conditions were documented among the 71597 subjects audited in the ADCM 2009. These were hypertension only, dyslipidaemia only, combination of hypertension and dyslipidaemia, and hypertension or dyslipidaemia.

Females recorded higher numbers in all 4 concomitant co-morbidities. Many of them had either hypertension or dyslipidaemia (66.8%). More than half of the females (59.4%) had hypertension only. About a third of female subjects (31.3%) had hypertension and dyslipidaemia.

In the younger age group, at least one of the concomitant co-morbid conditions was present. The presence of either hypertension or dyslipidaemia was recorded as early as 18 years of age. For the age group 18 – 19 years, 35% had either hypertension or dyslipidaemia and 5% had both. The older subjects showed higher percentage of concomitant co-morbid conditions. Expectedly, the age group 65 – 69 years showed the highest percentage in all co-morbid conditions except for dyslipidaemia. Dyslipidaemia was the highest among the 60 – 64 years age group (41.6%). Interestingly, as the subjects got older, the percentage of concomitant co-morbid condition started to decline and this was observed in subjects aged 70 and above.

The Chinese showed the highest percentage in all concomitant co-morbid condition with 72.3% having either hypertension or dyslipidaemia. About two-thirds (65.2%) of the Chinese had only hypertension. However among Indians, dyslipidaemia was recorded as the highest percentage (38.4%). For the Malays, 56.9% had hypertension. Overall, the audit showed a significant number of subjects with at least one concomitant co-morbid condition with slightly more than half (57.4%) of the subjects with hypertension.

For subjects with diabetes of more than 5 years duration, 88.3% had at least one concomitant co-morbid condition. The audit also showed 80% of subjects with hypertension and 56% with dyslipidaemia. Surprisingly, subjects with diabetes duration of less than 5 years showed relatively high concomitant co-morbid condition. Among them, 75.4% had either one of the co-morbidity and 65.3% had hypertension. These subjects showed 32.5% with both hypertension and dyslipidaemia. The high percentage of concomitant co-morbid conditions among the subjects of less than 5 years diabetes duration may reflect the severity of the disease.

**Table 2.1.59 Distribution of concomitant co-morbidity for patients with T2DM,
DRM-ADCM, January 1st – December 31st 2009**

Types of co-morbidity	N(%)
Hypertension	40659(57.4)
Dyslipidaemia	26794(37.8)
Hypertension and Dyslipidaemia	21381(30.2)
Hypertension or Dyslipidaemia	46072(65.0)

**Table 2.1.60 Distribution of concomitant co-morbidity for patients with T2DM by gender,
DRM-ADCM, January 1st – December 31st 2009**

Gender	Status	Hypertension	Dyslipidaemia	Hypertension and Dyslipidaemia	Hypertension or Dyslipidaemia
Male	Yes N(%)	15757(54.4)	10522(36.4)	8228(28.4)	18051(62.4)
	No N(%)	7449(25.7)	12684(43.8)	14978(51.8)	5155(17.8)
	Total N(%)	28939(100.0)	28939(100.0)	28939(100.0)	28939(100.0)
Female	Yes N(%)	24837(59.4)	16210(38.7)	13104(31.3)	27943(66.8)
	No N(%)	9646(23.1)	18273(43.7)	21379(51.1)	6540(15.6)
	Total N(%)	41841(100.0)	41841(100.0)	41841(100.0)	41841(100.0)
Missing	Yes N(%)	65(59.6)	62(56.9)	49(45.0)	78(71.6)
	No N(%)	26(23.9)	29(26.6)	42(38.5)	13(11.9)
	Total N(%)	109(100.0)	109(100.0)	109(100.0)	109(100.0)

**Table 2.1.61 Distribution of concomitant co-morbidity for patients with T2DM by age group,
DRM-ADCM, January 1st – December 31st 2009**

Age group (years)	Status	Hypertension	Dyslipidaemia	Hypertension and Dyslipidaemia	Hypertension or Dyslipidaemia
18 – 19	Yes N(%)	8(20.0)	8(20.0)	2(5.0)	14(35.0)
	No N(%)	23(57.5)	23(57.5)	29(72.5)	17(42.5)
	Total N(%)	40(100.0)	40(100.0)	40(100.0)	40(100.0)
20 – 24	Yes N(%)	32(21.6)	34(23.0)	13(8.8)	53(35.8)
	No N(%)	79(53.4)	77(52.0)	98(66.2)	58(39.2)
	Total N(%)	148(100.0)	148(100.0)	148(100.0)	148(100.0)
25 – 29	Yes N(%)	90(21.8)	96(23.2)	33(8.0)	153(37.0)
	No N(%)	231(55.9)	225(54.5)	288(69.7)	168(40.7)
	Total N(%)	413(100.0)	413(100.0)	413(100.0)	413(100.0)
30 – 34	Yes N(%)	265(30.1)	256(29.1)	124(14.1)	397(45.1)
	No N(%)	435(49.4)	444(50.4)	576(65.4)	303(34.4)
	Total N(%)	881(100.0)	881(100.0)	881(100.0)	881(100.0)

Age group (years)	Status	Hypertension	Dyslipidaemia	Hypertension and Dyslipidaemia	Hypertension or Dyslipidaemia
35 – 39	Yes N(%)	620(34.1)	506(27.9)	276(15.2)	850(46.8)
	No N(%)	830(45.7)	944(52.0)	1174(64.6)	600(33.0)
	Total N(%)	1816(100.0)	1816(100.0)	1816(100.0)	1816(100.0)
40 – 44	Yes N(%)	1644(39.4)	1329(31.8)	787(18.9)	2186(52.4)
	No N(%)	1768(42.4)	2083(49.9)	2625(62.9)	1226(29.4)
	Total N(%)	4173(100.0)	4173(100.0)	4173(100.0)	4173(100.0)
45 – 49	Yes N(%)	3570(47.9)	2509(33.7)	1713(23.0)	4366(58.6)
	No N(%)	2581(34.6)	3642(48.9)	4438(59.6)	1785(24.0)
	Total N(%)	7451(100.0)	7451(100.0)	7451(100.0)	7451(100.0)
50 – 54	Yes N(%)	5949(55.2)	4108(38.1)	3132(29.1)	6925(64.3)
	No N(%)	2968(27.6)	4809(44.6)	5785(53.7)	1992(18.5)
	Total N(%)	10773(100.0)	10773(100.0)	10773(100.0)	10773(100.0)
55 – 59	Yes N(%)	7841(59.8)	5317(40.6)	4265(32.5)	8893(67.9)
	No N(%)	3027(23.1)	5551(42.4)	6603(50.4)	1975(15.1)
	Total N(%)	13105(100.0)	13105(100.0)	13105(100.0)	13105(100.0)
60 – 64	Yes N(%)	7467(63.9)	4870(41.6)	4111(35.2)	8226(70.3)
	No N(%)	2252(19.3)	4849(41.5)	5608(48.0)	1493(12.8)
	Total N(%)	11694(100.0)	11694(100.0)	11694(100.0)	11694(100.0)
65 – 69	Yes N(%)	5689(66.6)	3497(40.9)	3086(36.1)	6100(71.4)
	No N(%)	1339(15.7)	3531(41.3)	3942(46.1)	928(10.9)
	Total N(%)	8546(100.0)	8546(100.0)	8546(100.0)	8546(100.0)
70 – 74	Yes N(%)	4159(63.9)	2489(38.2)	2215(34.0)	4433(68.1)
	No N(%)	926(14.2)	2596(39.9)	2870(44.1)	652(10.0)
	Total N(%)	6512(100.0)	6512(100.0)	6512(100.0)	6512(100.0)
75 – 79	Yes N(%)	2063(63.1)	1185(36.2)	1073(32.8)	2175(66.5)
	No N(%)	426(13.0)	1304(39.9)	1416(43.3)	314(9.6)
	Total N(%)	3271(100.0)	3271(100.0)	3271(100.0)	3271(100.0)
≥ 80	Yes N(%)	1262(61.1)	590(28.6)	551(26.7)	1301(63.0)
	No N(%)	236(11.4)	908(43.9)	947(45.8)	197(9.5)
	Total N(%)	2066(100.0)	2066(100.0)	2066(100.0)	2066(100.0)

Table 2.1.62 Distribution of concomitant co-morbidity for patients with T2DM by ethnicity, DRM-ADCM, January 1st – December 31st 2009

Ethnicity	Status	Hypertension	Dyslipidaemia	Hypertension and Dyslipidaemia	Hypertension or Dyslipidaemia
Malay	Yes N(%)	25002(56.9)	15676(35.7)	12618(28.7)	28060(63.9)
	No N(%)	10800(24.6)	20126(45.8)	23184(52.8)	7742(17.6)
	Total N(%)	43902(100.0)	43902(100.0)	43902(100.0)	43902(100.0)
Chinese	Yes N(%)	8764(65.2)	5936(44.1)	4975(37.0)	9725(72.3)
	No N(%)	2534(18.8)	5362(39.9)	6323(47.0)	1573(11.7)
	Total N(%)	13451(100.0)	13451(100.0)	13451(100.0)	13451(100.0)
Indian	Yes N(%)	6453(50.7)	4886(38.4)	3564(28.0)	7775(61.0)
	No N(%)	3568(28.0)	5135(40.3)	6457(50.7)	2246(17.6)
	Total N(%)	12739(100.0)	12739(100.0)	12739(100.0)	12739(100.0)
Other Malaysian	Yes N(%)	327(55.6)	190(32.3)	149(25.3)	368(62.6)
	No N(%)	161(27.4)	298(50.7)	339(57.7)	120(20.4)
	Total N(%)	588(100.0)	588(100.0)	588(100.0)	588(100.0)

Non Malaysian	Yes N(%)	48(54.5)	46(52.3)	28(31.8)	66(75.0)
	No N(%)	33(37.5)	35(39.8)	53(60.2)	15(17.0)
	Total N(%)	88(100.0)	88(100.0)	88(100.0)	88(100.0)
Missing	Yes N(%)	65(53.7)	60(49.6)	47(38.8)	78(64.5)
	No N(%)	25(20.7)	30(24.8)	43(35.5)	12(9.9)
	Total N(%)	121(100.0)	121(100.0)	121(100.0)	121(100.0)

Table 2.1.63 Distribution of concomitant co-morbidity for patients with T2DM by groups of duration of diabetes, DRM-ADCM, January 1st – December 31st 2009

Duration of diabetes (years)	Status	Hypertension	Dyslipidaemia	Hypertension and Dyslipidaemia	Hypertension or Dyslipidaemia
< 5	Yes N(%)	19067(65.3)	12436(42.6)	9498(32.5)	22005(75.4)
	No N(%)	10117(34.7)	16748(57.4)	19686(67.5)	7179(24.6)
	Total N(%)	29184(100.0)	29184(100.0)	29184(100.0)	29184(100.0)
5 – 10	Yes N(%)	14701(73.7)	9550(47.9)	7783(39.0)	16468(82.6)
	No N(%)	5241(26.3)	10392(52.1)	12159(61.0)	3474(17.4)
	Total N(%)	19942(100.0)	19942(100.0)	19942(100.0)	19942(100.0)
> 10	Yes N(%)	6668(80.0)	4668(56.0)	3978(47.7)	7358(88.3)
	No N(%)	1668(20.0)	3668(44.0)	4358(52.3)	978(11.7)
	Total N(%)	8336(100.0)	8336(100.0)	8336(100.0)	8336(100.0)
Missing	Yes N(%)	223(1.7)	140(1.0)	122(0.9)	241(1.8)
	No N(%)	95(0.7)	178(1.3)	196(1.5)	77(0.6)
	Total N(%)	13427(100.0)	13427(100.0)	13427(100.0)	13427(100.0)

CHAPTER THREE
3.0 TREATMENT AND MANAGEMENT

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3.1 Management

Management of type 2 diabetes comprises glycaemic management and management of co-morbidities such as hypertension and dyslipidaemia. Use of antiplatelet agents in individuals with high cardiovascular risk is recommended.

Non-pharmacological therapy of hyperglycaemia comprises lifestyle intervention (diet therapy and physical activity) and pharmacological therapy with oral hypoglycaemic agents and insulin therapy, frequently in combination.

Self blood glucose monitoring (SBMG) is recommended as an important self-care practice that contributes to improved glycaemic management. For patients requiring insulin therapy, SBMG is necessary to guide self adjustment of insulin dose towards achieving individualised glycaemic targets.

3.1.1 Glycaemic management

A total of 70889 patients with diabetes were included in this study and they were almost entirely patients with T2DM (99.0%) with only 685 patients (1.0%) with known T1DM.

Table 3.1.1 Current management method used for patients with T2DM, DRM-ADCM, January 1st-December 31st 2009

No	Current glycaemic control	Yes N(%)
1	Diet	2284(3.2)
2	Oral Hypoglycaemics	54080(76.3)
	• Sulphonylureas	37809(69.9)
	• Alpha glucosidase inhibitor	2611(4.8)
	• Thiazolidinediones	81(0.1)
	• Meglitinides	162(0.3)
	• Biguanidas	45005(83.2)
	• Others	73(0.1)
3	Insulin	7064(10.0)
	• Regular short acting	1114(15.8)
	• Rapid acting	6(0.1)
	• Intermediate acting	3878(54.9)
	• Long acting	42(0.6)
	• Pre - mixed	2548(36.1)
	• Others	12(0.2)

Table 3.1.2 Current management method of glycaemic control used for patients with T2DM, DRM-ADCM, January 1st-December 31st 2009

No	Current glycaemic control	N(%)
1	Diet only	839(1.2)
2	Oral anti-diabetic agent (OAD) only	47373(66.8)
	-Monotherapy (OAD)	18849(39.8)
	-≥2 OAD	27657(58.4)
3	Oral anti-diabetic agent (OAD) & Insulin	5353(7.6)
4	Insulin only	1685(2.4)

Table 3.1.3 Current management method of glycaemic control used for patients with T2DM by age group, DRM-ADCM, January 1st-December 31st 2009

Age group	Diet only N(%)	Oral anti-diabetic agent (OAD) only N(%)	Oral anti-diabetic agent (OAD) & Insulin N(%)	Insulin only N(%)
< 20	0(0.0)	20(50.0)	3(7.5)	6(15.0)
20 - 29	6(1.1)	312(55.6)	50(8.9)	45(8.0)
30 - 39	39(1.4)	1743(64.6)	175(6.5)	85(3.2)
40 -49	142(1.2)	7955(68.4)	839(7.2)	201(1.7)
50 - 59	251(1.1)	16001(67.0)	2131(8.9)	508(2.1)
60 - 69	228(1.1)	13742(67.9)	1569(7.8)	518(2.6)
70 - 79	126(1.3)	6331(64.7)	510(5.2)	271(2.8)
≥ 80	47(2.3)	1269(61.4)	76(3.7)	51(2.5)

Table 3.1.4 Current management method of glycaemic control used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes	Diet only N(%)	Oral anti-diabetic agent (OAD) only N(%)	Oral anti-diabetic agent (OAD) & Insulin N(%)	Insulin only N(%)
< 1 year	161(3.7)	3650(85.0)	120(2.8)	60(1.4)
< 5 years	615(2.1)	25342(86.8)	1228(4.2)	417(1.4)
5 – 10 years	171(0.9)	16227(81.4)	2226(11.2)	572(2.9)
> 10 years	50(0.6)	5562(66.7)	1867(22.4)	687(8.2)
Unknown	3(0.0)	242(1.8)	32(0.2)	9(0.1)

3.1.1.1 Diet therapy

Only a small proportion of patients (1.2%) were managed on diet therapy alone. There were no gender or ethnic differences in the proportion of patients on diet therapy alone. There was generally very low use of diet therapy alone in glycaemic management of patients across the age groups and regardless of the duration of diabetes.

Table 3.1.5 Current management method of diet only used for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Diet only N(%)
Male	325(1.1)
Female	513(1.2)
Missing	1(0.9)

Table 3.1.6 Current management method of diet only used for patients with T2DM by age group, DRM-ADCM, January 1st-December 31st 2009

Age group	Diet only N(%)
< 20	0(0.0)
20 - 29	6(1.1)
30 - 39	39(1.4)
40 -49	142(1.2)
50 - 59	251(1.1)
60 - 69	228(1.1)
70 - 79	126(1.3)
≥ 80	47 (2.3)

Table 3.1.7 Current management method of diet only used for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Diet only N(%)
Malay	509(1.2)
Chinese	221(1.6)
Indian	100(0.8)
Other Malaysian	6(1.0)
Non-Malaysian	2(2.3)
Missing	1(0.8)

Table 3.1.8 Current management method of diet only used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes	Diet only N(%)
< 1 year N(%)	161(3.7)
< 5 years N(%)	615(2.1)
5 – 10 years N(%)	171(0.9)
> 10 years N(%)	50(0.6)
Unknown N(%)	3(0.0)

3.1.1.2 Oral antidiabetic (OAD) therapy

As anticipated for the glycaemic management of patients with type 2 diabetes, 76.3% of the patients in the study were prescribed oral antidiabetic (OAD) therapy.

Biguanides (83.2%) and sulphonylureas (69.9%) were the most frequently prescribed OAD therapy. Alpha-glucosidase inhibitors were prescribed in only 4.8% of patients. Otherwise, there was minimal use (< 1%) of other OADs such as thiazolidinediones and meglitinides. This is likely related to the prescriber category for these drugs being restricted to consultants in hospitals and being unavailable in primary care facilities.

Among those prescribed OADs, 39.8% were on OAD monotherapy, the rest of the patients were on combination OADs with only 7.6% in combination with insulin therapy.

There were no gender or ethnic disparities in the pattern of OAD prescription among the patients in this study. There was also no difference in the pattern of OAD therapy across the age groups and with regards to duration of disease (Table 3.1.10 and Table 3.1.12).

Table 3.1.9 Current management method of oral hypoglycaemics used for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Sulphonylureas N(%)	Alpha glucosidase inhibitor N(%)	Thiazolidinediones N(%)	Meglitinides N(%)	Biguanides N(%)	Other N(%)
<i>Male</i>	21581(74.6)	15486(71.8)	1007(4.7)	37(0.2)	70(0.3)	17702(82.0)
<i>Female</i>	32418(77.5)	22275(68.7)	1603(4.9)	43(0.1)	92(0.3)	27236(84.0)
<i>Missing</i>	81(74.3)	48(59.3)	1(1.2)	1(1.2)	0(0.0)	67(82.7)

Table 3.1.10 Current management method used (OAD) for patients with T2DM by age group, DRM-ADCM, January 1st-December 31st 2009

Age group	Sulphonylureas N(%)	Aplha glucosidase inhibitor N(%)	Thiazolidinediones N(%)	Meglitinides N(%)	Biguanides N(%)	Other N(%)
< 20	12(52.2)	2(8.7)	0(0.0)	0(0.0)	16(69.6)	0(0.0)
20 - 29	218(58.8)	18(4.9)	0(0.0)	2(0.5)	320(86.3)	0(0.0)
30 - 39	1236(62.7)	76(3.9)	3(0.2)	11(0.6)	1712(86.9)	6(0.3)
40 -49	6018(66.8)	384(4.3)	9(0.1)	28(0.3)	7815(86.7)	6(0.1)
50 - 59	13045(70.1)	904(4.9)	29(0.2)	59(0.3)	15871(85.3)	22(0.1)
60 - 69	11217(71.5)	809(5.2)	26(0.2)	50(0.3)	12865(82.0)	11(0.1)
70 - 79	5085(72.4)	349(5.0)	10(0.1)	9(0.1)	5458(77.7)	21(0.3)
≥ 80	978(71.5)	69(5.0)	4(0.3)	3(0.2)	948(69.3)	7(0.5)

Table 3.1.11 Current management method of oral hypoglycaemics used for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Sulphonylureas N(%)	Aplha glucosidase inhibitor N(%)	Thiazolidinediones N(%)	Meglitinides N(%)	Biguanides N(%)	Other N(%)
Malay	33624(76.6)	23182(68.9)	1721(5.1)	39(0.1)	111(0.3)	27992(83.3)
Chinese	10464(77.8)	7438(71.1)	487(4.7)	23(0.2)	23(0.2)	8580(82.0)
Indian	9379(73.6)	6764(72.1)	385(4.1)	18(0.2)	27(0.3)	7925(84.5)
Other Malaysian	464(78.9)	334(72.0)	11(2.4)	0(0.0)	1(0.2)	387(83.4)
Non-Malaysian	73(83.0)	44(60.3)	6(8.2)	0(0.0)	0(0.0)	58(79.5)
Missing	76(62.8)	47(61.8)	1(1.3)	1(1.3)	0(0.0)	63(82.9)

Table 3.1.12 Current management method of oral hypoglycaemics used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes	Oral hypoglycaemics N(%)	Sulphonylureas N(%)	Alpha glucosidase inhibitor N(%)	Thiazolidinediones N(%)	Meglitinides N(%)	Biguanides N(%)	Other N(%)
< 1 year	3918(91.2)	1950(49.8)	134(3.4)	1(0.0)	10(0.3)	3282(83.8)	2(0.1)
< 5 years	27422(94.0)	16950(61.8)	934(3.4)	25(0.1)	98(0.4)	22629(82.5)	25(0.1)
5 – 10 years	18878(94.7)	14807(78.4)	1132(6.0)	24(0.1)	46(0.2)	15804(83.7)	23(0.1)
> 10 years	7486(89.8)	5865(78.3)	533(7.1)	31(0.4)	17(0.2)	6345(84.8)	23(0.3)
Unknown	294(2.2)	187(63.6)	12(4.1)	1(0.3)	1(0.3)	227(77.2)	2(0.7)

3.1.1.3 Insulin therapy

Among the total patients studied, only 10.0% were prescribed insulin therapy alone or in combination with OAD therapy. More than half of these patients were on insulin in combination with OADs.

Intermediate-acting insulin was the most frequently prescribed followed by premixed insulin and short-acting insulin (54.9%, 36.1% and 15.8% respectively). There was hardly any use of insulin analogues, rapid or long-acting, among the patients in this study.

The pattern of insulin prescription reflects the likely pattern of insulin regimen that patients followed– most frequently basal or bedtime insulin therapy with intermediate acting insulin in combination with OADs, followed by premixed insulin regimen and least commonly the more intensive basal-bolus insulin regimen requiring multiple injections of pre-meal short-acting insulin in combination with bedtime basal insulin.

There was no gender or ethnic differences in the pattern of insulin prescription among the patients studied. However, a greater proportion of younger patients (below 30 years) were prescribed premixed insulin. In patients within the 40 - 59 years age group, a greater proportion was prescribed intermediate acting insulin than premixed insulin (Table 3.1.13). There was a higher use of insulin in those with longer duration of diabetes in keeping with the progressive course of disease and the need for insulin therapy with progressive beta cell failure (Table 3.1.14). There was no difference in types of insulin prescribed according to duration of disease (Table 3.1.15).

Table 3.1.13 Current management method used (Insulin) for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Insulin N(%)	Regular short acting N(%)	Rapid acting N(%)	Intermediate acting N(%)	Long acting N(%)	Pre-mixed N(%)	Other N(%)
Male	2718(9.4)	460(16.9)	5(0.2)	1451(53.4)	22(0.8)	984(36.2)	3(0.1)
Female	4314 (10.3)	649(15.0)	1(0.0)	2416(56.0)	20(0.5)	1543(35.8)	9(0.2)
Missing	32(29.4)	5(15.6)	0(0.0)	11(34.4)	0(0.0)	21(65.6)	0(0.0)

Table 3.1.14 Current management method used (Insulin) for patients with T2DM by age group, DRM-ADCM, January 1st-December 31st 2009

Age group	Insulin N(%)	Regular short acting N(%)	Rapid acting N(%)	Intermediate acting N(%)	Long acting N(%)	Pre-mixed N(%)	Other N(%)
< 20	9(22.5)	3(33.3)	0(0.0)	3(33.3)	0(0.0)	6(66.7)	0(0.0)
20 - 29	96(17.1)	24(25.0)	0(0.0)	34(35.4)	0(0.0)	52(54.2)	0(0.0)
30 - 39	263(9.8)	54(20.5)	0(0.0)	140(53.2)	0(0.0)	110(41.8)	0(0.0)
40 -49	1043(9.0)	194(18.6)	1(0.1)	617(59.2)	8(0.8)	337(32.3)	2(0.2)
50 - 59	2648(11.1)	382(14.4)	2(0.1)	1511(57.1)	17(0.6)	902(34.1)	3(0.1)
60 - 69	2094(10.3)	320(15.3)	2(0.1)	1129(53.9)	8(0.4)	767(36.6)	6(0.3)
70 - 79	784(8.0)	121(15.4)	1(0.1)	380(48.5)	5(0.6)	321(40.9)	1(0.1)
≥ 80	127(6.1)	16(12.6)	0(0.0)	64(50.4)	4(3.1)	53(41.7)	0(0.0)

Table 3.1.15 Current management method used (Insulin) for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Insulin N(%)	Regular Short Acting N(%)	Rapid Acting N(%)	Intermediate Acting N(%)	Long Acting N(%)	Pre-Mixed N(%)	Other N(%)
Malay	3965(9.0)	725(18.3)	3(0.1)	2123(53.5)	18(0.5)	1414(35.7)	8(0.2)
Chinese	1491(11.1)	171(11.5)	3(0.2)	809(54.3)	21(1.4)	575(38.6)	2(0.1)
Indian	1502(11.8)	202(13.4)	0(0.0)	899(59.9)	3(0.2)	504(33.6)	2(0.1)
Other Malaysian	57(9.7)	8(14.0)	0(0.0)	28(49.1)	0(0.0)	25(43.9)	0(0.0)
Non-Malaysian	13(14.8)	2(15.4)	0(0.0)	9(69.2)	0(0.0)	4(30.8)	0(0.0)
Missing	36(29.8)	6(16.7)	0(0.0)	10(27.8)	0(0.0)	26(72.2)	0(0.0)

Table 3.1.16 Current management method of insulin used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes	Insulin N(%)	Regular Short Acting, N(%)	Rapid Acting N(%)	Intermediate Acting, N(%)	Long Acting N(%)	Pre-Mixed N(%)	Other N(%)
< 1 year	182(4.2)	49(26.9)	0(0.0)	99(54.4)	1(0.5)	58(31.9)	0(0.0)
< 5 years	1660(5.7)	327(19.7)	0(0.0)	921(55.5)	7(0.4)	552(33.3)	4(0.2)
5 – 10 years	2804(14.1)	396(14.1)	3(0.1)	1636(58.3)	14(0.5)	913(32.6)	4(0.1)
> 10 years	2559(30.7)	387(15.1)	3(0.1)	1302(50.9)	21(0.8)	1065(41.6)	4(0.2)
Unknown	41(0.3)	4(9.8)	0(0.0)	19(46.3)	0(0.0)	18(43.9)	0(0.0)

3.1.2 Management of hypertension

Hypertension commonly co-exists in patients with type 2 diabetes. The prevalence of hypertension in T2DM is reported to be around 40-80%. Hypertension should be detected and treated early in the course of DM to prevent cardiovascular disease (CVD) and to delay the progression of renal disease and diabetic retinopathy. In this study, 65.0% of patients have co-existing hypertension.

Pharmacological treatment should be initiated in patients with diabetes when the BP is persistently >130 mmHg systolic and/or >80 mmHg diastolic. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARB) are recommended as the agents of choice in the treatment of hypertension in patients with diabetes.

Table 3.1.17 Current antihypertensive management for patients with T2DM, DRM-ADCM, January 1st-December 31st 2009

No	Current hypertension control	Yes N(%)
1	Antihypertensive	41286(58.2)
	• ACE inhibitor	26389(63.9)
	• ARB	1515(3.7)
	• Centrally acting	223(0.5)
	• Alpha-blockers	2612(6.3)
	• Calcium channel blocker	15270(37.0)
	• Diuretic	9647(23.4)
	• Beta-blocker	15084(36.5)
	• Others	179(0.4)

Antihypertensive therapy was prescribed in the majority of patients. Two-thirds of the patients (58.2%) were prescribed antihypertensive treatment. The proportion is seen to be slightly lower than the proportion of patients with hypertension (65.0%).

The most commonly prescribed antihypertensive agents were an ACE-inhibitor (63.9%), followed by calcium channel blocker (37.0%), beta blockers (36.5%), and diuretics (23.4%). Notably, there was very little use of ARB (3.7%) which most likely reflects its lack in primary care facilities due to restriction in prescriber category at the time the study was performed.

The high use of ACE inhibitors among the patients in this study is in keeping with current guidelines that strongly recommend it as first-line antihypertensive agents in patients with diabetes.

There were no gender or ethnic differences in the pattern of antihypertensive prescription among the patients with diabetes in this study.

However, it was clearly evident that there was an increasing use of antihypertensive with age (Table 3.1.19). The pattern was similar across the different antihypertensive groups. This finding reflects the higher prevalence of hypertension among older patients with diabetes.

Table 3.1.18 Current management method of antihypertensive used for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Anti hypertensive N(%)	ACE inhibitor N(%)	ARB N(%)	Centrally acting N(%)	Alpha blockers N(%)	Calcium channel blocker N(%)	Diuretic N(%)	Beta blocker N(%)	Other N(%)
Male	16050 (55.5)	10695 (66.6)	606 (3.8)	74 (0.5)	1088 (6.8)	5627 (35.1)	3491 (21.8)	5397 (33.6)	77 (0.5)
Female	25163 (60.1)	15652 (62.2)	897 (3.6)	149 (0.6)	1518 (6.0)	9611 (38.2)	6145 (24.4)	9661 (38.4)	102 (0.4)
Missing	73 (67.0)	42 (57.5)	12 (16.4)	0 (0.0)	6 (8.2)	32 (43.8)	11 (15.1)	26 (35.6)	0 (0.0)

Table 3.1.19 Current antihypertensive management for patients with T2DM by age group, ADCM registry, DRM-ADCM, January 1st-December 31st 2009

Age group (years)	Anti hypertensive N(%)	ACE inhibitor N(%)	ARB N(%)	Centrally acting N(%)	Alpha blockers N(%)	Calcium channel blocker N(%)	Diuretic N(%)	Beta blocker N(%)	Other N(%)
< 20	10 (25.0)	10 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (20.0)	0 (0.0)	0 (0.0)	0 (0.0)
20 - 29	133 (23.7)	95 (71.4)	2 (1.5)	0 (0.0)	6 (4.5)	30 (22.6)	9 (6.8)	24 (18.0)	0 (0.0)
30 - 39	936 (34.7)	681 (72.8)	25 (2.7)	6 (0.6)	26 (2.8)	201 (21.5)	116 (12.4)	213 (22.8)	2 (0.2)
40 -49	5332 (45.9)	3587 (67.3)	146 (2.7)	13 (0.2)	186 (3.5)	1526 (28.6)	936 (17.6)	1722 (32.3)	23 (0.4)
50 - 59	14017 (58.7)	9273 (66.2)	465 (3.3)	57 (0.4)	745 (5.3)	4856 (34.6)	2968 (21.2)	5104 (36.4)	47 (0.3)
60 - 69	13310 (65.8)	8351 (62.7)	516 (3.9)	79 (0.6)	961 (7.2)	5390 (40.5)	3363 (25.3)	5194 (39.0)	73 (0.5)
70 - 79	6276 (64.2)	3734 (59.5)	285 (4.5)	56 (0.9)	568 (9.1)	2691 (42.9)	1840 (29.3)	2387 (38.0)	28 (0.4)
≥ 80	1272 (61.6)	658 (51.7)	76 (6.0)	12 (0.9)	120 (9.4)	574 (45.1)	415 (32.6)	440 (34.6)	6 (0.5)

Table 3.1.20 Current management method of antihypertensive used for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Anti hypertensive N(%)	ACE inhibitor N(%)	ARB N(%)	Centrally acting N(%)	Alpha blockers N(%)	Calcium channel blocker N(%)	Diuretic N(%)	Beta blocker N(%)	Other N(%)
Malay	25371 (57.8)	16429 (64.8)	788 (3.1)	116 (0.5)	1386 (5.5)	9149 (36.1)	5846 (23.0)	8990 (35.4)	108 (0.4)
Chinese	8871 (66.0)	5331 (60.1)	474 (5.3)	68 (0.8)	778 (8.8)	3643 (41.1)	2161 (24.4)	3666 (41.3)	44 (0.5)
Indian	6586 (51.7)	4355 (66.1)	223 (3.4)	37 (0.6)	420 (6.4)	2304 (35.0)	1557 (23.6)	2266 (34.4)	23 (0.3)
Other Malaysian	335 (57.0)	203 (60.6)	9 (2.7)	2 (0.6)	21 (6.3)	118 (35.2)	68 (20.3)	124 (37.0)	4 (1.2)
Non-Malaysian	49 (55.7)	25 (51.0)	9 (18.4)	0 (0.0)	1 (2.0)	21 (42.9)	4 (8.2)	13 (26.5)	0 (0.0)
Missing	74 (61.2)	46 (62.2)	12 (16.2)	0 (0.0)	6 (8.1)	35 (47.3)	11 (14.9)	25 (33.8)	0 (0.0)

**Table 3.1.21 Current management method of antihypertensive used for patients with T2DM
by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009**

Duration of diabetes (years)	Anti hypertensive N(%)	ACE inhibitor N(%)	ARB N(%)	Centrally acting N(%)	Alpha blockers N(%)	Calcium channel blocker N(%)	Diuretic N(%)	Beta blocker N(%)	Other N(%)
< 1	2497 (58.1)	1410 (56.5)	82 (3.3)	11 (0.4)	89 (3.6)	871 (34.9)	633 (25.4)	851 (34.1)	16 (0.6)
< 5	19365 (66.4)	11870 (61.3)	567 (2.9)	82 (0.4)	910 (4.7)	6797 (35.1)	4678 (24.2)	7055 (36.4)	83 (0.4)
5 – 10	14927 (74.9)	9985 (66.9)	521 (3.5)	89 (0.6)	999 (6.7)	5540 (37.1)	3281 (22.0)	5513 (36.9)	57 (0.4)
> 10	6775 (81.3)	4400 (64.9)	422 (6.2)	51 (0.8)	695 (10.3)	2851 (42.1)	1629 (24.0)	2441 (36.0)	39 (0.6)
Unknown	219 (1.6)	134 (61.2)	5 (2.3)	1 (0.5)	8 (3.7)	82 (37.4)	59 (26.9)	75 (34.2)	0 (0.0)

**Table 3.1.22 Current management method of antihypertensive used for patients with T2DM
by gender, DRM-ADCM, January 1st-December 31st 2009**

Gender	Anti-hypertensive N(%)	1 Antihypertensive N(%)	2 Antihypertensive N(%)	3 Antihypertensive N(%)	>3 Antihypertensive N(%)
Male	16050	7793(48.6)	5203(32.4)	2247(14.0)	518(3.2)
Female	25163	11368(45.2)	8525(33.9)	3833(15.2)	935(3.7)
Missing	73	38(52.1)	19(26.0)	12(16.4)	4(5.5)

**Table 3.1.23 Current management method of antihypertensive used for patients with T2DM
by age group, DRM-ADCM, January 1st-December 31st 2009**

Age group (years)	Antihypertensive N(%)	1 Antihypertensive N(%)	2 Antihypertensive N(%)	3 Antihypertensive N(%)	>3 Antihypertensive N(%)
< 20	10	8 (80.0)	2 (20.0)	0 (0.0)	0 (0.0)
20 - 29	133	101 (75.9)	25 (18.8)	2 (1.5)	2 (1.5)
30 - 39	936	627 (67.0)	222 (23.7)	49 (5.2)	13 (1.4)
40 -49	5332	3025 (56.7)	1551 (29.1)	535 (10.0)	100 (1.9)
50 - 59	14017	6788 (48.4)	4630 (33.0)	1934 (13.8)	408 (2.9)
60 - 69	13310	5658 (42.5)	4585 (34.4)	2246 (16.9)	575 (4.3)
70 - 79	6276	2467 (39.3)	2288 (36.5)	1097 (17.5)	309 (4.9)
≥ 80	1272	525 (41.3)	444 (34.9)	229 (18.0)	50 (3.9)
< 20	10	8 (80.0)	2 (20.0)	0 (0.0)	0 (0.0)

Table 3.1.24 Current management method of antihypertensive used for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Antihypertensive N(%)	1 Antihypertensive N(%)	2 Antihypertensive N(%)	3 Antihypertensive N(%)	>3 Antihypertensive N(%)
Malay	25371	12153 (47.9)	8350 (32.9)	3504 (13.8)	844 (3.3)
Chinese	8871	3658 (41.2)	3126 (35.2)	1582 (17.8)	369 (4.2)
Indian	6586	3150 (47.8)	2132 (32.4)	946 (14.4)	229 (3.5)
Other					
Malaysian	335	171 (51.0)	106 (31.6)	42 (12.5)	10 (3.0)
Non-Malaysian	49	31 (63.3)	13 (26.5)	4 (8.2)	1 (2.0)
Missing	74	36 (48.6)	20 (27.0)	14 (18.9)	4 (5.4)

Table 3.1.25 Current management method of antihypertensive used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes (years)	Antihypertensive N(%)	1 Antihypertensive N(%)	2 Antihypertensive N(%)	3 Antihypertensive N(%)	>3 Antihypertensive N(%)
< 1	2497	1313(52.6)	807(32.3)	283(11.3)	46(1.8)
< 5	19365	9477(48.9)	6375(32.9)	2549(13.2)	534(2.8)
5 – 10	14927	6842(45.8)	4995(33.5)	2282(15.3)	564(3.8)
> 10	6775	2788(41.2)	2294(33.9)	1237(18.3)	351(5.2)
Unknown	219	92(42.0)	83(37.9)	24(11.0)	8(3.7)

The majority of patients on antihypertensives received monotherapy (46.5%) and a lesser proportion were on dual antihypertensive therapy (33.3%) (Table 3.1.22). The low use of combination antihypertensive therapy in these patients will likely explain the poor control of hypertension as only 38.2% of patients were found to have achieved BP target of $\leq 130 / 80$ mmHg as recommended by current guidelines for patients with type 2 diabetes.

3.1.3 Management of dyslipidaemia

Diabetes mellitus is a coronary heart disease equivalent. Current clinical guidelines recommend that all patients without overt CVD over the age of 40 years should be treated with a statin

regardless of baseline LDL cholesterol levels. All patients with diabetes and overt CVD should be treated with a statin to achieve recommended targets.

In this study, 37.8% of the patients had known dyslipidaemia. However, a slightly higher proportion (41.6%) received lipid lowering therapy, primarily a statin. Among the patients in this study, only 30.4% attained LDLC target of < 2.6 mmol/L as recommended in current guidelines for patients with diabetes without prior cardiovascular event.

It is evident that the use of lipid lowering agents among adult diabetic patients in this study is low despite the majority of patients having lipid targets beyond recommended range.

Table 3.1.26 Current lipid lowering management for patients with T2DM, DRM-ADCM, January 1st-December 31st 2009

Current lipid control	Yes N(%)
Lipid lowering agent	29489(41.6)
• Statin	26483(89.8)
• Fibrate	2709(9.2)
• Others	32(0.1)

Approximately 30-40% of patients above 30 years were prescribed a lipid lowering medication (Table 3.1.28). There were no genders or ethnic differences in the use of lipid lowering agents.

Table 3.1.27 Current management method of lipid lowering agent used for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Lipid lowering agent N(%)	Statin N(%)	Fibrate N(%)	Other N(%)
Male	11465(39.6)	10114(88.2)	1289(11.2)	17(0.1)
Female	17954(42.9)	16302(90.8)	1416(7.9)	15(0.1)
Missing	70(64.2)	67(95.7)	4(5.7)	0(0.0)

Table 3.1.28 Current lipid lowering management for patients with T2DM by age group, DRM-ADCM, January 1st-December 31st 2009

Age group (years)	Lipid lowering agent N(%)	Statin N(%)	Fibrate N(%)	Other N(%)
< 20	8 (20.0)	8 (100.0)	0 (0.0)	0 (0.0)

Age group (years)	Lipid lowering agent N(%)	Statin N(%)	Fibrate N(%)	Other N(%)
20 - 29	143 (25.5)	125 (87.4)	15 (10.5)	2 (1.4)
30 - 39	799 (29.6)	666 (83.4)	117 (14.6)	0 (0.0)
40 -49	4282 (36.8)	3761 (87.8)	474 (11.1)	5 (0.1)
50 - 59	10450 (43.8)	9382 (89.8)	992 (9.5)	8 (0.1)
60 - 69	9211 (45.5)	8342 (90.6)	771 (8.4)	12 (0.1)
70 - 79	3965 (40.5)	3619 (91.3)	294 (7.4)	4 (0.1)
≥ 80	631 (30.5)	580 (91.9)	46 (7.3)	1 (0.2)

Table 3.1.29 Current management method of lipid lowering agent used for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Lipid lowering agent N(%)	Statin N(%)	Fibrate N(%)	Other N(%)
Malay	17736 (40.4)	16052 (90.5)	1436 (8.1)	16 (0.1)
Chinese	6243 (46.4)	5545 (88.8)	713 (11.4)	7 (0.1)
Indian	5160 (40.5)	4566 (88.5)	531 (10.3)	8 (0.2)
Other Malaysian	231 (39.3)	209 (90.5)	22 (9.5)	1 (0.4)
Non-Malaysian	48 (54.5)	43 (89.6)	3 (6.3)	0 (0.0)
Missing	71 (58.7)	68 (95.8)	4 (5.6)	0 (0.0)

Table 3.1.30 Current management method of lipid lowering agent used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes (years)	Lipid lowering agent N(%)	Statin N(%)	Fibrate N(%)	Other N(%)
< 1	1693(39.4)	1556(91.9)	104(6.1)	4(0.2)
< 5	13826(47.4)	12486(90.3)	1135(8.2)	15(0.1)
5 – 10	10524(52.8)	9404(89.4)	1055(10.0)	8(0.1)
> 10	4983(59.8)	4457(89.4)	502(10.1)	9(0.2)
Unknown	156(1.2)	136(87.2)	17(10.9)	0(0.0)

3.1.4 Use of antiplatelet therapy

Cardiovascular disease is the major cause of morbidity and mortality in people with diabetes. There is strong evidence that aspirin is effective for secondary prevention of cardiovascular events. The decision to start patients on low dose aspirin as a primary prevention of CVD should be individualised and is currently recommended for asymptomatic people with diabetes who have a high risk of developing CVD.

Table 3.1.31 Current antiplatelet therapy in patients with T2DM, DRM-ADCM, January 1st-December 31st 2009

Current antiplatelet therapy	Yes N(%)
Antiplatelet	17900(25.3)
• Acetyl salicylate acid	16626(92.9)
• Ticlopidine	609(3.4)
• Clopidogrel	118(0.7)
• Others	247(1.4)

One-third of patients in this study were prescribed antiplatelet therapy, primarily aspirin. Aspirin was more frequently prescribed in those 40 years and above. This pattern correlates with the increased risk of CVD with age as well as the likelihood of prior cardiovascular events.

There were no gender or ethnic differences observed in the pattern of aspirin use among patients in this study.

Table 3.1.32 Current management method of antiplatelet used for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Antiplatelet N(%)	Acetyl salicylate acid N(%)	Ticlopidine N(%)	Clopidogrel N(%)	Other N(%)
Male	7797(26.9)	7244(92.9)	266(3.4)	63(0.8)	101(1.3)
Female	10046(24.0)	9330(92.9)	339(3.4)	55(0.5)	146(1.5)
Missing	57(52.3)	52(91.2)	4(7.0)	0(0.0)	0(0.0)

Table 3.1.33 Current antiplatelet therapy according to age group in patients with T2DM, DRM-ADCM, January 1st-December 31st 2009

Age group (years)	Antiplatelet N(%)	Acetyl salicylate acid N(%)	Ticlopidine N(%)	Clopidogrel N(%)	Other N(%)
< 20	2 (5.0)	2 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)
20 - 29	47 (8.4)	46 (97.9)	0 (0.0)	0 (0.0)	0 (0.0)
30 - 39	330 (12.2)	314 (95.2)	7 (2.1)	1 (0.3)	1 (0.3)
40 -49	2161 (18.6)	2034 (94.1)	37 (1.7)	7 (0.3)	28 (1.3)
50 - 59	5956 (24.9)	5590 (93.9)	159 (2.7)	17 (0.3)	73 (1.2)
60 - 69	5930 (29.3)	5512 (93.0)	215 (3.6)	32 (0.5)	85 (1.4)
70 - 79	2931 (30.0)	2661 (90.8)	149 (5.1)	41 (1.4)	50 (1.7)
≥ 80	543 (26.3)	467 (86.0)	42 (7.7)	20 (3.7)	10 (1.8)

Table 3.1.34 Current management method of antiplatelet used for patients with T2DM by ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Antiplatelet N(%)	Acetyl salicylate acid N(%)	Ticlopidine N(%)	Clopidogrel N(%)	Other N(%)
Malay	10121 (23.1)	9489 (93.8)	283 (2.8)	15(0.1)	116(1.1)
Chinese	4074 (30.3)	3716 (91.2)	184 (4.5)	81(2.0)	76(1.9)
Indian	3454 (27.1)	3190 (92.4)	131 (3.8)	20(0.6)	51(1.5)
Other Malaysian	169 (28.7)	156 (92.3)	6 (3.6)	1(0.6)	4(2.4)
Non-Malaysian	23 (26.1)	21 (91.3)	1 (4.3)	1 (4.3)	0(0.0)
Missing	59 (48.8)	54 (91.5)	4 (6.8)	0 (0.0)	0(0.0)

Table 3.1.35 Current management method of antiplatelet used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes (years)	Anti-platelet N(%)	Acetyl salicylate acid N(%)	Ticlopidine N(%)	Clopidogrel N(%)	Other N(%)
< 1	813(18.9)	756(93.0)	25(3.1)	3(0.4)	8(1.0)
< 5	7230(24.8)	6713(92.8)	206(2.8)	27(0.4)	123(1.7)
5 – 10	7009(35.1)	6589(94.0)	207(3.0)	31(0.4)	80(1.1)
> 10	3562(42.7)	3236(90.8)	192(5.4)	59(1.7)	44(1.2)
Unknown	99(0.7)	88(88.9)	4(4.0)	1(1.0)	0(0.0)

3.1.5 Self blood glucose monitoring

Self blood glucose monitoring (SBGM) is the method of choice for monitoring day to day glycaemic control. Self blood glucose monitoring should be carried out for patients on insulin and is desirable for those on OAD agents. Frequency of blood glucose testing depends on the glucose status, glucose goals and mode of treatment.

Although SBGM has not been shown to have a significant impact on outcome measures such as HbA1c and body weight, it is recommended as part of a wider educational strategy to promote self-care.

The number of patients (2427 patients) performing SBGM was very low with only one in 20 patients (3.4%) There were no differences in SMBG monitoring with regards to gender, ethnicity, age group or duration of disease.

Table 3.1.36 Current management method of self-monitoring glucose used for patients with T2DM by gender, DRM-ADCM, January 1st-December 31st 2009

Gender	Current management (self-monitoring glucose) N(%)
Male	1028(3.6)
Female	1382(4.8)
Missing	17(0.1)

Table 3.1.37 Current management method used (self-monitoring glucose) for patients with T2DM by age group, DRM-ADCM, January 1st-December 31st 2009

Age group (years)	Current management (self-monitoring glucose) N(%)
< 20	0(0.0)
20 - 29	25(4.5)
30 - 39	93(3.4)
40 -49	336(2.9)
50 - 59	843(3.5)
60 - 69	726(3.6)
70 - 79	331(3.4)
≥ 80	73(3.5)

Table 3.1.38 Current management method used (self-monitoring glucose) for patients with T2DM by age ethnicity, DRM-ADCM, January 1st-December 31st 2009

Ethnicity	Current management (self-monitoring glucose) N(%)
Malay	1170(2.7)
Chinese	730(1.7)
Indian	479(1.1)
Other Malaysian	20(0.0)
Non-Malaysian	10(0.0)
Missing	18(0.0)

Table 3.1.39 Current management method of self-monitoring glucose used for patients with T2DM by duration of diabetes, DRM-ADCM, January 1st-December 31st 2009

Duration of diabetes (years)	Current management (self-monitoring glucose) N(%)
< 1	108(0.6)
< 5	879(4.6)
5 – 10	865(4.5)
> 10	674(3.5)
Unknown	9(0.0)

RECOMMENDATION

This second ADCM report managed to capture notification of patients over a full period of 12 months in 2009. However it is only limited to data from 9 states with 70889 patients notified. Many health clinics and hospitals in Malaysia have not participated in the registry. Even then the notifications of patients were not 100% yet and thus we suspect under reporting to be a major problem. Therefore all physicians who manage diabetes in Malaysia must be encouraged to start reporting their cases to DRM-ADCM. Subsequently, it can be extended to include doctors in the private sectors and armed forces to ensure more cases are registered nationwide.

More promotional activities and training has to be conducted to attract more healthcare facilities to be Source Data Providers. The case report form (CRF) is almost similar with the variables collected for audit purposes i.e. Quality Assurance Program (QAP) Management of Diabetes of Non-Communicable Disease Division, Ministry of Health. Therefore Source Data Providers (SDPs) can achieve both Diabetes Registry and the QAP for diabetes management. The CRF has been revised to simplify the data collection process. Dedicated doctors and paramedics must be identified to co-ordinate the reporting to ensure accurate and complete information.

Having a website, regular newsletter and communication via email should serve as means of updating SDPs with the progress of the registry. A standard real-time report can be generated so that SDPs can update their progress in a defined duration of time. Technical committee meetings should be held regularly to identify problems and suggest solution or new strategies.

We hope that the efficient data collection and reporting to ADCM will continue. This will enable us to have a better perspective of the status of diabetes patients in Malaysia and to recommend better strategies and planning to related stakeholders.

APPENDIX 1

DATA MANAGEMENT

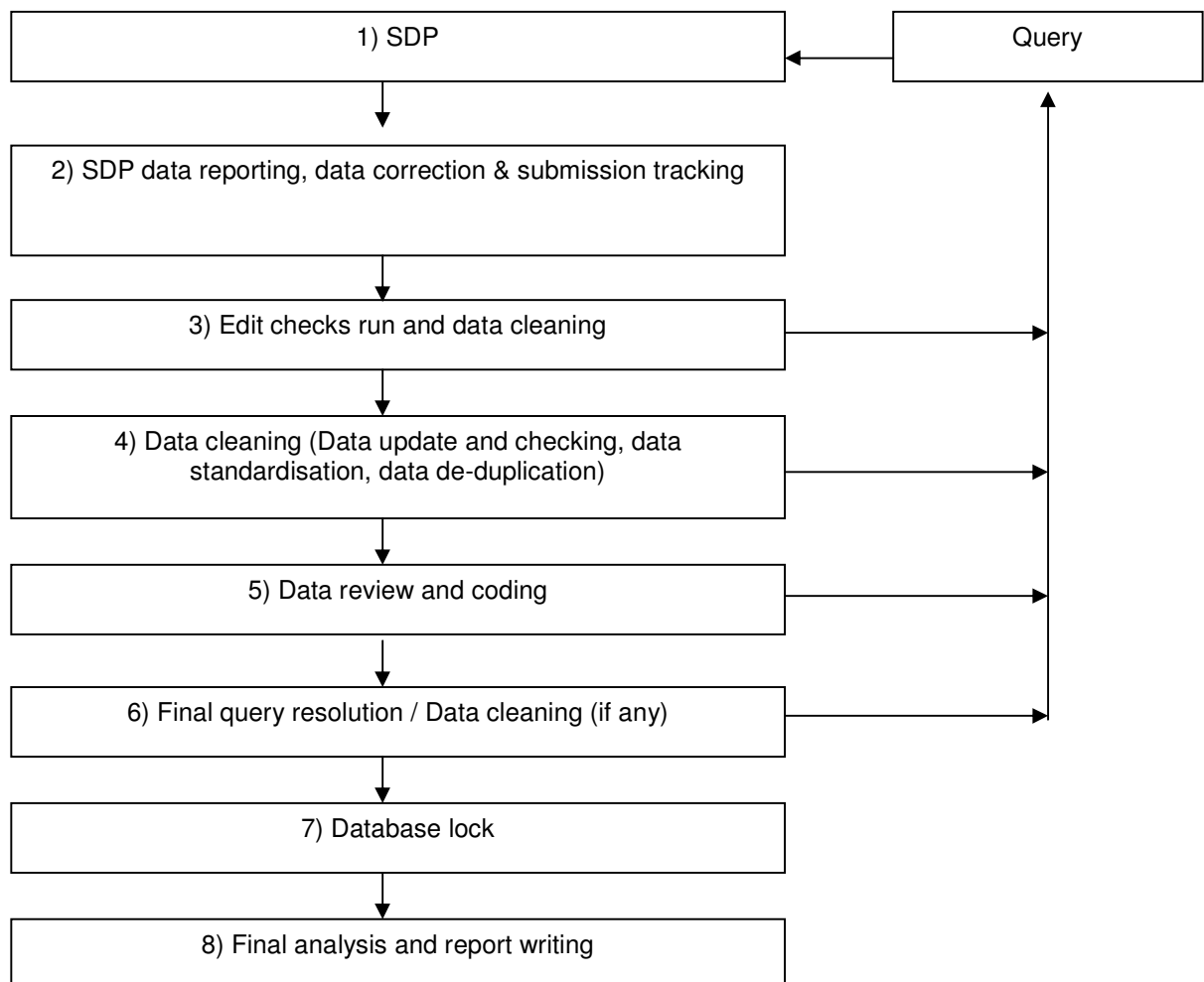
The An Audit of Diabetes Control and Management (ADCM) maintain a database that includes data from notification form and annual census form. Data is stored in SQL Server due to the high volume of data accumulated throughout the years.

Data sources

Source Data Providers (SDPs) of ADCM comprise health clinics and hospitals throughout Malaysia.

Data flow process

This section describes the data management flow process of the An Audit of Diabetes Control and Management (ADCM).



SDP data reporting, data correction and submission tracking

Data reporting by SDP is done via Web Applications e-Case Report Forms.

There are a number of data security features that are designed into ADCM web application (eCRF) such as web owner authentication, two-level user authentication (user name and password authentication, access control, data encryption, session management to automatically log off the application, audit trail and data backup, and disaster recovery plan.)

The SDP submits ADCM Notification form on an ad hoc basis whenever there is a case. The SDP also submits annual census data. An alert page containing all overdue submissions for audit is available to users to ease submissions tracking.

Prior to registering a patient record, a verification process is done by using the search function to find if a patient exists in the entire registry. The application will also be able to detect a duplicate record if the same IC number is keyed in should the step of searching patient is left out. This step is done to avoid duplicate records. For patients whose records already exist in the database, SDP only needs to add a new notification with basic patient particulars auto filled based on existing patient information in the database.

There are a few in-built functionalities at the data entry page that serve to improve data quality. One such function is auto calculation to reduce error in human calculation. There is also an inconsistency check function that disables certain fields if these fields are answered in a certain manner. When value entered is out of range, user is prompted for the correct value.

A real time data query page is also available via the web application to enable user to check which non-compulsory data is missing, out of range or inconsistent. A link is provided on the data query page for users to click on to resolve the query for the particular patient.

Real time reports are also available in the web application. The aggregated data reports are presented in the form of tables and graphs. The reports are typically presented in two manners; one as centre's own data aggregated data report and second as registry's overall aggregated data report. This way, the centre is able to compare itself against the overall registry's average.

Data download function is also available in the web application to allow users to download their own centre's data for all the forms entered for their own further analysis. The data are downloadable as Text - tab delimited (.txt) format, Microsoft excel workbook (.xls) and Comma separated value (.csv) format.

Edit checks run and data cleaning

Edit checks were performed periodically by the registry manager to identify missing compulsory data, out of range values, inconsistency data, invalid values and error with de-duplication. Data cleaning is then performed based on the results of edit checks. Data update and data checking of the dataset is performed when there is a query of certain fields when necessary. It could be due to request by user, correction of data based on checking from data query in eCRF or after receiving results for preliminary data analysis. During data standardisation, missing data are handled based on derivation from existing data. Data de-duplication is also performed to identify duplicate records in the database that might have been missed by the SDP.

Method for handling missing data and outliers

Fields	Data range
HEIGHT (cm)	50.0-200.0
WEIGHT (kg)	25.0-200.0
WC	40.0-150.0
BMI	> 14.0
BP	50.0-300.0
RBG	1.0-40.0
FBG	1.0-40.0
2HrPP	1.0-40.0
HBA1c	3.0-25.0
TC	1.0-20.0
TG	0.1-15.0
HDL	0.5-6.0
LDL	0.5-10.0
SERUM CREATINIE	30.0-2000.0
Glomerular filtration rate (GFR)	0-150.0

Data review and coding

Data coding of free text description was done by the data manager. The expert panel comprising members with expertise and knowledge in the relevant area serves as Quality Control to assess the coding by data manager. They ensure that complex medical data are reviewed and assessed to detect clinical nuances in the data.

Final query resolution / data cleaning / database lock

A final edit check run was performed to ensure that data is clean. All queries were resolved before database is locked to ensure data quality and integrity. Final dataset is subsequently locked and exported to the statistician for analysis.

Data analysis

Please refer to the Statistical Analysis Method section for further details.

Data release policy

One of the primary objectives of the Registry is to make data available to the Family Medicine Specialists, policy makers and researchers. The Registry would appreciate that users acknowledge the Registry for the use of the data. Any request for raw data or data that requires a computer run must be made in writing (by e-mail, fax, or registered mail) accompanied with a signed Data Release Application Form to the Patient Registry Unit, National Clinical Research Centre. These requests will need prior approval from the Advisory Board before data can be released.

Registry ICT infrastructure and data centre

The operations of the ADCM are supported by an extensive ICT infrastructure to ensure operational efficiency and effectiveness.

The ADCM subscribes to co-location service with a high availability and highly secured Internet Data Centre at Cyberjaya in order to provide ADCM with quality assured Internet Hosting services and state-of-the-art physical and logical security features without having to invest in costly data centre setup internally. Physical security features implemented are of state of the art technology and include anti-static raised flooring, fire protection with smoke and heat alarm warning system, biometric security access, video camera surveillance system, uninterrupted power supply, environmental control, etc.

Other managed security services include patch management of the servers, antivirus signature monitoring and update, firewall traffic monitoring and intrusion detection, security incidence response, data backup service done on a daily, weekly and monthly basis, data recovery simulation to verify that backup works which is done at least once yearly, network security scan and penetration test on a half-yearly basis, security policy maintenance, maintenance and monitoring of audit trail of user access, etc. Managed system services such as usage and performance report, operating system maintenance and monitoring, bandwidth monitoring and systems health monitoring are also provided.

APPENDIX 3

ANALYSIS SETS, STATISTICAL METHODS AND DEFINITIONS

ANALYSIS SETS

This refers to the sets of cases which data were included in the analysis.

1. Patients notification in 1st January – 31st December 2009

There were 71597 patients in this dataset. This analysis set was used for the analysis in chapters 1, 2 and 3 which include data such as patient's particulars, duration and type of diabetes, clinical examination details, complications and diabetes management.

STATISTICAL METHOD

Descriptive analysis was done in presenting frequencies and percentages of distribution. For continuous data, the mean, standard deviation, median, minimum, maximum, median and inter quartile range were reported. For standardisation in output table, the value of percentages and summary descriptive were limited to one decimal point only. The summaries of data presentation by chapter were described as below:

Chapter 1: Patient's socio-demographic particulars

Chapter 1 explains the registry for patient's socio-demographic particulars such as gender, ethnicity, age group, types of diabetes mellitus and duration of diabetes.

Chapter 2: Clinical presentation upon complications

Chapter 2 presents the clinical information, complications and concomitant co-morbidity. The tables were displayed based on gender, age group, ethnicity and groups of duration of diabetes. The glomerular filtration rate (GFR) in this study was derived from the Cockcroft-Gault formula. Cockcroft-Gault formula:

Male : $1.23 \times (140 - \text{Age}) \times \text{weight} / \text{creatinine at presentation}$

Female : $1.04 \times (140 - \text{Age}) \times \text{weight} / \text{creatinine at presentation}$

Chapter 3: Treatment and management

Chapter 3 explains the details of diabetes mellitus management such as glycaemic management, diet therapy, oral antidiabetic therapy, insulin therapy, hypertension management, dyslipidaemia management, use of antiplatelet therapy and self blood glucose monitoring.

STATISTICAL SOFTWARE

Stata version 9.2 and SPSS 14.0

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MALAYSIAN ENDOCRINE AND METABOLIC SOCIETY