Original Article

Clinical Profile and Types of Youth-Onset Diabetes in Chennai: The Indian Council of Medical Research Registry of Youth-Onset Diabetes in India – Chennai Centres

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Abstract

Background: The first national-level multicentric clinic-based registry of youth-onset diabetes from India was started in the year 2006 by the Indian Council of Medical Research (ICMR). **Objective:** In this study, we present the data collected from one of the Regional Collaborating Centre, Chennai (RCC03) of the ICMR Young Diabetes Registry (YDR). **Materials and Methods:** YDR recruited young diabetes participants reporting on/after January 1, 2000, with age onset ≤25 years at the time of diagnosis of diabetes, and residing within the Chennai Metropolitan Area. The reporting centers (RCs) that were willing to participate in the registry were included, and their staff was trained to fill-in the baseline and follow-up proforma. **Results:** Overall, 29 RCs participated, which includes six government hospitals, and remaining are private speciality hospitals or single-physician clinics. So far, RCC03 had contributed 4194 young diabetes participants to ICMR-YDR from the Chennai region. Among the registered 48.1% (n = 2020) were type 1 diabetes mellitus (T1DM), 43.4% (n = 1821) were type 2 diabetes mellitus (T2DM), 6.4% (n = 269) were gestational diabetes mellitus, and remaining 2.0% (n = 84) had secondary diabetes. Among T1DM, 58% of them had age onset of <15 years, whereas in T2DM, 95% of them had age onset ≥15 years. Differences in their clinical profiles were seen among these participants. All T1DMs were on insulin treatment at the time of registration or they had been prescribed insulin at their first visit to the RCs, and 12% of the T2DMs were on insulin. **Conclusions:** The observations from RCC03 of the registry reveal that 48.1% were T1DM and 43.4% were T2DM. These results suggest that there is equal contribution of T1DM and T2DM cases in the Chennai region, which needs to be studied in detail.

Keywords: Chennai, ICMR, registry, type 1 diabetes, type 2 diabetes, young diabetes

Introduction

Disease registries are a collection of secondary data related to patients, about their specific condition and diagnosis, and they play an essential role in surveillance studies. India has a history of successful registries like the Indian Council of Medical Research (ICMR) Cancer Registry, the ICMR Young Diabetes Registry (YDR), the Chronic Kidney Disease Registry, and the Hemophilia Registry. These registries help us to understand the demographic

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and socioeconomic details, clinical characteristics, biochemical profile, associated complications, and treatment in the abovesaid conditions. The registries also help clinicians and policymakers to make targeted decisions during the management of disease conditions in an Indian setup.

The first national-level multicentric clinic-based registry of youth-onset diabetes from India was started in the year 2006 by ICMR. The YDR objectives and the organizational structure have been detailed in an earlier publication.[1] Currently, ICMR-YDR has 11 regional collaborating centers (RCCs; including phases I and II) coordinating with data collection from its own geographically based reporting centers (RCs), which in turn transfer data to the Technical Coordinating Unit. A recent publication also provides the results from phase I baseline data collected so far in the whole registry.[2]

In this article, we present the data collected from one of the Regional Collaborating Centre, Chennai (RCC03). The paper aims to present the variations in young-onset diabetes data collected at the Chennai RCs.

Materials and Methods

A detailed methodology of the YDR registry is published elsewhere.[1] A uniform registry protocol, training manuals, and proformas were developed and adopted across all RCs. The YDR registry recruited all individuals with diabetes reporting on/after January 1, 2000, with age ≤25 years at the time of diagnosis of diabetes (defined as fasting plasma glucose ≥126 mg/dL or 2-h post-load plasma glucose ≥200 mg/dL) and residing within the assigned geographical area. The classification into various diabetes categories was done based on the assessment of the principal investigator of the study/physician/diabetologist/pediatrician at the RC using symptom-based clinical criteria agreed on by the registry expert group before initiation of data collection in 2006.[1] The definition of different forms of diabetes used in the registry is given as Table S1. Phase I of the YDR was a pilot study to evolve, validate, and standardize the data collection at two to three centers, and phase II formed the main registry at extended centers.

We contacted all the clinics in the government and private hospitals and clinics in Chennai for their willingness to join the ICMR-YDR. The criteria to join the registry is that they should see young diabetes participants in their clinic as per the ICMR criteria. Once they agreed, the RCs have to give a consent letter to participate and share their data with ICMR. We trained the staff from RCs (who have agreed to join the registry) to fill the proforma.

At the Chennai site, the registry started in 2006, gradually with three to five private diabetes centers from Chennai. Over the years, the number of RCs have grown, and we have now 29 centers currently participating in the registry. From the year 2010, major government hospitals and their affiliated peripheral hospitals started registering young diabetes participants into the registry.

Data collection

Information from participants was obtained using a baseline proforma at the time of registration in the RCs.[1] Data from the period 2000 to 2006 were collected retrospectively in a structured format from medical records, and prospective data were collected from the year 2007 to date. We captured the follow-up data of individuals registered in YDR annually using an annual follow-up proforma.[1]

The staff in each RC manually filled the proforma from their electronic records or medical records. One of our team members will go to each RC and collect the filled proforma after checking the provided information. Data verification was done and entered into the ICMR software. Baseline data entries were completed in August 2019 and follow-up data entries in December 2019. Data were downloaded from the software for the study analysis (January 2020). Storage of hard copies of all proformas was done at RCC03. Duplication of data was prevented by using exact and adequate patient identifier characteristics (a combination of full name, age, gender, and postal code). The ethics committee approvals were obtained from all RCCs but not mandatory for the RCs, and it has been detailed elsewhere.[1] Informed consent was obtained from all the participants.

Statistical analysis

Descriptive statistics are given as mean with standard deviation and frequencies as percentages. One-way analysis of variance was used to compare continuous variables, while the chi-square test was used to compare proportions between the groups. We used paired t-tests to compare the means and chi-square or Fisher's exact tests to assess differences in proportions as appropriate. Data have been combined in groups as type 1 diabetes mellitus (T1DM) and Latent Autoimmune Diabetes in Adults (LADA) as one group, type 2 diabetes mellitus (T2DM) and clinical Maturity Onset Diabetes in Young (MODY), gestational diabetes mellitus (GDM), and other diabetes types like drug-induced diabetes, fibrocalculous pancreatic diabetes, and other genetic syndromes were put together to form a category named "Secondary diabetes."

Results

From the Chennai metropolitan area, we contacted 53 possible RCs, and 29 responded to participate in the registry. Currently, these 29 RCs are giving baseline data to ICMR. Figure 1 shows the geographic regions in Chennai for the registry. Each center had been provided with a

separate code (RC code number). There are six government hospitals, and the remaining are private speciality hospitals and single-physician clinics from Chennai.

Table 1 lists the name of the principal investigators, name of the RCs, area of the center, and the number of participants provided by each center in phases I and II of the YDR registry. Overall, from phases I and II, RCC03 has contributed 4194 young diabetes participants to the ICMR-YDR. Out of 4194 participants, 586 (14%) participants were provided by the government hospitals, the primary source was from the Institute of Child Health and Hospital for Children. Among the private hospitals, the Dr. Mohan's Diabetes Specialities Centre contributed the highest number, with 2306 (55%) participants followed by other private diabetes hospitals.

Table 2 shows the distribution of diabetes classification of young diabetes at RCC03. Among the participants registered (n = 2020), 48.1% were T1DM or LADA, (n = 1821) 43.4% were T2DM or clinical MODY, (n = 269) 6.4% were GDM, and the remaining (n = 84) 2.0% belong to secondary diabetes. Gender distribution shows that (n = 2295) 54.7% of young diabetes participants at RCC03 were females [Table 3].

Table 4 shows the anthropometry and biochemical profile of different types of young diabetes at RCC03. The anthropometric and biochemical profile given above clearly shows the differentiation of T1DM, T2DM, and other young diabetes participants in the registry.

Figure 2 shows the stratification according to age at diagnosis at RCC03. Among T1DM, 58% of them fall under the age-onset category of less than 15 years, whereas in T2DM, 95% of them had age onset above 15 years of age. Table 5 shows the treatment pattern of young diabetes participants. Among T1DM, 83% were on insulin treatment, and only 12% of T2DM were on insulin.

Data on religion, education, socioeconomic status, parental history of diabetes, mode of presentation, previous hospitalization, complications, and comorbidities are given in Tables S2–S5.

Discussion

This article brings out the data collected from Chennai RCC03 from different diabetes clinics in the government and private sectors, and the data received cover most of the Chennai city. There are variations in the data collected like government hospitals gave mostly of T1DM, whereas private hospitals consist of T2DM and GDM participants. All RCs have contributed participants to RCC03, and it adds strength to the nationwide data pool.

The ICMR registry, which has been started in 2006 with five RCCs, has been now extended to 11 centers. Currently,

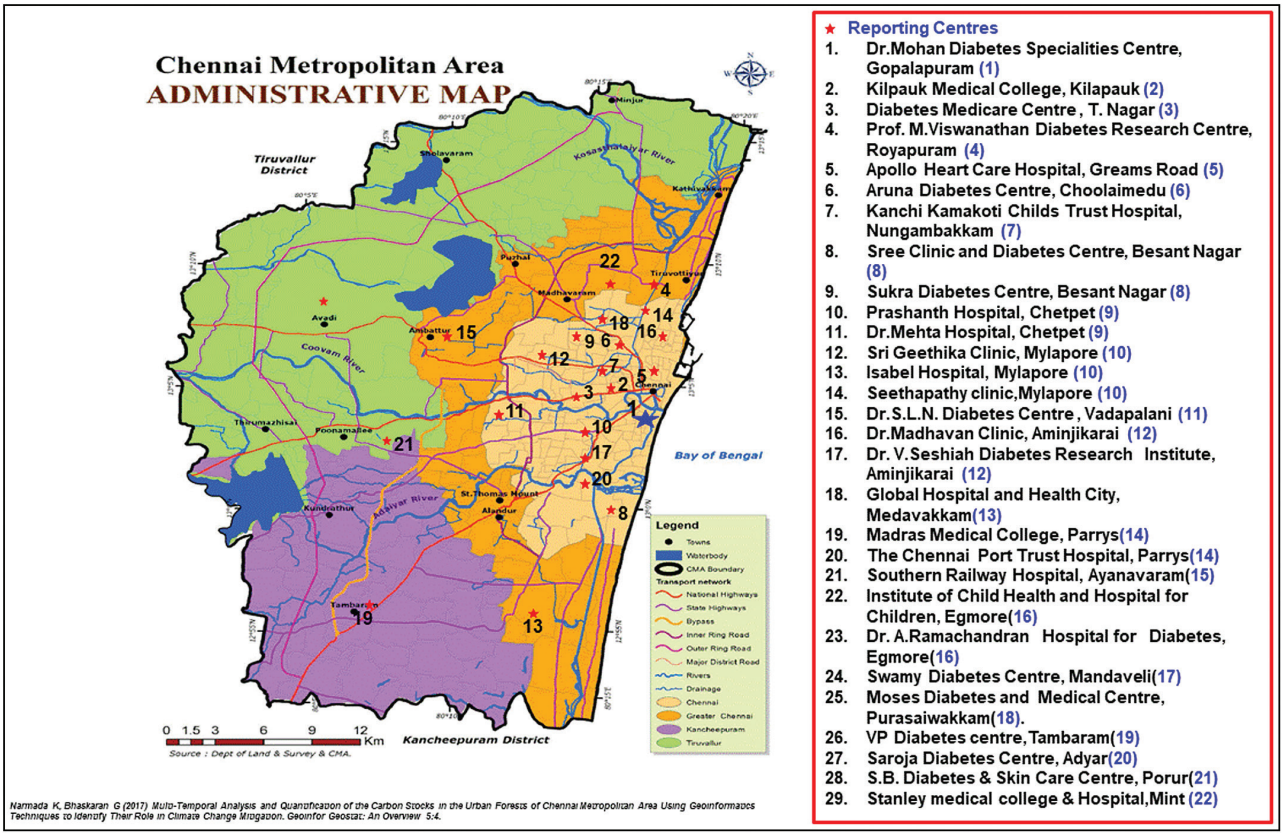

Figure 1: Distribution of reporting centers at Regional Collaborating Centre, Chennai

Table 1: Number of participants recruited from the Regional Collaborating Centre, Chennai in phases I and II (2006–2019)

S. No.	RC Code	Investigator's name	Name of the RC	Places in Chennai metropolitan area	Phase I	Phase II	Total
1	001	Dr. V. Mohan	Dr. Mohan's Diabetes Specialties Centre	Gopalapuram	1097	1209	2306
2	004	Dr. E. Suresh	Government Kilpauk Medical College (G)	Kilpauk	15	81	96
3	005	Dr. G. Vijayakumar	Diabetes Medicare Centre	T. Nagar	189	109	298
4	006	Dr. Vijay Viswanathan	Prof.M. Viswanathan Diabetes Research Centre	Royapuram	186	220	406
5	008	Dr. Jaishree Gopal	Apollo Heart Care Hospital	Greams Road	5	-	5
6	009	Dr. A. Paneerselvam	Aruna Diabetes Centre	Choolaimedu	26	5	31
7	013	Dr. A. Srivatsa	Sree Clinic Diabetes Centre	Besant Nagar	27	10	37
8	014	Dr. S. Nallaperumal	Prashanth Hospital	Chetpet	0	13	13
9	026	Dr. Jalaja Ramesh	Sree Geethika Clinic	Mylapore	0	9	9
10	027	Dr. Vasanthi T.	Child Trust Hospital	Nungambakkam	43	1	44
11	032	Dr. S. Lakshmi Narayan	Dr S L N Diabetes Centre	Vadapalani	0	3	3
12	034	Dr. K. P. Hemchand	Mehta Hospital	Chetpet	0	7	7
13	037	Dr. R. Madhavan	Dr. Madhavan's Clinic	Aminjikarai	0	2	2
14	038	Dr. K. Baraneedharan	Global Hospital	Medavakkam	0	5	5
15	039	Dr. V. Parthasarathy	Dr V P Diabetes Centre	Tambaram	1	-	1
16	040	Dr. V. A. Gunasekaran	Chennai Port Trust Hospital (G)	Royapuram	6	2	8
17	041	Dr. S. Sinharoy	Southern Railway Hospital (G)	Ayanavaram	6	10	16
18	042	Dr. Ezhilarasi/Dr. R. V. Dhakshayani	Institute of Child Health and Hospital for Diabetes (G)	Egmore	152	113	265
19	043	Dr. Uma Ram	Dr. Seethapathy Clinic	Mylapore	0	1	1
20	044	Dr. S. Nallaperumal	Swamy Diabetes Centre	Mandaveli	8	26	34
21	045	Dr. K. Baraneedharan	Sukra Diabetes Centre	Besant Nagar	0	10	10
22	046	Dr. C. R. Anand Moses	Moses Diabetes Clinic	Purasaiwakkam	6	31	37
23	047	Dr. P. Dharmarajan	Rajiv Gandhi Government General Hospital (G)	Parrys	14	143	157
		Dr. I. Periyandavar	Tamil Nadu Government Multi Super Speciality Hospital (G)				
24	048	Dr. Jalaja Ramesh	Isabel Hospital	Mylapore	0	2	2
25	049	Dr. V. Seshiah	Dr V Seshiah Diabetes Research Institute	Aminjikarai	2	43	45
26	050	Dr. A. Ramachandran	Dr. A. Ramachandran's Diabetes Hospitals	Egmore	0	251	251
27	051	Dr. P. Dharmarajan	S.B. Diabetes and Skin Care Centre	Porur	0	25	25
28	052	Dr. I. Periyandavar	Saroja Diabetes Centre	Adyar	1	35	36
29	053	Dr. A. Shanmugam	Stanley Medical College (G)	Washermanpet	-	44	44
			Total		1784	2410	4194

G = government hospital, RC = reporting center

phases I and II of the registry have been extended to phase III (cohort based) successfully, which will bring more precise and detailed information on the young diabetes individuals. Some of the clinics were able to give consent in phase I but were able to provide participants only in phase II. Few centers that were able to provide participants in phase I could not provide participants in phase II, which may be due to unforeseen management decisions like the change of directors/dean/doctors of the hospital. We have registered RCs even if they have given details of one patient. Overall, we have collected baseline details of 1784 individuals in phase I and 2410 with young-onset diabetes in phase II.

It is interesting to note that the overall percentage of T1DM (48%) and T2DM (43%) differs considerably from the nationwide paper, where 63.9% had T1DM and 25.3 had T2DM.[2] The increasing trend for T2DM to develop in young people is of particular concern. In children and adolescents in some parts of the Asia-Pacific region, T2DM now outnumbers T1DM by a ratio of 4:1 in less than 18 years.[3]

Similarly, the female predominance of young diabetes is seen in RCC03, whereas it was males in the national data. Recently, the Pediatric Diabetes Consortium (PDC) registries reported that in their study, children and adolescents with T2DM were more likely to be female.[4] The above data show that data differ in the southern region, i.e., in Chennai. If more collaborating center-wise data get published, we will be able to see the differences or characteristics of each region's data.

The age at onset of diabetes peaks for T2DM and other forms of diabetes after the age of 15 years, whereas for

Table 2: Young diabetes participants according to classification at the Regional Collaborating Centre, Chennai

S. No.	RC No.	Investigator's name	Name and place of the reporting center	Type 1 (n = 2020)	Type 2 (n = 1821)	GDM (n = 269)	Secondary DM (n = 84)*	Total
1	1	Dr. V. Mohan	Dr. Mohan's Diabetes Specialities Centre	879 (43.5)	1232 (67.7)	134 (49.8)	61 (72.6)	2306 (55.0)
2	4	Dr. E. Suresh	Kilpauk Medical College and Hospital (G)	82 (4.1)	9 (0.5)	4 (1.5)	1 (1.2)	96 (2.3)
3	5	Dr. G. Vijayakumar	Diabetes Medicare Centre	64 (3.2)	173 (9.5)	60 (22.3)	1 (1.2)	298 (7.1)
4	6	Dr. Vijay Viswanathan	Prof.M. Viswanathan Diabetes Research Centre	198 (9.8)	193 (10.6)	8 (3.0)	7 (8.3)	406 (9.7)
5	8	Dr. Jaishree Gopal	Apollo Heart Care Hospital	1 (0.0)	2 (0.1)	2 (0.7)	-	5 (0.1)
6	9	Dr. A. Paneerselvam	Aruna Diabetes Centre	29 (1.4)	2 (0.1)	-	-	31 (0.7)
7	13	Dr. A. Srivatsa	Sree Clinic and Diabetes Centre	27 (1.3)	9 (0.5)	1 (0.4)	-	37 (0.9)
8	14	Dr. S. Nallaperumal	Prashanth Hospitals	-	5 (0.3)	8 (3.0)	-	13 (0.3)
9	26	Dr. Jalaja Ramesh	Sri Geethika Clinic	1 (0.0)	1 (0.1)	7 (2.6)	-	9 (0.2)
10	27	Dr. T. Vasanthi	Kanchi Kamakoti Childs Trust Hospital	35 (1.7)	4 (0.2)	-	5 (6.0)	44 (1.0)
11	32	Dr. S. Lakshmi Narayan	Dr S L N Diabetes Centre	-	1 (0.1)	2 (0.7)	-	3 (0.1)
12	34	Dr. K. P. Hemchand	Mehta Hospital	7 (0.3)	-	-	-	7 (0.2)
13	37	Dr. R. Madhavan	Dr. Madhavan's Clinic	1 (0.0)	-	1 (0.4)	-	2 (0.0)
14	38	Dr. K. Baraneedharan	Global Hospitals and Health City	-	3 (0.2)	1 (0.4)	1 (1.2)	5 (0.1)
15	39	Dr. V. Parthasarathy	Dr V P Diabetes Research Centre	1 (0.0)	-	-	-	1 (0.0)
16	40	Dr. V. A. Gunasekaran	The Chennai Port Trust Hospital (G)	2 (0.1)	6 (0.3)	-	-	8 (0.2)
17	41	Dr. S. Sinharoy	Southern Railway Hospital (G)	7 (0.3)	7 (0.4)	-	2 (2.4)	16 (0.4)
18	42	Dr. R. V. Dhakshayani	Institute of Child Health and Hospital for Children (G)	260 (12.9)	1 (0.1)	-	4 (4.8)	265 (6.3)
19	43	Dr. Uma Ram	Seethapathy Nursing Home and Clinic	-	-	1 (0.4)	-	1 (0.0)
20	44	Dr. S. Nallaperumal	Swamy Diabetes Centre	18 (0.9)	16 (0.9)	-	-	34 (0.8)
21	45	Dr. K. Baraneedharan	Sukra Diabetes Centre	5 (0.2)	5 (0.3)	-	-	10 (0.2)
22	46	Dr. C. R. Anand Moses	Moses Diabetes and Medical Centre	16 (0.8)	13 (0.7)	8 (3.0)	-	37 (0.9)
23	47	Dr. P. Dharmarajan	Rajiv Gandhi Government General Hospital (G)	141 (7.0)	9 (0.5)	5 (1.9)	2 (2.4)	157 (3.7)
		Dr. I. Periyandavar	Tamil Nadu Government Multi Super Speciality Hospital (G)					
24	48	Dr. Jalaja Ramesh	Isabel Hospital	-	-	2 (0.7)	-	2 (0.0)
25	49	Dr. V. Seshiah	Dr V Seshiah Diabetes Research Institute	15 (0.7)	15 (0.8)	15 (5.6)	-	45 (1.1)
26	50	Dr. A. Ramachandran	Dr. A. Ramachandran's Diabetes Hospitals	162 (8.0)	85 (4.7)	4 (1.5)	-	251 (6.0)
27	51	Dr. P. Dharmarajan	S.B. Diabetes and Skin Care Centre	17 (0.8)	8 (0.4)	-	-	25 (0.6)
28	52	Dr. I. Periyandavar	Saroja Diabetes Centre	13 (0.6)	17 (0.9)	6 (2.2)	-	36 (0.9)
29	53	Dr. A. Shanmugam	Stanley Medical College (G)	39 (1.9)	5 (0.3)	-	-	44 (1.0)
			Total	2020 (48.2)	1821 (43.4)	269 (6.4)	84 (2.0)	4194

DM = diabetes mellitus, FCPD = fibrocalculous pancreatic diabetes, G = government hospital, GDM = gestational diabetes mellitus, RC = reporting center

Data are presented as n (%)

*Secondary DM includes FCPD

Table 3: Gender distribution of the participants at the Regional Collaborating Centre, Chennai

Variables	Type 1 (n = 2020)	Type 2 (n = 1821)	GDM (n = 269)	Secondary DM (n = 84)	Total
Male	982 (48.6)	878 (48.2)	-	39 (46.4)	1899 (45.3)
Female	1038 (51.4)	943 (51.8)	269 (100.0)	45 (53.6)	2295 (54.7)
Total	2020 (48.2)	1821 (43.4)	269 (6.4)	84 (2)	4194

DM = diabetes mellitus, GDM = gestational diabetes mellitus

Data are presented as n (%)

T1DM, the majority of them fall below 15 years. The mean reported age and age at diagnosis of diabetes in children and adolescents varies in different regions[5-9] either by reporting less than 14 years of age or their upper age limit as 18 years. Therefore, these studies tend to miss data on children and adolescents in the left out age groups leading to underestimations in some of the studies. If researchers would adopt a standard age breakdown and limit the age

Table 4: Anthropometry and biochemical profile of different types of diabetes at the Regional Collaborating Centre, Chennai

Variables	Type 1 (n = 2020)	Type 2 (n = 1821)	GDM (n = 269)	Secondary DM (n = 84)
Age at first visit (years)	15.8 ± 9.0	26.8 ± 9.1	23.5 ± 2.0	20.3 ± 11.6
Age onset of diabetes (years)	12.6 ± 6.6	21.2 ± 3.7	23.1 ± 1.8	16.2 ± 7.7
Height (cm)	147 ± 24	161 ± 12	156 ± 9	148 ± 27
Weight (kg)	42.6 ± 18.5	70.6 ± 16.6	69.8 ± 12.9	50.3 ± 23.3
Body mass index (kg/sq.m)	19.2 ± 6.5	27.1 ± 7.1	28.6 ± 6.0	21.1 ± 7.1
Waist circumference (cm)	69.5 ± 14.2	89.3 ± 14.1	88.6 ± 10.7	69.6 ± 16.3
Systolic blood pressure (mm Hg)	108 ± 15	121 ± 15	114 ± 12	110 ± 13
Diastolic blood pressure (mm Hg)	71 ± 9	78 ± 9	73 ± 7	74 ± 10
Fasting plasma glucose (mg/dL)	224 ± 113	193 ± 81	109 ± 45	192 ± 105
Glycated hemoglobin (%)	10.8 ± 2.8	9.5 ± 2.3	6.3 ± 1.3	8.9 ± 3.3

DM = diabetes mellitus, GDM = gestational diabetes mellitus

Data are given as mean ± SD

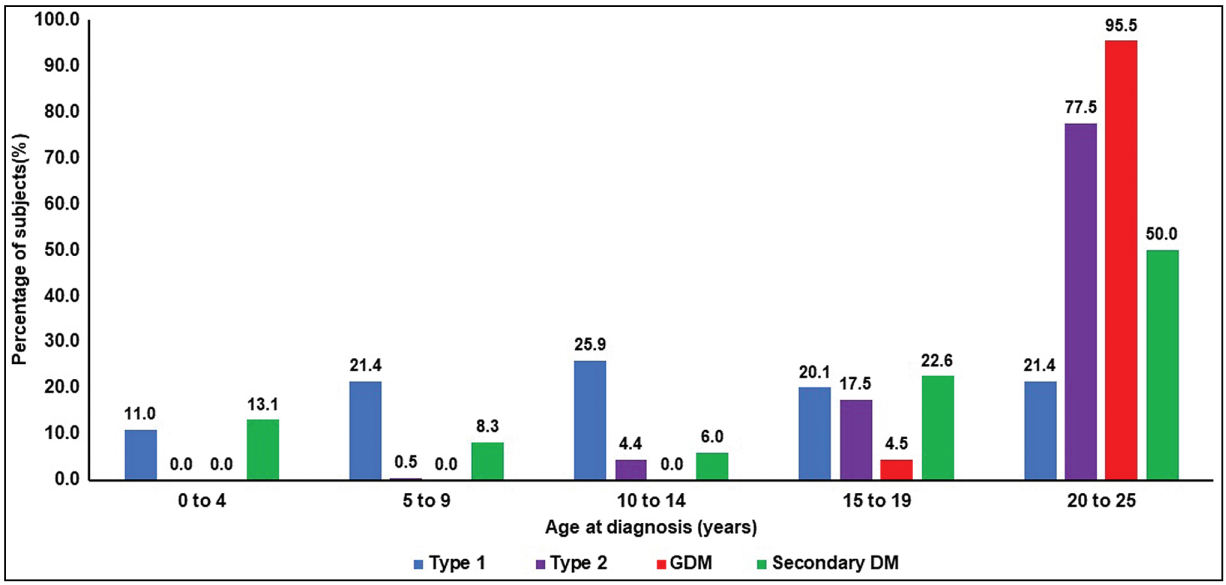

Figure 2: Stratification according to age at diagnosis. DM = diabetes mellitus, GDM = gestational diabetes mellitus

of adolescents studied up to 20 years of age, it would be helpful to collate the data worldwide.[10]

The majority of the T1DMs (62.6%) visit the RC for the first time within one year of onset of diabetes, whereas in the case of T2DM, it differs: 45% get registered within a year and 40% report to the center only after three years. This shows that even though they have been diagnosed as T2DM, it takes a longer time to reach proper treatment facilities. Already, these T2DMs may have remained undiagnosed, and this situation leads to high prevalence of complications at the time of clinical diagnosis of diabetes.[11,12]

As reported by the PDC registries,[4] T1DM had higher mean glycated hemoglobin levels at the time of diagnosis, and in our study also, T1DM had higher levels when compared to other categories of diabetes at the time of registration visit to the RCs. In The SEARCH for Diabetes in Youth (SEARCH) study,[13] 11.2% of the youth-onset T2DMs were on insulin only. Similar results have been observed in these data also.

Recent studies reported around 80% of young T2DMs have a parental history of diabetes, and it increases risk of not only glucose intolerance but also other cardiometabolic risk factors like overweight, low high-density lipoprotein cholesterol, and high blood pressure in Asian Indian adolescents.[14-17] The present study had similar findings with strong parental history of diabetes. In our study, 24% of T1DMs were presented with osmotic symptoms at the time of presentation, whereas in The European Diabetes (EURODIAB) Prospective Complications Study on T1DM, polyuria was the most common presenting symptom (96%).[18] In T2DM, they had other clinical forms of presentations like giddiness, breathlessness, body pain, shoulder pain, etc.

In this study, both T1DM and T2DM reported a history of hospitalization at the time of registration visit to the RCs, either due to diabetic ketoacidosis in T1DM or uncontrolled hyperglycaemia in T2DM. This calls for early treatment in these youths to prevent diabetes complications. Higher prevalence of microvascular

Table 5: Treatment pattern of young diabetes participants at the Regional Collaborating Centre, Chennai at the time of registration visit

Medications at the time of registration visit	Type 1 (n = 2020)	Type 2 (n = 1821)	GDM (n = 269)	Secondary DM (n = 84)	Total
Insulin (%)	1671 (82.8)	211 (11.7)	110 (40.9)	33 (40.2)	2025 (48.4)
OHA (n [%])*	19 (0.9)	843 (46.5)	10 (3.7)	17 (20.7)	889 (21.3)
Insulin and OHA (n [%])	105 (5.2)	487 (26.9)	12 (4.5)	16 (19.5)	620 (14.8)
No treatment/diet and exercise (n [%])	225 (11.1)*	280 (14.9)	137 (50.9)	18 (19.5)	646 (15.5)
Total	2020 (48.2)	1821 (43.4)	269 (6.4)	84 (2.0)	4194

DM = diabetes mellitus, GDM = gestational diabetes mellitus, OHA = oral hypoglycaemic agents, T1DM = type 1 diabetes mellitus

*Most of the T1DMs are newly diagnosed at the time of registration visit and referred to us for further treatment

complications was found in T2DM than in T1DM. Also, the presence of cardiometabolic risk factors such as dyslipidemia and hypertension in T2DM subjects leads to increased risk of developing cardiovascular disease in the future. This underscores the need for prevention and aggressive control of T2DM at younger age in order to prevent chronic complications in the future.[19]

The strengths of the registry include longitudinal data of large sample sizes. At present, YDR gives both retrospectively and prospectively from the year 2000 with over 20,000 data to date, i.e., around 20 years. It helps in tracking down the natural history of disease over time and provides generalizable evidence and effectiveness of diabetes treatment in the world.

The study has few limitations. The whole geographic region, i.e., Chennai, could not be covered due to various reasons (funding constraints, insufficient staff, the unwillingness of RCs, etc.). This is a collection of data on young diabetes from the clinics who were willing to participate. There could be ascertainment bias since there may be missed proportion of the young diabetes from the target population. However, these data give a snapshot of the clinical profile of young diabetes attending urban diabetes centers. As there is no systematic registry protocol or a central electronic medical record system in our country, these data give very valuable information on the pattern of young diabetes. Only limited variables were used for the main analysis, and the remaining are given as Tables S1–S5.

The ICMR-YDR is contributing to the nationwide data of both youth-onset T1DM and T2DM. Large diabetes registries especially for the children and adolescents are in need of the hour worldwide in every region due to the increasing incidence of T1DM and T2DM and its impact on health care. A recent systematic review of national diabetes registries worldwide renders 12 registries across four continents, giving new insights on prevalence, treatment, complications, and mortality among diabetic patients.[20] These registries help a lot in health care planning, making policies, and to construct management guidelines.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

Knowledge of COVID-19 and Perception Regarding Isolation, Quarantine, Social Distancing, and Community Containment During COVID-19 Pandemic Among People with Diabetes

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Abstract

Aim: The aim of this article is to determine knowledge level and perception about coronavirus disease 2019 (COVID-19) among people with diabetes. **Materials and Methods:** A cross-sectional study was conducted among 268 diabetic subjects from April 2020 to October 2020 at the outpatient department of Baqai Institute of Diabetology and Endocrinology, Karachi, Pakistan. A series of questions regarding knowledge and perception about COVID-19 were asked, and participants' demographic characteristics and source of information regarding COVID-19 were recorded and analyzed. **Results:** Among 268 participants, 59.7% had diabetes for more than 5 years. More than half of the subjects had heard about COVID-19 on television (63.8%). The majority of subjects had information about symptoms of COVID-19, including fever (92.2%), dry cough (79.9%), flu (78%), and shortness of breath (52.6%). Most of the participants had knowledge about preventive measures for COVID-19 such as wearing a face mask (77.6%), washing hands frequently with soap (72.8%), using hand sanitizer (72%), social distancing (47.4%), isolation and hygiene (38.8%), and quarantining (32.1%). However, less than half of the participants knew the correct meanings of social distancing (40.3%), isolation (29.1%), and quarantine (22.4%). **Conclusion:** Overall, most of the participants had information about common symptoms of COVID-19 including fever, dry cough, flu, and shortness of breath as they had heard about COVID-19 on television, at office, radio, and their living area. The government has taken effective measures in the prevention of COVID-19. Still, there remains a need for public awareness campaigns to combat the spread of disease.

Keywords: COVID-19, diabetes, knowledge and perception, Pakistan

Introduction

The novel coronavirus (COVID-19) has arisen spontaneously since December 2019 and has emerged as a major health issue worldwide.[1] The infection caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is termed novel because the respective virus behaved differently from its peers. It is highly contagious and was seen to affect a subset of people more severely causing a high death toll.[2] It was first reported in Wuhan, a city of Central Hubei Province of China, and now around 219 countries and territories are affected by this infection.[3] It has also reached Pakistan and the number of confirmed cases of COVID-19 is rising every day.[4] Transmission of COVID-19 has been reported to occur from human to human, and when an individual coughs or sneezes, the virus is conjecture to spread through respiratory droplets. Tiredness, fever, cough, sore throat, and shortness of breath are the most common symptoms. Other rare symptoms include headache, runny nose,

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aches, and diarrhea. Also, a loss of smell and taste has been experienced by some people.[5] To control and prevent the spread of COVID-19, many countries have taken drastic measures including quarantining, isolation, social distancing, traveling restriction, and community containment.[6]

COVID-19 appears to be severe among subjects with advancing age and underlying comorbidities. Similarly, diabetes mellitus has emerged as a distinctive comorbidity leading to severe disease, acute respiratory distress syndrome, and increased COVID-19 fatalities.[7] According to the National Institutes of Health in Italy, 35.5% of people who died from SARS-CoV-2 infection had diabetes.[8] Another study reported that people with diabetes have a three-fold increased risk of severe outcomes (classified as hospitalization, intensive care unit admission, intubation, or death) compared with people without diabetes.[9]

Type 2 diabetes has been discovered to increase the production of angiotensin-converting enzyme 2 (ACE2) in the lungs. ACE2 promotes the novel coronavirus pneumonia as a binding site for COVID-19, although decreased ACE2 expression may result in severe lung injury after infection. Serious diseases and glucocorticoids can impair insulin sensitivity; hence, infectious diseases are associated with high mortality of diabetic people.[10] It is imperative that people with diabetes are required to take extra care, strictly compliant with social distancing and hygiene, and maintain good glycemic control during COVID-19.[7] However, the compliance of people to these safety measures will be strongly affected by their knowledge of COVID-19. Therefore, knowledge of people with diabetes is expected to be the key element in their fight against this infection. Thus, this study aimed to determine diabetic people's knowledge level and perceptions about COVID-19.

Materials and Methods

This cross-sectional study was carried out in the outpatient department of Baqai Institute of Diabetology and Endocrinology (BIDE), a tertiary care diabetes center in Karachi, Pakistan. Type 1 and type 2 diabetic subjects of age ≥15 years attending the diabetic clinic from April 2020 to October 2020 were included in the study. Ethical approval was obtained with ref no. BIDE/IRB/AFAWWAD/10/28/20/0284 from the Ethical Review Board of BIDE before the start of this study. Consent was received from all the participants via a consent form to allow for inclusion of their non-identifiable information in the study. The sample size was calculated using a single proportion sample size formula, with a precision of 5% and a confidence interval of 90%. The percentage of diabetic subjects with significant knowledge of COVID-19 was assumed to be 50%. A systematic random sampling technique was used to collect data from study participants. The data were collected by trained volunteers by using proper protective materials such as wearing gloves and surgical face mask, using hand sanitizer, and standing around 2 m away from the participant.

The self-structured questionnaire was developed for data collection by reviewing the published related literature. It was divided into two sections. The first section covered the participants' demographic and other information. In this section, questions were related to age, gender, education level, marital status, occupation, language, type of diabetes, duration of diabetes, and other comorbidities. The second section comprised 32 questions that covered the knowledge of COVID-19 including sources of information, knowledge about coronavirus, behavioral intentions, and prevention practices. After the preliminary draft questionnaire was composed, it was reviewed by senior researchers of BIDE. Necessary modifications were done in the preparation of final draft on the basis of expert's suggestions. The questionnaire was also validated through Cronbach's α. The value of Cronbach's α of 0.881 indicated that the questionnaire was reliable and fit to conduct the study.

Statistical analysis

After the data collection, all questionnaires were entered into a customized Excel-based system. All data were subsequently imported into and analyzed via Statistical Package for the Social Sciences version 20.0. Descriptive statistics were then generated and reported as numbers (percentages) as well as mean ± standard deviation, where appropriate.

Results

A total of 268 diabetic subjects participated in this study, out of which 130 (48.5%) were males and 138 (51.5%) were females. The mean age of the participants was 46.37±12.57. The majority of the subjects had type 2 diabetes (89.6%), whereas only 10.4% had type 1 diabetes. One hundred and eight (40.3%) subjects had diabetes for less than 5 years, whereas 160 (59.7%) subjects had diabetes for more than 5 years. Most of them were married (79.1%), employed (41.8%), and Urdu speaking (59.3%). Around 39% of subjects had hypertension followed by other diseases (18.7%) [Table 1].

Table 2 demonstrated the knowledge about COVID-19 among diabetic subjects. More than half of the subjects had heard about COVID-19 on television (63.8%), whereas very few of them had heard at office (6.7%) and radio (1.9%). Around 14% of subjects had known COVID-19 patients in their living area and 8.6% had known COVID-19 patients in their family. The majority of subjects had information about symptoms of COVID-19 including fever (92.2%), dry cough (79.9%), flu (78%), and shortness

of breath (52.6%). About 9% of the respondents reported that COVID-19 cannot be prevented, whereas 23% were not sure about it. The remaining respondents recognized the following preventive measures for COVID-19: wearing a face mask (77.6%), washing hands frequently with soap (72.8%), using hand sanitizer (72%), social distancing (47.4%), isolation and hygiene (38.8%), quarantining (32.1%), increasing vitamin C intake (26.9%), drinking clean water (20.2%), removing stagnant water (6%), avoiding meat, poultry, and eggs (5.2%), and using mosquito repellent (0.4%).

Table 1: Characteristics of studied subjects

Parameters	Frequency	Percentage
n	268	
Age (years)*	46.37 ± 12.57	
Gender		
Male	130	48.5
Female	138	51.5
Type of diabetes		
Type 1	28	10.4
Type 2	240	89.6
Duration of diabetes (years)		
< 5	108	40.3
> 5	160	59.7
Education		
Unable to read and write	23	8.6
Primary	14	5.2
Secondary	18	6.7
Matric	36	13.4
Intermediate	60	22.4
Graduate	69	25.7
Postgraduate	48	17.9
Marital status		
Married	212	79.1
Unmarried	56	20.9
Occupation		
Employed	73	27.2
Self-employed	39	14.6
Unemployed	48	17.9
Others	108	40.3
Language		
Urdu	159	59.3
Punjabi	39	14.6
Balochi	6	2.2
Sindhi	24	9
Pashto	21	7.8
Others	19	7.1
Diseases (if any)		
Hypertension	104	38.8
Obesity	21	7.8
Dyslipidemia	9	3.4
Heart disease	22	8.2
Stroke	2	0.7
Any other	50	18.7

*Presented as mean ± SD

The respondents identified major vulnerable groups to get infected as older population with comorbidity (67.9%), children (33.6%), and diabetic people (26.9%). A very large number of subjects reported that the vaccine for COVID-19 is not available in Pakistan. More than half of the subjects agreed that stopping themselves from watching news will help in decreasing the fear (57.8%), and COVID-19 will be successfully controlled (51.1%). Some subjects (29.1%) had misconception that the virus will die at high temperatures. However, notably, confusion was found among participants when asked if touching the dead body of COVID-19 patient could result in infection (52.2% agreed vs. 47.8% disagreed) [Table 2].

Some people (24.3%) reported that they did not hear the word "quarantine," whereas only 22.4% of people know the correct meaning of quarantine, that is, *to separate and restrict the movement of healthy people who are exposed to disease to see if they have no symptoms*. Moreover, only 3.4% disagreed that quarantining oneself will prevent from getting COVID-19 and spreading it to others. The majority of the subjects (76.1%) had heard about the term "isolation," but only a few (29.1%) knew the correct meaning of it, that is, *to separate healthy people from people with communicable disease.* Similarly, most of the subjects (85.4%) had heard about the term "social distancing," but only half of them understand the correct meaning of it (40.3%) and knew that at least 6 feet distance should be maintained between two people (45.9%). Likewise, only 35.6% had heard the word "community containment," but most of them were not sure about its meaning [Table 3].

Discussion

The majority of our study participants had information about symptoms of COVID-19. Most of the participants had knowledge about preventive measures for COVID-19, such as wearing face mask, washing hands frequently with soap, using hand sanitizer, social distancing, isolation and hygiene, quarantining, increasing vitamin C intake, drinking clean water, removing stagnant water, avoiding meat, poultry, and eggs, and using mosquito repellent. Subjects also had misconceptions and confusion regarding infection spreading, term quarantine, social distancing, etc. In our study, although participants had misconceptions, most of the study participants displayed correct answers similar to the study carried out by Zhong and co-workers.[11] In an online survey, Geldsetzer[12] assessed similar KAP findings among the US and UK people. Most of our study population were being graduate, postgraduate, or intermediate. The majority of people heard about COVID-19 on television in our study. We are also in line with recent findings by Ahmed *et al.*[13]; a study from Pakistan that carried out during the exponential spread of cases in Pakistan with strict lockdown reported that social media such as Facebook, WhatsApp, Twitter, etc. and television to be the most common sources of