RESEARCH ARTICLE

TYPE 2 DIABETES MELLITUS MANAGEMENT KNOWLEDGE AMONG PHC PHYSICIANS IN BURAIDAH CITY, 2020

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Manuscript Info

Abstract

Introduction: Type 2 diabetes mellitus (T2DM) is highly prevalent in Saudi Arabia. primary health care (PHC) doctors provide most of T2DM medical care

Objectives: To estimate PHC physicians and family medicine residents level of T2DM management knowledge as per Saudi national reference of clinical guidelines for care of diabetic patients.

Methods: We conducted a cross-sectional study using a structured questionnaire. Beside general participant characteristics, we prepared 17 questions on four aspects of T2DM management. These were diagnosis, non-pharmacological and oral hypoglycemic agent, insulin and follow up. Each aspect was given a score of 4-6 points and the total score was 20 points.

Result: Out of 258 physicians, 178 were actually available at the time of the survey and 106 completed the study questionnaire. The overall response rate was 41.1%. The mean age of participants was 34.1 years and around two thirds of them were males. In-training family medicine residents formed the largest segment, 45 (42.5%). Mean duration of practice was 7.8 years. The reported daily workload showed that more than one-third of physicians (36.5%) manage ≥ 20 patients per day and almost all of them manage T2DM. Out of the total 20 points, only one quarter of participants had scored more than 15 points, while another quarter could not achieve more than 40%. Only physician qualification had impacted physician performance.

Conclusion: PHC doctors knowledge about T2DM management is sub-optimal. Properly selected educational activities targeted diabetes management are needed.

Introduction:-

Worldwide, one billion have diabetes mellitus (DM) or are prediabetes[1]. DM is one of four chronic identified to be of top priority for world leaders. Diabetes prevalence rose from 4.3% in 1981 to 8.5% in 2014. This increase was mainly due to increase in the prevalence of type 2 diabetes, driven by increasing prevalence of obesity and overweight [2]. kingdom of Saudi Arabia (KSA) is in the top ten countries in the prevalence in diabetes and obesity prevalence [3]. The latest national survey showed a prevalence rate of DM among adults at 13.4% [4].

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Primary health care centers (PHCCs) form the cornerstone of chronic diseases care in KSA. All diabetic patients are expected to be registered in the chronic disease clinic at the nearest PHCC. Periodic screening as well as case finding are conducted by primary care providers at each PHCC. Routine follow up and treatment are smoothly provided at primary care level, either independent or, more commonly, as shared care with hospitals.

At the national level, the past decade witnessed a more focus on chronic diseases in general and DM in particular. National surveys and screening programs were conducted. Furthermore, management guidelines and clinical manuals were released or updated [5]. Courses for primary care staff were conducted, both at national and provincial levels as part of the well-organized continuous medical education (CME) activities.

Aims and Objectives:-
To assess the theoretical knowledge of DMII management in PHC physicians, R1, R2, R3, and R4 family residents.

Specific objectives:
1. To study the demographic variables in relation to T2DM management among PHC physicians
2. To measure the level of theoretical knowledge of T2DMmanagement of PHC physicians and family medicine residents.
3. To determine factors that affect physician's knowledge such as years of experience, number of patients seen per day, work hours per week.

Literature Review:-
Diabetes care is a multidisciplinary one where team members come from different disciplines and have various backgrounds and expertise. Furthermore, different systems have different care delivery approaches. Physician compliance with guidelines is prudent as they are the cornerstone of the diabetes care. Hence, ensuring physicians knowledge was a matter of research focus. Regulatory bodies guidance and control of diabetes care vary from none to comprehensive control via detailed guidelines and manuals. Diabetes care is frequently audited against those manuals or guidelines.

We searched PubMed and Google Scholar for the following items "diabetes mellitus", "type 2", "physicians", "management" and "knowledge". To refine the search results to our objectives we added one or more of the following items "primary care" "family medicine", "audit", and "guidelines" or 'manual". "Saudi" was also added to detect local studies. Our search identified only 6 related studies.

A study from Palestine looked at physicians and nurses self-reported knowledge and compliance with local diabetes guidelines. Of 253 physicians, 61% were primary healthcare physicians while the rest were from different specialties including endocrinologists. While 73.5% of physicians thought that they were committed to the guidelines, only 57.5% of them reported that they have a copy of the guidelines and less proportion (53%) of them reported they were familiar with guidelines. Physicians knowledge were tested mainly for routine blood pressure monitoring, screening for complication, and referral. However management was not addressed in that study [6].

Shera et al described knowledge and attitude of 767 Pakistani family physicians. Most (90%) of their sample reported that they were involved in treating diabetes. Physicians overall knowledge was 62% but ranged between 29.7% and 86.6% [7].

Fogelman et al surveyed 362 Israeli family physicians attitude and practice about type 2 diabetes mellitus management. Studied domains focused around reported advices and agreement with study attitude statements about patient management issues, while direct patient management was not assessed [8].

Rätsep et al assessed 163 Estonian doctors awareness about national guidelines of type 2 diabetes mellitus management. Only 52% of doctors had at least 50% adherence level, in a scale of 0 to 12. Although two-thirds of them stated that they have the guidelines, 79% reported using them [9].

In Saudi Arabia, we found two studies that assessed primary care physicians knowledge about type 2 DM management. The first study was conducted in 2010 by Khan et al from Al-Hasa. They studied 99 PHC physicians

knowledge, attitude, and practice regarding type 2 diabetes mellitus management. They addressed many aspects of type 2 diabetes mellitus including questions on diagnosis management. The overall mean score was 66.6% [10].
The last of study was conducted in Riyadh by Amin et al in 2015. They surveyed 146 family physicians including 103 PHC doctors working in 15 PHCCs. A long comprehensive list of diagnosis, management, and follow-up items were studied. Those items were based on American diabetes association (ADA) standards. PHCC physicians correct responses ranged from 43.7% to 98% with a median of 67% [11].

Study rationale:
As most of the ambulatory care of DM is provided by primary health care (PHC) physicians, it is crucial that national manuals are known and adhered to by primary care physicians. Exploring PHC doctor's knowledge level will help primary health care administration to identify areas of knowledge deficiency, hence to focus CME activities on those areas.

Methodology:-
Buraidah city is the capital and largest city in Qassim with more than 400,000 inhabitants [12]. Of these, around 300,000 are registered in ministry of health (MOH) primary health care centers. Currently, there are 39 active PHCCs in Buraidah. The total official number of PHCCs physicians in these centers is 258 [PHCC administration, personal communication]. We targeted all available PHCCC doctors at the time of the survey as well as all family medicine in-training residents.

This study was conducted during the period between April 2020 to December 2021. The study tool was a close ended structured questionnaire designed by the investigators for this study. The questionnaire had two main parts. The first part composed of questions about socio-demographic status, qualification and experience backgrounds. The second part contained questions on participant knowledge about T2DM diagnosis and treatment. The latest issue (2014) of the national (Saudi) manual was used as a sole reference for this section [5]. A short introduction was written at the top of the questionnaire informing the participant about the survey, seeking his/her participation and assuring data confidentiality and voluntariness of participation. The questionnaire was prepared on a google form as well as on paper form. The google form was saved in google drive and a link was made ready for dissemination.

After we got the ethical approval from the regional research ethics committee, we sought the permission from the primary health care administration. PHCC administration issued a circular directed to all health centers in Buraidah encouraging PHCC directors to cooperate with the investigators. A list of all Buraidah PHCC physician names and mobile phone numbers were taken from the two supervisory offices in Buraidah.

We contacted each doctor via WhatsApp application. The link for the study questionnaire was sent to each doctor with a brief greeting and encouraging paragraph.

At each health center, data collectors met the PHCC director, introduced himself and presented a brief explanation about the survey. After getting the director permission, the data collectors tried to meet all available physicians at the time of the visit. A brief introduction was conveyed to each doctor and the study link was sent from the principal investigator mobile phone to the physician's one.

Data collection continued for two weeks from the time of first dissemination. We sent two reminders for non-respondents.

Completed data forms were transferred from Google to an excel sheet. They were then reviewed for completeness and consistency. Statistical analysis of data was performed using Epi Info 7.2 and SPSS version 28.1 statistical softwares.

Qualitative variables were presented as frequencies and quantitative variables were summarized using medians and interquartile ranges. Knowledge responses were scored as true-false, and single best choice were given one mark for correct response while questions with more than one correct choices were given two marks for fully correct answers and one mark for partially correct ones. All scores were summed up into one final score. Independent variables association with physician's performance were assessed by comparing their medians final scores. Mann-Whitney or Kruskal-Wallis were used to compare medians. The statistical significance level was set at p-value of <0.05.

Results:-

Sociodemographic section:

The total number of targeted primary health care physicians was 258. Of these, only 178 physicians were actually available at the time of the survey. We managed to send all of them the study questionnaire. One hundred and six doctors completed the study questionnaire. The overall response rate was 41.1%, but the response rate for those who were actually sent the questionnaire was 59.5%.

The mean age of participants was 34.1 years. Almost half of doctors were younger than 30 years (46.2%), while around two thirds of them were males (63.2%), and of Saudi nationality (61.3%).

In-training family medicine residents formed the largest segment, 45 (42.5%). One third of physicians had the basic medical degree, Bachelor of Medicine and Bachelor of Surgery(MBBS) only. Majority (89.6%) of surveyed doctors were affiliated with ministry of health (MOH). Mean duration of practice was 7.8 years (range, 1-30 years) and half of doctors had less than five years in medical practice, while around two thirds (63.2%) had less than five years of experience in primary health care centers (PHCC). The reported daily workload showed that more than one third of physicians (36.5%) manage ≥ 20 patients per day and almost all doctors were involved in management of diabetes mellitus patients with median number of 20 diabetic patients per week. Regarding on job education and training on diabetes, only 35.8% of the sample reported having a course about DM and around half reported attending at least one symposium dedicated to DM, table 1.

Final score:

Only one participant answered all questions correctly but one quarter of participants had scored more than 15 out of the total 20 points. Furthermore, another quarter could not score 60% out of total 20 points. Graph 1. summarizes physicians performance in the four main domains, diagnosis and screening, oral hypoglycemic agents, insulin, and monitoring patients

Diagnosis and screening score:

Of the selected national guidelines screening and diagnosis items, only 4.7% of PHC doctors could identify all items correctly. Forty percent could not identify half of the items, while one third fail to recognize indications of screening high risk individuals for diabetes. Furthermore, around one quarter wrongly labeled prediabetes values as normal or diabetic.

Oral antidiabetic score:

Only one fifth of participants managed to have all items for oral antidiabetics correctly and around half could not identify half of the items. Although two thirds identified metformin indications correctly, one half failed to identify that chronic kidney disease is a contra-indication for Sulphonylurea drugs.

Insulin score:

Regarding insulin indications/modification items, only around half of doctors correctly identified two of five items.

Monitoringscore:

One quarter of respondents failed to choose the right self-monitoring choices. Furthermore, half of PHC doctors wrongly identified the right blood pressure targeted level and another half do not know the right lipid profile targeted level.

Variables associations

The relationships between tested categorical variables and the final score median were quite similar. Even for those variables with differences, the differences were small. Furthermore, the only independent variable that showed statistically significant difference was physician rank, as there was increase in the median score of physicians as they hold higher grade in the system, p-value=0.008, table 2.

Linear regression showed weak and non-significant relationship between independent continuous variables and final score except for the reported number of patients seen by each doctor, both total and diabetic. Surprisingly, the relationship was an inverse and significant one as the final score decreased as the number of patients increased, p=0.0017.

Item	N	%
Gender: Male Female	67 39	63.2 36.8
Age: (by years) < 30 30-40 > 40	49 37 20	46.2 34.9 18.9
Nationality: Saudi Non-saudi	65 41	61.3 38.7
Qualification: MBBS Family Medicine resident Diploma/master Doctorate/Fellowship	35 45 15 11	33.0 42.5 14.2 10.4
Taken diabetes course:	38	35.8
Attended symposium:	52	49.1

Table 1:- Primary health care physician's knowledge about T2DM management, Buraidah, Qassim, 2021. Participant characteristics.

Table 2:- Primary health care physicians knowledge about T2DM management, Buraidah, Qassim, 2021. Participant practice characteristics.

Item	Range		Median (Q1-Q3)		
	Min	**Max**	**Median**	**Q1**	**Q3**
Duration of practice (years)	1	30	5	3	13
Experience in PHCC (years)	0	26	4	1.75	8
Number of patients per day, n=74	9	60	20	15.75	30
Number of diabetic patients per week, n=78	0	120	20	12	30

Table 3:- Primary health care physicians knowledge about T2DM management, Buraidah, Qassim, 2021. Relationship between participant characteristic and final score.

Item	Final score Median	p-value*
Gender: M F	13 13	0.7
Nationality: Saudi Non-Saudi	13 13	0.85
Qualification: MBBS Family medicine resident Master/diploma	13 13 14	0.008**

consultant	15	
Taken course:	14	0.08
Attended symposium:	13	0.4
*Kruskal-Wallis **Wilcoxon		
Item	**Coefficient**	**p-value**
Age	0.059	0.547
Duration of practice	0.184	0.608
Experience in PHCC	0.163	0.0975
Number of patient per day	- 0.274	0.0196
Number of diabetic patient per week	-0.353	0.0017

Figure 1:- Primary health care physicians knowledge about T2DM management, Buraidah, Qassim, 2021. Knowledge level score percent.
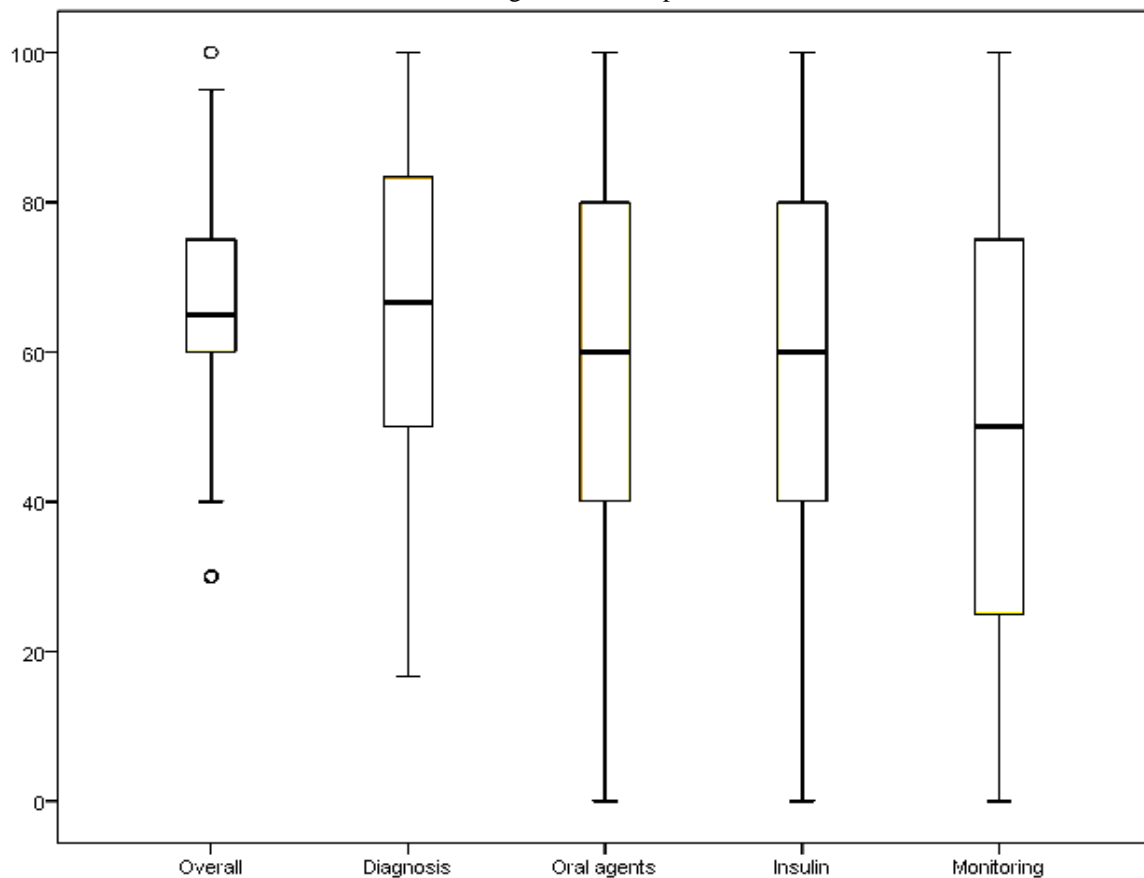
Discussion:-

Buraidah PHCC doctors knowledge about T2DM management national guidelines is sub-optimal, as only half of the respondent could achieve two thirds of the final score. Although higher rank order physicians have better knowledge compared to juniors, the median score of consultant physicians was not up to the expectation, as half of them had scored less than 75% of the total.

Most previous studies addressing physicians knowledge about T2DM had reported similar findings [7-11]. The median knowledge level of PHC physicians was around 62% in a study conducted by Amin et al, from Riyadh [11], while the median knowledge level was found in Al hasa to be higher by Khan et al, 77% [10]. Variable median knowledge levels were reported from three international surveys, Pakistan, Israel, andEstonia, 52%, 61%, and 90%, respectively[7-9].

The knowledge levels of specific domain scores were sub-optimal as well. The least knowledge level was that of diabetes monitoring as only half of the participants could achieve 50% of monitoring score. On the other hand, PHCC doctors knowledge score was the best, with a median score of 70% of its highest value. Although different studies had different questionnaires and analyzed their results differently, our finding was generally lower than its precedents[7-11].

In our study, we gave a score to each correct answer then summed up domain scores and the total score. This gave us a good overall mirror about physician's knowledge for different domains while most other studies had reported long list of items which made it difficult to compare knowledge levels between studies.

The association between studied variables and the knowledge score was only significant for physician rank. Riyadh and Israeli Studies should slight differences between certified and non-certified PHCC in most of the domains. In fact, in both studies, the non-certified doctors had occasionally scored better in some of the domains [Ref Riyadh-Israel]. Of note, the negative association between the number of diabetic patients seen by our sample physicians and knowledge score. We do not have plausible explanation for this association. This issue was not addressed by previous similar studies Further in-depth examination may question this relationship or uncover genuine reasons.

Strengths of the study:
The study questionnaire followed the national (Saudi) manual, as a sole reference. The survey response rate was good. Summing up estimated Knowledge levels into an overall score and sub scores made it easy to quantify physician knowledge levels and to identify weakness areas.

Limitations of the study:
COVID-19 Pandemic limited the number of available targeted physicians, prolonged the data collocation period, and probably decreased the response rate.

After we collected our data a new guideline was released, this time by the Saudi health council [13].

In our study, we did not inquire about awareness of that national diabetes guidelines or asked them about their diabetes management reference. The reason was that we thought such questions may affect their responses, hence distort their actual knowledge level.

The study was done in Buraidah city only. It may be difficult to generalize the results to other cities or provinces in the kingdom.

Conclusion:-
PHC doctors have sub-optimal knowledge about national T2DM management guidelines.

Recommendations:-
Further exploration of PHCC physician knowledge levels and identification of the best methods for knowledge and practice improvement.

Periodic audit of PHCC doctors performance for various PHCC programs and chronic diseases management as per guidelines and manuals.

Institutional Review Board (IRB) Statement:
Before collection of the data, IRB approval was taken from regional Research Ethics Committee, Qassim with ethical approval number 1441-1065093.

Informed Consent Statement:
Oral informed consent was taken from all the participants and explained the importance of the study and purpose of the study.

Data Availability Statement:
Data preserved and available at principal investigator computer and can be shared on request as a soft copy.

Conflicts of interest:
None.

Author Contributions:
Principal Investigator:
Research idea development from the principal investigator, also involved in review of literature, tool development, data collection and manuscript writing.

Co-investigator (Research Supervisor): Involved in all stages of development, monitoring, data analysis and manuscript writing and editing task till final stage of manuscript preparation.

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Appendices

No./percentage of correct answer of knowledge of diagnosis and treatment of T2DM		
ITEM	NO.	precentage
Screening of high risky patient to developing T2DM	64	60.4%
Classification of patient with HA1C 6.2	81	76.4%
Off label metformin may be considered for individuals	70	66.0%
Initial management of T2DM	104	98.1%
Affective of Metformin on HA1C	75	70.8%
Affective of PPD4 class on HA1C	46	43.4%
Contraindication of Sulphonylureas class with patient had chronic kidney disease	54	50.9%
Initial management of newly diagnosis T2DM patient with HA1C 11.5%	39	36.8%
Management of T2DM patient on maximum dose of two oral antidiabetic drugs	78	73.6%
Uncontrolled T2DM patient on maximum dose of oral antidiabetic and 1 unit/kg/day of basal insulin next step	47	44.3%
Adjustment insulin doses in T2DM patient	44	41.5%
Adjustment dose of premixed insulin to controlled hypoglycemia	80	75.5%
Target of blood pressure for patient had T2DM	58	
Target level of lipid profile for patient had T2DM	53	50.0%

NO./percentage of knowledge of diagnosis and treatment of T2DM score

		NO.	%
diagnosis	1.00	5	4.7%
	2.00	12	11.3%
	3.00	25	23.6%
	4.00	36	34.0%
	5.00	23	21.7%
	6.00	5	4.7%
oral_antidiabetic	.00	2	1.9%
	1.00	5	4.7%
	2.00	22	20.8%
	3.00	29	27.4%
	4.00	27	25.5%
	5.00	21	19.8%
insulin_score	.00	5	4.7%
	1.00	15	14.2%
	2.00	29	27.4%
	3.00	22	20.8%
	4.00	26	24.5%
	5.00	9	8.5%
Monitoring_score (n=104)	.00	12	11.5%
	1.00	28	26.9%
	2.00	27	26.0%
	3.00	28	26.9%
	4.00	9	8.7%
Relationship between mean of participant			

NO. and percentage of score knowledge of diagnosis and treatment of T2DM

ITEM		NO.	%
Screening score	1.0	17	16.0%
	2.0	69	65.1%
	3.0	20	18.9%
Diagnosis score	1.0	39	36.8%
	2.0	67	63.2%
Self-monitoring score	1.0	15	14.4%
	2.0	63	60.6%
	3.0	26	25.0%

characteristic and final score	
mean	p-value
13.2 13.5	0.6
13.2 13.5	0.59
12.5 13.06 14 15.9	** 0.01
13.9	0.1
13.5	0.48

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Bachelor of Medicine and Surgery (MBBS) with GBA: 3.2/5
from Faculty of
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Saudi Medical Licensing Exam: 70% 15/11/2016.

Health related courses and Workshops:
Basic Life Support (BLS)course on MAY 2021.
• Advance trauma life support(ATLS) Course on December
2016provided by king Saud hospital at Unaizah.
Attend Electrocardiogram: basics and advanced
workshop on May 5th,2016.
• Basic surgical skill course on December 2017 by
DrSulaimanAlhabbib Medical Group -Qassim Hospital.
Health Education Activities:
Health Education Poster " Gastric bypass diet: what to
eat after the surgery ", Holliday Inn Aqaser Hotel Riyadh,
on November 2017.
• Health Advocate Provider and participate in social health
awareness campaign Held in Al-Othaim Mall in Al-Qassim
for Children as Volunteer on September 2017.
• Health Advocate Provider and participate in social health
awareness campaign Held in Alhamra walk side in
Alqassim for health care as volunteer on August 2017.

Research:
Bariatric Surgery to Treat Obesity Among Adults publication by
The Egyptian Journalof Hospital Medicine at 17-8-2017.

Conference and symposium attendance:
• Primary care update symposium 26/11/2015.
• Review of hot topics in pediatric 24/12/2015.
• Second Conference on public health and family medicine
(Saudi Women's health).

Hobbies &other interests:
Browsing Internet
Jogging

References:
Reference letter from Dr. Mohammed Abrar consultant,
general surgery at King Saud hospital- Unaizah , March
2017.