

TMSS Medical College Journal (TMCJ)

Volume 24, No. 01, January 2025

Contents

Editorial

- Artificial Intelligence in Revolutionizing Healthcare Practice 5-8
Dr. Mst Shohela Pervin, Dr. Sultana Razia

Original Article

- Common Symptoms of Post COVID-19 Syndrome of Patients Attended in a Tertiary Care Hospital in Northern Part of Bangladesh. 9-14
Dr. Md. Azizur Rahman, Dr. Md. Zakir Hossain, Dr. Ahmad Al Montasir, Dr. Shahidul Islam Shahin, Dr. Md. Asif Uddula, Dr. Md. Forhad Hossain, Dr. Parvat Kuwar Chhetri, Dr. Md. Abu Kaher Siddique.
- Risk Factors for Cisplatin-Induced Nephrotoxicity among Cancer Patients in Bangladesh: A Multicenter Cross-Sectional Study. 15-20
Dr. Umme Abd Armina, Dr. Syed Shafiq Tamal, Dr. Rajan Talukder, Dr. Samim Reza, Dr. Ahasun Ullah Sikder, Dr. Nafisa Akkas.
- Prescribing Trends of Antidiabetic Drugs among Patients in Type 2 Diabetes Mellitus with Chronic Kidney Disease in a Tertiary Care Hospital, Bangladesh. 21-28
Dr. Nafisa Akkas, Dr. Mahfuza Majeda Rowshan, Dr. Riti Yusuf, Dr. Umme Abd Armina, Dr. Nazia Akhter, Dr. Sabrin Jahan Mitu.
- Disease pattern in the Department of Physical Medicine and Rehabilitation at TMSS Medical College and Rafatullah Community Hospital 29-33
Dr. Ferdousur Rahman Al-Mahmud, Dr. Muhammad Alamgir Mandal.

Case Report

- Thoracic Extramedullary Hematopoiesis in a 35- Year -Old Male: A Case Report 34-38
Mano Ranjan Dey, Disha Bondopadhyay.



An Official Publication of TMSS Medical College



TMSS Medical College Journal (TMCJ)

January 2025

An Official Publication
of
TMSS Medical College, Bogura, Bangladesh

TMSS Medical College Journal (TMCJ)

Vol. 24, No 1, January 2025

An Official Publication of TMSS Medical College, Bogura, Bangladesh

Editorial Board

Chairperson : Prof. Dr. Md. Zakir Hossain
Editor-in-Chief : Prof. Dr. A.K.M Ahsan Habib
Associate Editor : Dr. Md. Abdul Mazid
Advisory Editor : Prof. Dr. Moudud Hossain Alamgir
Managing Editor : Dr. Md. Matiur Rahman

Members

Brig Gen Dr. Md. Jamilur Rahaman (Retd)
 Prof. Dr. Md. Anup Rahman Chowdhury
 Prof. Dr. Md. Shahjahan Ali Sarker
 Prof. Dr. Md. Shahjahan Ali
 Prof. Dr. Md. Akram Hossain
 Prof. Dr. Md. Kamrul Ahsan
 Prof. Dr. Hafiza Arzuman
 Prof. Dr. Md. Azfarul Habib
 Prof. Dr. Md. Rafiqul Islam
 Prof. Dr. Md. Rezaul Islam
 Prof. Dr. Nur-A-Farhana Islam
 Prof. Dr. Md. Sheik Abdul Muktaf
 Dr. Md. Amirul Islam

Advisory Board

Prof. Dr. Hosne-Ara Begum
 Prof. Dr. M. Afzal Hossain
 Prof. Dr. A.K.M. Ahsan Habib
 Prof. Dr. Md. Rezaul Alam
 Prof. Dr. Jawadul Haque
 Shahzadi Begum

The TMSS Medical College Journal (TMCJ) is published two times a year (January and July). The TMSS Medical College Journal (TMCJ) is approved by Bangladesh Medical & Dental Council (BM&DC/4-D-2016/1478: Dated 15.01.2017). It accepts original articles, review articles and case reports. While every effort is always made by the Editorial Board and the members of the Journal Committee to avoid inaccurate or misleading information appearing in the TMSS Medical College Journal, information within the individual article are the responsibility of its author(s). The TMSS Medical College Journal, its Editorial Board and Journal Committee accept no liability whatsoever for the consequences of any such inaccurate and misleading information, opinion or statement.

Printed by

TMSS Printing Press
 Bogura, Bangladesh
 e-mail: tmssprintingpress@gmail.com

Address of Correspondence

Editor-in-Chief, TMSS Medical College Journal, TMSS Medical College
 Rangpur Road, Thengamara, Bogura, Bangladesh.
 Phone: 051-61830, 01775-316617
 e-mail: editortmcjournal@gmail.com, Web: www.tmcjournal.org, www.tmssmedicalcollege.com

Original Article

Prescribing Trends of Antidiabetic Drugs among Patients in Type 2 Diabetes Mellitus with Chronic Kidney Disease in a Tertiary Care Hospital, Bangladesh

Akkas N^{1*}, Rowshan MM², Yusuf R³, Armina UA⁴, Akhter N⁵, Mitu SJ⁶

1. Dr. Nafisa Akkas, Lecturer, Department of Pharmacology, Chattogram Medical College, Chattogram.
2. Dr. Mahfuza Majeda Rowshan, Professor, Department of Pharmacology, Sir Salimullah Medical College, Dhaka.
3. Dr. Riti Yusuf, Assistant Professor, Department of Pharmacology, Sir Salimullah Medical College, Dhaka.
4. Dr. Umme Abd Armina, Assistant Professor, Department of Pharmacology, TMSS Medical College, Bogura.
5. Dr. Nazia Akhter, Lecturer, Department of Pharmacology, Dinajpur Medical College, Dinajpur.
6. Dr. Sabrin Jahan Mitu, Assistant Professor, Popular Medical College, Dhaka.

*Corresponding Author

Abstract

Background: In Bangladesh, the prevalence (34%) of Type 2 Diabetes Mellitus patients with chronic kidney disease is rising in recent years. There is lack of studies on the prescribing patterns of antidiabetic drugs in our country regarding Type 2 Diabetes Mellitus with chronic kidney disease patients.

Objective: The aim of this study was to assess the prescribing pattern of antidiabetic drugs in Type 2 Diabetes Mellitus with chronic kidney disease patients.

Materials and Methods: A cross sectional study was performed from July 2022 to June 2023, by analyzing patients attending OPD of Endocrinology and Nephrology Department of SSMCMH. Total 344 participants were enrolled after meeting the selection criteria.

Results: Mean age of the participants was 65.6 years with a male gender predominance (58.2%). Mean HbA1c was 7.5. Majority of the participants (39.5%) were in stage 3b kidney disease. DPP-4 inhibitors were frequently prescribed as single drug (23.5%) and also SGLT2 inhibitors (16.0%). Among the combination therapy, insulin + DPP-4 inhibitor (28.8%) was used mostly prescribed followed by metformin + SGLT2 inhibitor (12.5%).

Conclusion: In our study the combination of metformin and SGLT 2 inhibitor were found to be used frequently when eGFR is >30ml/min. Nonetheless, it is evident that its utilization was lesser in the previous year than it is currently. Thus, we can conclude that this medications have been used more frequently in recent years. This finding may further help to conduct a comparative study to assess the kidney function between those who are received this combination group and those who are not.

Keywords: Chronic kidney disease, KDIGO guideline, Prescribing Pattern, Type 2 Diabetes Mellitus, WHO Prescribing Indicators.

Introduction

Diabetes Mellitus has become one of the most common non communicable diseases and also become one of the fastest growing global health emergencies of the 21st century. About 536.6 million people found to be suffering from Diabetes Mellitus globally. In Bangladesh there is a dreadful rise in this disease's progression from 8.4 million in 2011 to 13.1 million by 2021. It is alarming that, Bangladesh is in the top 8th

position among other countries of the world regarding this.¹ It is fundamental for people with Diabetes Mellitus to be diagnosed as early as possible to prevent or delay complications, avoid a premature death, decrease healthcare cost and improve quality of life. People with uncontrolled Diabetes Mellitus has an increased risk of developing life threatening micro and macro vascular complications.² Uncontrolled Diabetes

Mellitus can be prevented by using appropriate antidiabetic agents.^{3, 4} A previous study showed that 1% reduction of mean HbA_{1c} significantly reduces diabetes related deaths (21%) as well as microvascular complications (37%).⁵

Chronic kidney disease is the most common (approximately 40%) micro vascular complication of poorly controlled Type 2 Diabetes Mellitus.^{6,7,8} It has become the leading cause of chronic kidney disease.⁹ The prevalence is extremely high in Bangladesh too.^{10, 11} According to KDIGO, 2022, Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease, plasma glucose control is based on a combination of metformin and SGLT2 inhibitors (SGLT2i) for Type 2 Diabetes Mellitus with chronic kidney disease (CKD), when eGFR is >30 ml/min/1.73m². SGLT2 inhibitors are recommended for patients with Type 2 Diabetes Mellitus and chronic kidney disease (CKD) because SGLT2 inhibitors can reduce albuminuria dramatically by 30 to 40%.^{12, 13} Prescription pattern monitoring study is a tool for assessing the prescribing, dispensing and distribution of medicines.¹⁴ Several previous studies in Bangladesh have raised concerns about prescribing pattern of antidiabetic drugs to people with renal impairment. Thus irrational prescribing can lead to increase in cost of drug therapy, which may lead to non-adherence.¹⁵ The aims of this study was to assess the prescribing pattern of antidiabetic drugs among patients with Type 2 Diabetes Mellitus and chronic kidney disease .

Materials and Methods

Study design

This is descriptive, cross-sectional and observational study.

Study place

Sir Salimullah medical College Mitford hospital, Dhaka

Study period

From July 2022 to June 2023

Study population

Participants attending in the Endocrinology and Nephrology Department of Sir Salimullah Medical College Mitford Hospital, Dhaka, Bangladesh.

Sample size determination

344 participants diagnosed as Type 2 Diabetes Mellitus with chronic kidney disease were included for this study with 95% confidence and 5% precision levels. At first ethical clearance and permission were taken from the Institutional ethical committee of Sir Salimullah Medical College Mitford Hospital, Dhaka.

Data collection

At first informed written consent was taken from every respondents. The following variables were sought: age, gender, stages of chronic kidney disease, Duration of Type 2 Diabetes Mellitus etc were collected according to participant's history. HbA_{1c}, eGFR, serum creatinine, were sought from the participant's previous laboratory investigation reports. Antidiabetic drugs are analyzed by observing the prescriptions. Confidentiality was strictly maintained. WHO Prescribing Indicators were analyzed by standardized formula. Participants having HbA_{1c} >6.5 was considered as uncontrolled Diabetes Mellitus. CKD staging was done by calculating eGFR. eGFR was calculated by using CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) Creatinine Equation (2021). This equation is recommended by the National Kidney foundation of Bangladesh and American Society of Nephrology Task Force Reassessing the Inclusion of Race in Diagnosing Kidney disease. The stages of kidney disease is categorized as eGFR 45-59 stage 3a, eGFR 30-44 stage 3b, eGFR 15-29 stage 4 and eGFR <15 stage 5.

Statistical Analysis

Statistical analysis was performed using SPSS (version

23.0). Qualitative variables (sex, co morbidities) of this study was expressed as percentage. Quantitative variable (e.g. age) was expressed as mean +/-standard deviation.

Ethical Approval

The Ethical Review Committee (ERC) of Sir Salimullah Medical College, Dhaka, approved the research protocol, questionnaire, consent statements. The ERC reference number was 59.14.1100. 031. 18.001.23.732

Results

Our study shows mean age was 65.6 with male gender predominance. Most of the participants were from middle socioeconomic class (47.1%) (Table I)

Table I: Distribution of demographic characteristics of the study participants (n=344)

Variables	Number of participants	Percentage (%)	Mean± SD
Age (years)			Age
40-49	21	6.1	
50-59	114	33.1	
60-69	164	47.7	65.6± 7.7
70-79	44	12.8	
≥80	1	0.3	
Range (min-max)	40.0	-80.0	
Gender			
Male	199	58.2	
Female	145	42.8	
Socioeconomic status			
Lower	124	36.1	
Middle	162	47.1	
Upper	58	16.9	

Table II: Distribution of clinical characteristics of study participants

Clinical characteristics	Number of participants	Percentage (%)
HbA _{1c} (%)		
<6.5	170	49.4
>6.5	174	50.6
Mean±SD	7.5±1.29	
Fasting plasma glucose (mmol/L)		
<7.0	149	43.3
≥7.0	195	56.7
Mean±SD	8.18±2.48	

This study shows that half of the participants have uncontrolled HbA_{1c} >6.5% and fasting blood glucose level >7.0 mmol/L (Table II)

Figure 1- Prevalence of CKD by stage 3a-5

Our study shows 39.5% participants were in stage 3b chronic kidney disease (Figure-1)

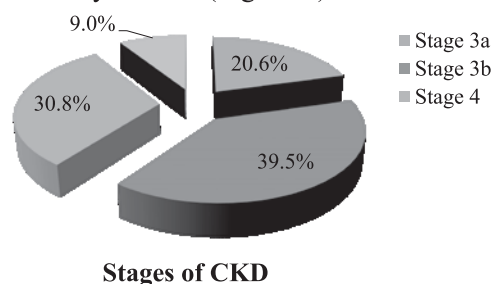


Table III: Patterns of using antidiabetic drugs in different stages of CKD (n=344)

Antidiabetic drugs	Stages of CKD							
	Stage 3a (n=71)		Stage 3b (n=136)		Stage 4 (n=106)		Stage 5 (n=31)	
	n	%	n	%	n	%	n	%
Single class								
DPP-4 inhibitor (23.5%)	21	29.6	17	12.5	43	40.6	0	0.0
SGLT2 inhibitor (16.0%)	19	26.8	0	0.0	0	0.0	0	0.0
Insulin (6.10%)	14	19.7	41	30.1	0	0.0	0	0.0
Metformin (5.5%)	1	1.4	0	0.0	5	4.7	15	48.4
Sulfonylurea (0.0)	0	0.0	0	0.0	0	0.0	0	0.0
Combination classes								
Insulin + DPP-4 inhibitor (28.8%)	8	11.3	18	13.2	57	53.8	16	51.6
Metformin + SGLT2 inhibitor (12.5%)	2	2.8	41	30.1	0	0.0	0	0.0
DPP-4inhibitor + SGLT2 inhibitor (2.0%)	3	4.2	4	2.9	0	0.0	0	0.0
Metformin + Sulfonylurea (3.5%)	12	16.9	0	0.0	0	0.0	0	0.0
Insulin + SGLT2 inhibitor (5.2%)	4	5.6	13	9.6	1	0.9	0	0.0

*DPP-4 inhibitor- Dipeptidyl peptidase-4; SGLT2 inhibitor- Sodium Glucose Co Transporter 2 inhibitors

On evaluation of individual antidiabetic drugs prescribed, it was found that DPP-4 inhibitor (23.5%) was the most commonly prescribed mono therapy followed by SGLT2 inhibitor (16.0%). Whereas Insulin and DPP-4 inhibitor (28.8%) followed by Metformin and SGLT2 inhibitor (12.5%) were the most commonly prescribed dual antidiabetic drug combinations (Table III)

Table IV: Distribution of WHO Prescribing Indicators of the study participants (n=344)

WHO Prescribing indicators	Percentage (%)
1. Average number of drug per prescription	2.7±1.6
≤2	65.7
3-4	24.1
5-6	12.5
>6	3.5
1. Percentage of drugs prescribed by generic name	
Yes	0.0
No	100.0
1. Percentage of drugs encounter with antibiotics	
Yes	4.1 (n=14)
No	95.3
1. Percentage of drugs encounter with injections	
Yes	40.7 (n=140)
No	59.3
5. Percentage of drugs prescribed from EDL	
Yes	32.2 (n=309)
No	67.8

*EDL- Essential Drug List

Average number of drug per prescription was 2.7, none of the drugs were prescribed by generic name. Percentage of antibiotics and injection encountered were 4.1% and 40.7% respectively. 32.2% drugs were prescribed from EDL (Table IV)

Discussion

The number of people with Diabetes Mellitus and its consequences rises day by day, resulting in a serious health concern. In Bangladesh, 34%¹¹ of patients with chronic kidney disease have Diabetes Mellitus, and this number is alarmingly rising. The pace and progression of microalbuminuria are slowed down by strict blood glucose control. According to current guidelines, there are numerous novel renoprotective antidiabetic medication regimens accessible. Therefore, the purpose of this study was to evaluate the prescribing practices of antidiabetic medications in patients with Type 2 Diabetes Mellitus with chronic kidney disease.

In our study, the range of age of study participants was 40-80 years and majority was from 61-70 years (42.7%). The mean age was 65.6 years which was similar to other previous studies.^{16,17} However this finding did not match with another study where mean age was found 74 years¹⁸. This dissimilarity may happen due to geographical differences.

This study showed slightly male predominance among the participants. It was observed that 58.2% (190) participants were male and 42.8% (154) participants were female. This data coincides with other studies.^{18, 19} Socioeconomic status is very important for selecting drug options. Most of the participants in this present study belonged to middle socioeconomic class (47.1%). These findings are comparable with Tanvir et al., 2013.¹⁹

Staging of CKD is very important for treatment purpose and drug choice. In this study about 39.5% (136) participants were in stage 3b kidney disease, 30.8% (106) participants were in stage 4 and 20.6% (71) participants were in stage 3a. 9% (31) had end

stage renal disease (ESRD) (stage 5). This findings was in concurrence with the result of Abreu et al., 2022.¹⁸ In our observational study mean HbA_{1c} was 7.50% . Suchlike findings also observed by a study reported by Manski-Nankervis et al., 2019.²⁰ In their study they found an average HbA_{1c} 7.3%. We also observed that mean eGFR was 33.03.

According to this observational study, it is observed that among all the antidiabetic regimens, 12.5% (43/344) of Diabetes patients received the combination of an SGLT2 inhibitor with metformin, in contrast to 28.8% (99/344) of DPP-4 inhibitor with insulin. None of the participants prescribed with GLP-1RA, thiazolidinediones, α glucosidase inhibitors. This could be due to the fact that these drugs are not recommended in DM with CKD patients except GLP-1RA. GLP-1RA is recommended but it is too expensive and most of participants of our study were from middle class family. This findings was comparable with other study where they observed DPP-4 inhibitors was most commonly prescribed drug (56.4%), followed by insulin (34.6%), biguanides (32.7%), SGLT-2 inhibitors (22.6%), sulfonylureas (11.6%), GLP-1 agonists (3.4%), α -glucosidase inhibitors (1.5%) and thiazolidinediones (0.7%)¹⁸. Nevertheless according to an Australian study, biguanides (81%) were most prescribed drug followed by sulfonylureas (52%) and DPP-4 inhibitor (38%).²⁰

KDIGO, 2022, Clinical Practice Guideline for Diabetes Management in Chronic Kidney Disease recommended an SGLT2 inhibitor in combination with metformin as first line treatment in Type 2 Diabetes Mellitus with CKD patients.¹² A study conducted by Saibal et al., 2018, in Bangladesh found that only 1.1% SGLT2 inhibitors were prescribed in their studies.²¹ In our study we found this number is increasing significantly. Metformin with SGLT2 inhibitor was less frequently prescribed may be due to low eGFR and high price. Majority of the participants had serum creatinine above 1.5mg/dl and with serum creatinine above 1.5mg/dl, FDA does not recommend to use metformin²². So we got less participants with metformin. In this study, most of the participants were treated with DPP-4 inhibitor with insulin where

majority of the participants were older with lower eGFR and higher HbA_{1c}. Only linagliptin is prescribed among all the other DPP-4 inhibitors. This may be due to linagliptin is safer for aged and renal impaired patients because no dose adjustment is required as linagliptin is biliary excreted.¹⁶ Insulin was more frequently prescribed to participants with uncontrolled glycemic control and also for limited medication choices among Diabetes patients with lower eGFR. Sulfonylureas was not used alone as a mono therapy but used in combination with metformin in 3.5% participants. This may be due to increase chance of hypoglycemia with sulfonylureas in patients with impaired renal function. Besides these drugs, insulin + SGLT2 inhibitor 18 (5.2%), DPP-4 inhibitor+ SGLT2 inhibitor 7 (2.0%), metformin + DPP-4 inhibitor 4 (1.2%), and metformin + insulin 1 (0.3%) combinations also prescribed.

In this study number of drugs per prescription was 2.7, which is almost similar to the WHO recommendation (1.6-1.8).²³ A comparable result was reported in a study conducted by Sada et al., 2015.²⁴ Higher results were reported in studies reported by Hafeez et al., 2020 (3.2).²⁵ This difference in average number of medicines can be due to different study population, co-morbidities and difference in physician prescribing behaviour. All the drugs in the present study were found to prescribe in trade name only, whereas WHO recommendation is 100%²³, like that of study carried out by Hafeez, et al., 2020.²⁵ Whereas 98% drugs prescribed by their generic name in Sada et al., 2015 study.²⁴ Physician's trust in the quality of trade medicine might be one of the reasons for this high number of drug prescribing in trade name in present study. Antibiotics are among the most commonly prescribed drugs in hospitals. At present antibiotic resistance is a matter of worldwide concern. In our study, percentage of encounters with an antibiotics were 4.7% only, which was much lower than the standard (20.0%-26.8%).²³ Percentage of encounters with an injections were 40.7% of total number of drugs which was much higher than the standard (13.4-24.1%)²³. Hafeez et al., 2020 reported that number of antibiotics and injections were 76.4% and

8.2% of total number of medicines respectively.²⁵ The percentage of injections in our study was high because majority of the participants were treated with insulin which is available only as par enteral route. The drugs prescribing from the national drug list of essential medicine in present study only 32.2%, which was much lower than the WHO recommendation (100%).²³ Our finding found much lower than the study conducted by Hafeez et al., 2020 (97.8%).²⁵ In our country, EDL was last updated on 2016. Only four antidiabetic drugs (glibenclamide, gliclazide, metformin and insulin) are included in EDL of Bangladesh.²⁶ Since 2016 many new antidiabetic drugs like DPP-4 inhibitors, SGLT2 inhibitors, GLP1 RA etc were included in the guideline but the EDL of Bangladesh did not included those drugs. Whereas our neighbourhood country, India, already included DPP4 inhibitor (Teleniglipatin) in their National List of Essential Medicines (NLEM). Pakistan also included DPP-4 inhibitor and SGLT2 inhibitor (empaglifozin) in their National Essential Medicine List. Though in our country the Essential Drug List of Bangladesh should updated in every 2 years but it did not update since last 7 years. So physicians could not use the newer antidiabetic drugs properly although they have good glycemic control with other cardiovascular and renal benefits. Hence only 32.2% drugs were prescribed from EDL of Bangladesh.

Limitatins

The study was carried out with a small size over a short period of time only from single institution. Cross sectional study can not establish causality.

Conclusion

In our study we've found that this combination is used more frequently in stage 3b of chronic kidney disease. However it can be seen that in the previous years, its usage have been lower than what it is now. So we can say that the prescribing of this combination of drugs has been increased in recent years.

Recommendations

Further study can be done in other tertiary level hospitals in Bangladesh to find out

the variations in the treatment. Further follow up study should be done on the participants receiving metformin and SGLT2 inhibitor combinations.

Funding: No funding sources.

Disclosures: The authors declared no conflict of interest.

References

1. Ogurtsova K, Guariguata L, Barengo NC, Ruiz PL, Sacre JW, Karuranga S, IDF diabetes Atlas: Global estimates of undiagnosed diabetes in adults for 2021. *Diabetes research and clinical practice*. 2022;183:109118.
2. Baena-Díez JM, Peñafiel J, Subirana I, Ramos R, Elosua R, Marín-Ibañez A, Risk of cause-specific death in individuals with diabetes: a competing risks analysis. *Diabetes care*. 2016;39(11):1987-95.
3. Hermansen K, Mortensen LS, Hermansen ML. Combining insulins with oral antidiabetic agents: effect on hyperglycemic control, markers of cardiovascular risk and disease. *Vascular Health and Risk Management*. 2008; 4(3): 561-74.
4. Ahmad NS, Islahudin F, Paraidathathu T. Factors associated with good glycemic control among patients with type 2 diabetes mellitus. *Journal of diabetes investigation*. 2014;5(5):563-9.
5. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *bmj*. 2000;321 (7258):405-12.
6. Shubrook JH, Neumiller JJ, Wright E. Management of chronic kidney disease in type 2 diabetes: screening, diagnosis and treatment goals, and recommendations. *Postgraduate Medicine*. 2022;134(4):376-87.
7. Stephens JW, Brown KE, Min T. Chronic kidney disease in type 2 diabetes: Implications for managing glycaemic control, cardiovascular and

- renal risk. *Diabetes, Obesity and Metabolism*. 2020 ;22:32-45.
8. Thomas MC, Cooper ME, Zimmet P. Changing epidemiology of type 2 diabetes mellitus and associated chronic kidney disease. *Nature Reviews Nephrology*. 2016;12(2):73-81.
 9. Koye DN, Magliano DJ, Nelson RG, Pavkov ME. The global epidemiology of diabetes and kidney disease. *Advances in chronic kidney disease*. 2018;25(2):121-32.
 10. Hoque S, Muttalib MA, Islam MI, Khanam PA, Akter N, Akber T. Prevalence of nephropathy with evaluation of HbA1c level and other associated risk factors in type 2 diabetic patients in a tertiary level hospital. *KYAMC Journal*. 2017 1;8(1):21-6.
 11. Afroz A, Alam K, Hossain MN, Biswas A, Ali L, Magliano DJ, Billah B. Burden of macro-and micro-vascular complications of type 2 diabetes in Bangladesh. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2019;13(2):1615-22.
 12. Rossing P, Caramori ML, Chan JC, Heerspink HJ, Hurst C, Khunti K. KDIGO 2022 clinical practice guideline for diabetes management in chronic kidney disease. *Kidney international*. 2022;102(5):S1-27.
 13. Cherney D, Lund SS, Perkins BA, Groop PH, Cooper ME, Kaspers S. The effect of sodium glucose cotransporter 2 inhibition with empagliflozin on microalbuminuria and macroalbuminuria in patients with type 2 diabetes. *Diabetologia*. 2016;59:1860-70.
 14. Jain S, Upadhyaya P, Goyal J, Kumar A, Jain P, Seth V. A systematic review of prescription pattern monitoring studies and their effectiveness in promoting rational use of medicines. *Perspectives in clinical research*. 2015;6(2):86-90.J
 15. Kennedy J, Erb C. Prescription noncompliance due to cost among adults with disabilities in the United States. *American journal of public health*. 2002 Jul;92(7):1120-4.
 16. Tsai KY, Chen S, Chou CW, Tzeng TF, Lee YJ, Chen ML. Quality of care and prescription patterns among patients with diabetic kidney disease—a large-scale cohort study from Taiwanese clinics. *PeerJ*. 2022;10:e13636.
 17. Huri HZ, Lim LP, Lim SK. Glycemic control and antidiabetic drugs in type 2 diabetes mellitus patients with renal complications. *Drug design, development and therapy*. 2015 Aug 7:4355-71.
 18. Abreu R. Prevalence of Antidiabetic Drugs Prescription in Type 2 Diabetes and Chronic Kidney Disease Patients from Tâmega e Sousa. *J Diabetes Treat*. 2022;7:1097.
 19. Tanvir S, Butt G, Taj R. Prevalence of depression and anxiety in chronic kidney disease patients on haemodialysis. *Ann Pak Inst Med Sci*. 2013;9(2):64-7.
 20. Manski-Nankervis JA, Thuraisingam S, Sluggett JK, Kilov G, Furler J, O'Neal D, et al. Prescribing of diabetes medications to people with type 2 diabetes and chronic kidney disease: a national cross-sectional study. *BMC Family Practice*. 2019 Dec;20:1-1
 21. Saibal AA, Begum SA, Islam MZ, Akter MS. Trends of Prescriptions of Anti-Diabetic Drugs in Type-2 Diabetic Patients. 2011; 27 (6): 1164-65
 22. Sambol, N.C., Chiang, J., Lin, E.T., Goodman, A.M., Liu, C.Y., Benet, L.Z.. Kidney function and age are both predictors of pharmacokinetics of metformin. *The Journal of Clinical Pharmacology*, 1995; 35(11):1094-1102.
 23. Isah AO, Ross-Degnan D, Quick J, Laing R, Mabadeje AFB: The development of standard values for the WHO drug use prescribing indicators. ICUM/EDM/WHO. 2017;35(11):1094-1102
 24. Sada O, Tefera W, Demewz A. Assessment of Drug Use by Using Who's Prescribing and Health Facility Indicators in Kombolcha Health centers, Northeast Ethiopia. 2015;1(10):304-305.

25. Hafeez H, Akbar J, Munir AB, Qamar-uz-Zaman M, Faiz S, Abbas SM, Evaluation of rational drug use among pediatrics by using WHO core drug use indicators in selected hospitals of Pakistan. International Journal of Pharmaceutical Research. 2020 Jun(1). DOI:10.31838/ijpr/2020.SP1.088
26. Islam SM, Islam MT, Islam A, Rodgers A, Chow CK, Naheed A. National drug policy reform for noncommunicable diseases in low-resource countries: an example from Bangladesh. Bulletin of the World Health Organization. 2016 Apr 5;95(5):382.
TMSS Medical College Journal 2025; 24(21-28):