A Case Control Study of Type 2 Diabetes Mellitus among Patients Attending Medicine Department of Tertiary Care Hospital, Gurugram, Haryana.

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Abstract:

Introduction: Diabetes Mellitus (DM) is traditionally known as silent disease. Diabetes is no more restricted in urban areas only but is also established at rural areas as well. It is one of the leading cause of long term morbidity and a major health hazard in a developing country like India, therefore, it is pertinent to find its associated risk factors. **Objectives:** To study the clinical presentation and risk factors associated with type-2 diabetes mellitus patients attending SGT hospital. **Method**: It was a hospital based case control study done in medicine department of Tertiary Care Hospital, Gurugramusing the purposive sampling. There were 800 participants including 400 cases of type 2 diabetes mellitus and 400controls (age and gender matched).Information was collected on sociodemographic variables and risk factors using a pre-tested structured interview schedule. **Results:** The mean age among cases was 55.20$\pm$ 8.54 years and among control group was 53.96$\pm$9.29 years. The difference between education status and occupation of study subjects was found to be significant. Pain and numbness was the most common symptom which was 70.75%. On assessing risk factors, physical activity, the habit of smoking, family history and Body mass Index (BMI) had a positive association. **Conclusion:** The findings of the study revealed that a high proportion of risk factors such as family history of diabetes, literacy status, occupation, BMI, smoking and physical activity were prevalent in the type 2DM subjects.

Keywords: Body mass Index, Diabetes Mellitus, Sociodemographic, Tertiary care hospital.

Introduction:

The American Diabetes Association defines diabetes mellitus as "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels".[1] In 2019, diabetes was the direct cause of 1.5 million deaths and 48% of all deaths due to diabetes occurred before the age of 70 years. Another 460 000 kidney disease deaths were caused by diabetes, and raised blood glucose causes around 20% of cardiovascular deaths.[2]

Diabetes is slow in onset, most of the people are asymptomatic and as a result of this 66% remain undiagnosed and this causes a delay in the diagnosis by 8–12 years. The prevalence of diabetes is swiftly increasing over the globe at an alarming rate. According to the International Federation of Diabetes, 415 million adults around the world are suffering from diabetes, and it is estimated that the

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numbers will reach around 642 million by 2040.[3] In India, an estimated 7.8% of the population above 18 years of age has raised blood glucose levels or are on treatment for diabetes. Genetic predisposition combined with life style changes, associated with urbanization and globalization, contribute to this rapid rise of diabetes in India. Moreover, type 2 diabetes in the Indian population appears to occur at least a decade earlier compared to Europeans. This means that, in the next 10 – 20 years, productivity of the youth of our country could be seriously affected.[4] Type 2 diabetes affects how your body uses sugar (glucose) for energy. It stops the body from using insulin properly, which can lead to high levels of blood sugar if not treated. Over time, type 2 diabetes can cause serious damage to the body, especially nerves and blood vessels. Type 2 diabetes is often preventable. Factors that contribute to developing type 2 diabetes include being overweight, not getting enough exercise, and genetics. Early diagnosis is important to prevent the worst effects of type 2 diabetes. The best way to detect diabetes early is to get regular check-ups and blood tests with a healthcare provider. Symptoms of type 2 diabetes can be mild. They may take several years to be noticed. Symptoms may be similar to those of type 1 diabetes but are often less marked. As a result, the disease may be diagnosed several years after onset, after complications have already arisen. More than 95% of people with diabetes have type 2 diabetes. Type 2 diabetes was formerly called non-insulin dependent, or adult onset. Until recently, this type of diabetes was seen only in adults but it is now also occurring increasingly frequently in children. Diabetes is an emerging global epidemic and public health problem. In spite of the drastic increase in both the prevalence and incidence of type 2 DM worldwide, they have been especially spectacular in societies with economic transition. Diabetes patients, if not strictly monitored, develop multiple chronic complications leading to irreversible disability and death. Coronary heart disease, lower limb amputation, stroke are more common in diabetics. Micro vascular complications like diabetic nephropathy and retinopathy are severe health problems resulting in progressive worsening of the quality of life and premature death.[5] There are many studies describing natural history and risk factors of type 2DM in different populations, but still there is a paucity of studies conducted in population of Gurugram. Hospital based study would be more appropriate to include larger sample of type 2DM cases as compared to population based study. Hence it was decided to conduct a hospital based case control study to add knowledge in this regard among the population of Gurugram.

In view of the above, this study was conducted to study the clinical presentation of type 2 diabetes patients attending SGT hospital and to find the epidemiological correlates and risk factors associated with type-2 diabetes.

Method:

It was a hospital based case control study conducted among patients in SGT hospital. A total of 400 diabetic mellitus type 2(cases) and non-diabetic mellitus type 2(400) controls were recruited during the study period. People with fasting plasma glucose values of e $\geq$7.0 mmol/L (126 mg/dl), 2-h post-load plasma glucose e $\geq$11.1 mmol/L (200 mg/dl), HbA1c $\geq$6.5% (48 mmol/mol); or a random blood glucose $\geq$11.1 mmol/L (200 mg/ dl) in the presence of signs and symptoms were considered to have diabetes.[6]

Total 800 subjects were selected by using purposive sampling technique and divided into two groups i.e., case group (400 subjects) & Control group (400 subjects). Cases were defined as those who are known diagnosed diabetics and age above 18 years, as cases (Type2 Diabetes Mellitus). Controls were defined as those attended to medicine OPD and IPD of "Department of Medicine" SGT medical college Hospital, Gurugram during study period for other problems and with blood sugar levels within normal limits, which were age and gender matched with cases and who was willing to give his/her consent for the participation were included in the study. Person

who was unable to respond to questionnaire by any means (e.g. visual/hearing deficit, mentally unsound) and who did not agree to participate in the study were excluded and Pregnant women and critically ill persons were excluded. Patients who did not match for age and sex with selected cases, having history of cardio-vascular diseases, patients with fasting blood glucose ≥126 mg/dl or Random blood glucose level/ Post-prandial glucose ≥200mg/dl were excluded from controls.

The subjects were approached individually after ethical permission obtained from the institution of SGT, Gurugram. Hospital authority's permission were taken for data collection from the patients attended to medicine OPD for comparison age and gender matched healthy individuals as a control included in the study. Informed consent was taken from the sample to collect the data and confidentiality of the subjects was maintained. Guidelines of scale items were explained to participants. While queries were encouraged regarding unclear items. Weight in kg and height in cm of the study participants were recorded. Weight was recorded for each participant without shoes and heavy clothing, with standing erect using weighing machine to an accuracy of 0.5 kg using a standard procedure. Height was measured with a measuring tape to the nearest of 0.1 cm, using a standard procedure. Using the weight and height, body mass index (BMI) was calculated in Kg/m^2, for each subject. Socio demographic details include age, gender, educational status, occupational status, family type, living status, residence, monthly income, anthropometry (BMI) were collected. A pre-designed, pre-tested, and semi-structured questionnaire was used for collecting data by personal interview method. The questionnaire included questions on socio-demographic characteristics of the study subjects, anthropometric measurements, physical examination and the socio-economic status of the study subjects was assessed using Modified B G Prasad socio-economic scale.[7] Collected data was first entered in the MS Excel spreadsheet and coded appropriately. The comparison between cases and controls were analyzed using Pearson's Chi-square test of significance and odds ratio wherever applicable. The level of significance was considered at $p< 0.05$. All statistical analyses were performed using SPSS software version 21.

Results:

Table 1 shows that the mean age among cases was 55.20± 8.54 years and among control group was 53.96±9.29 years. The age range was 46 (minimum = 33 years, maximum = 79 years). There was no statistical difference between the distribution of age of cases and control. (P =0.12). The observed similarity among case and controls is because of frequency matching conducted during selection of study subjects. Among all the study participants, 474(59.25%) were males and 326(40.75%) were females. Among (400) cases 68(17%) were illiterate, 231(57.75%) were educated till secondary and senior secondary while 74(18.50%) were graduate and above. Among cases graduate 74(58.74%) were more as compared to control group 52(41.26%). This difference was found to be statistically significant. (P< 0.001). The possible reason behind observed finding may be association between education and income. Higher educated people might be earning more and so living a more urbanized life style. Among all the study participants (800) most of them were unskilled or semiskilled 526(65.75%); while 60(7.5%) were unemployed, 135(16.89%) were retired. Out of 60 unemployed, cases constituted 31(51.66%) and rest 29(48.34%) belonged to control group. Similar distribution was found among those involved in unskilled occupation (314), 173(55.10%) were cases and 141(44.90%) were controls. Out of 212 semiskilled, cases constituted 93(43.86%) and rest 119(56.14%) belonged to control group. Out of 79 skilled occupation, cases were 31(39.24%) and rest 48(60.76%) were control group. Out of 135 retired, cases were 72(53.30%) and controls were 63 (46.67%). The difference in

distribution of cases and controls among different occupation was found to be statistically significant (p=0.02). It was observed that, 308(38.50%) of the study subjects belonged to socio economic class (II), followed by 245(30.62%) socioeconomic class (I), 133(16.62%) in class (III), 81(10.13%) in class (IV) and 33(4.13%) of the subjects belonged to class(V) respectively. Out of 245 class (I), cases constituted 130(53.06%) and rest 115(46.94%) belonged to control group. Out of 308 class (II), cases constituted 155(50.32%) and rest 153(49.68%) belonged to control group. Out of 133 class (III), cases constituted 59(44.36%) and rest 74(55.64%) belonged to control group. Out of 81 class (IV), cases constituted 39(48.15%) and rest 42(51.85%) belonged to control group. Out of 33 class (V), cases constituted 17(51.52%) and rest 16(48.48%) belonged to control group. This difference was found to be

Table 1: Association between socio-demographic variables among cases and controls(N=800)

Variables	Cases(%) (n=400)	Control(%) (n=400)	Total(%) (n=800)	chi square p value
Age group (in years)				
30-45	52 (41.94)	72 (58.06)	124 (100)	4.21*
46-60	189 (50.40)	186 (49.60)	375 (100)	0.12#
>60	159 (52.82)	142 (47.18)	301 (100)	
Gender				
Male	239 (50.42)	235 (49.57)	474 (100)	0.08*
Female	161 (49.38)	165 (50.62)	326 (100)	0.77#
Literacy				
Illiterate	68 (53.54)	59 (46.56)	127 (100)	57.09*
Primary	27 (20.77)	103 (79.23)	130 (100)	<0.001#
Secondary	126 (51.64)	118 (48.36)	244 (100)	
Higher secondary	105 (60.70)	68 (39.10)	173 (100)	
Graduate	74 (58.74)	52 (41.26)	126 (100)	
Occupation				
Unemployed	31 (51.66)	29 (48.34)	60 (100)	10.77*
Unskilled	173 (55.10)	141 (44.90)	314 (100)	0.03#
Semiskilled	93 (43.86)	119 (56.14)	212 (100)	
skilled	31 (39.24)	48 (60.76)	79 (100)	
Retired	72 (53.33)	63 (46.67)	135 (100)	
Socio-economic status				
Class I	130 (53.06)	115 (46.94)	245 (100)	2.76*
Class II	155 (50.32)	153 (49.68)	308 (100)	0.59#
Class III	59 (44.36)	74 (55.64)	133 (100)	
Class IV	39 (48.15)	42 (51.85)	81 (100)	
Class V	17 (51.52)	16 (48.48)	33 (100)	

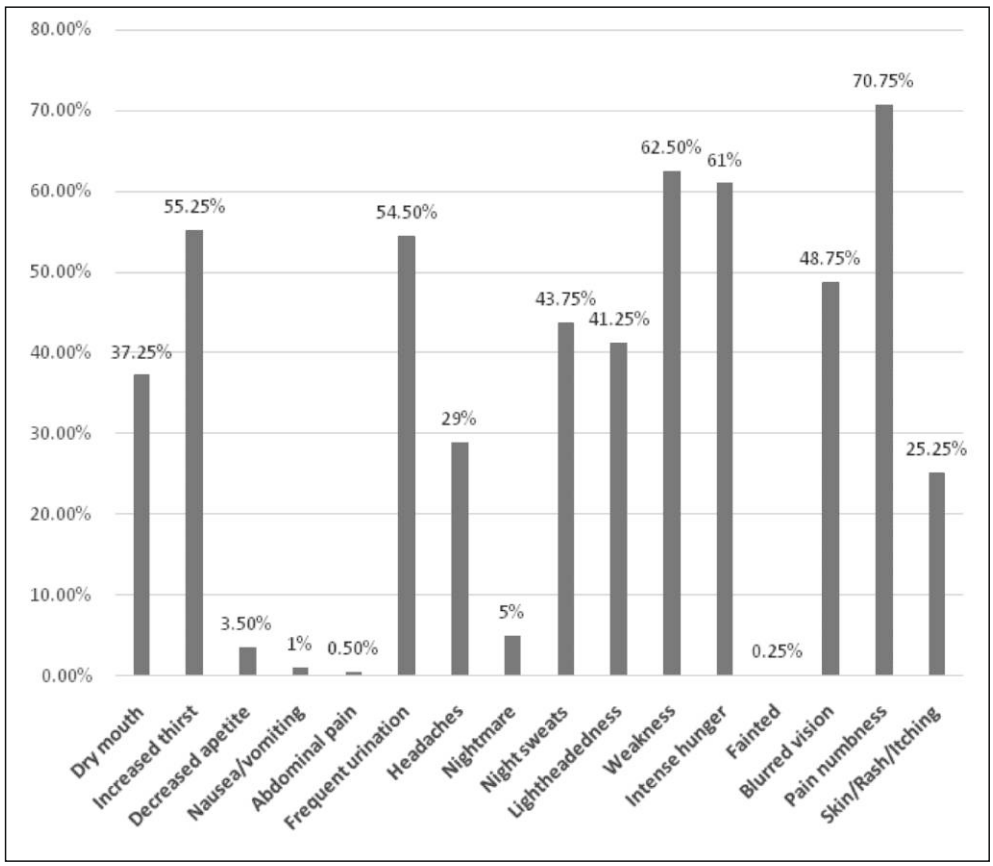
***χ^2 value #p-value, p-value < 0.05 considered as statistically significant**

statistically non-significant (p = 0.59). Study population has the similar lifestyle in respect of socioeconomic class.

Figure 1 shows that most of the subjects had multiple symptoms. Pain and numbness was the most common presenting symptom 70.75%. Weakness was second most common symptom 62.50% which was more in <60yrs age group. Intense hunger was 61% and increased thirst was 55.25%. Frequent urination was symptom of approximately half of the subjects (54.50%). Dry mouth (37.25%), headaches (29%), lightheadedness (41.25%), night sweats (43.75%), blurred vision (48.75%) and itching/rash (25.25%) were common symptoms. Other symptoms were like decreased appetite (3.50%), vomiting (1%), abdominal pain (0.50%) and nightmare (5%).

Table 2 shows that habit of smoking was almost double among cases144(66.06%) then control group74(33.94%). This difference was found to be statistically highly significant (p=<0.00001) [OR 2.48,CI(1.79-3.43)]. Habit of drinking alcohol was more among cases 115(54.50%) as compared to control group96(45.49%). This difference was found to be statistically non-significant (p=0.13) [OR 1.28 CI (0.93-1.75)]. The cases may be occasional alcoholics. Among all the study participants (800) only 40(5%) subjects were having habit of tobacco chewing,760(95%) were non tobacco chewers. Among tobacco users 21(52.50%) were control and rest 19(47.50%) were cases. Among non-tobacco chewers 381(50.14%) were cases and rest 379(49.86%) were control. This difference was found to be statistically non-significant (p=0.74) [OR 0.90 CI (0.48-1.7)].

Figure 1: Distribution of cases according to their symptoms (N = 400)



*** Multiple Responses**

Table 2: Association between risk factors among cases and controls (N=800)

Risk factors	Response	Cases (n=400) (%)	Controls n=400 (%)	chi square p value	Odds ratio 95% CI
Smoking	**Yes**	144 (66.06)	74 (33.94)	30.89* <0.001#	2.48 (1.79-3.43)
	No	256 (43.99)	326 (56.01)		
Alcohol use	**Yes**	115 (54.50)	96 (45.49)	2.32* 0.13#	1.28 (0.93-1.75)
	No	285 (48.38)	304 (51.62)		
Tobacco chewing	**Yes**	19 (47.5)	21 (52.5)	0.11* 0.75#	0.90 (0.48-1.7)
	No	381 (50.14)	379 (49.86)		

#p-value, p-value <0.05 considered as statistically significant, *χ^2 value

Table 3 shows that among all the study participants (800) approximately half of the subjects 424(53%) were doing moderate physical activity, followed by 231(28.88%) who were doing heavy physical activity and 145(18.13%) were involved in light physical activity. Among those involved in light physical activity 85(58.62%) were cases and rest 60(41.38%) were control group. Among those involved in moderate physical activity 245(57.78%) were cases and rest 179(42.22%) were control group. Among those involved in heavy physical activity 70(30.30%) were cases and rest 161(69.70%) were control group. Thus, the proportion of cases is lesser among those with better physical activity and this was found to be statistically significant. (P<0.001). It was found that number of fathers is more than mothers who had history of Type 2 diabetes in this observation similarly males are more affected than females in our study table 3. This difference was found to be statistically significant(P <0.001). Among all the study participants (800), almost half of the subjects 425(51.87%) were overweight and above. Similarly, approximately half of the control group were having normal weight and below 194(48.50%). Out of 83 underweight, 32(38.55%) belonged to cases and rest 51(61.45%) were control. Out of 302 normal weight, 108(35.76%) belonged to cases and rest 194(64.24%) were control. Out of 310 over weight, 189(60.97%) belonged to cases and rest 121(39.04%) were control. Out of 105 obese, 71(67.62%) belonged to cases and rest 34(32.38%) were control. This difference was found to statistically highly significant (p<0.001)

Discussion:

In the present study, the mean age of the cases (diabetic type 2, N=400) was 55.20 years (SD 8.54). Out of 400 cases(diabetic type 2), 189(47.25%) were in 45-60 age group, 159(39.75%) in >60yrs and 52(13%) in 30-45 age group. Similarly out of 400 controls, 186(46.50%) were in 45-60 age group, 142(35.50%) in >60yrs and 72(18%) in 30-45 age group. This finding is comparable with that reported in the study done by Jain S K et al[8] where reported mean age of cases was 54years ± 12.30.Similarly in another hospital based study conducted in Rajasthan ,majority of the diabetic patients (96.0%) were aged more than equal to 30 years.[9] However, in a community based study conducted by Kundaswamy et al[10] in Puducherry, the mean age group among diabetics was 52.49±9.72 and majority belonged to 40-49 years.

Table 3: Association between different parameters among cases andcontrols (N=800)

Parameters	Classification	Cases n=400 (%)	Controls n=400 (%)	chi square p value
Physical Activity	**Light**	85 (58.62)	60 (41.38)	50.43*
	Moderate	245 (57.78)	179 (42.22)	<0.001#
	Heavy	70 (30.30)	161 (69.70)	
Family History	**Only father**	90 (78.26)	25 (21.74)	212.84*
	Only mother	82 (82.82)	17 (17.18)	<0.001#
	Both Parents	4 3(93.48)	3 (6.52)	
	No history	155 (30.57)	352 (69.43)	
	Cousin	30 (90.90)	3 (9.10)	
BMI	**Underweight**	32 (38.55)	51 (61.45)	56.79*
	Normal	108 (35.76)	194 (64.24)	<0.001#
	Overweight	189 (60.97)	121 (39.04)	
	Obese	71 (67.62)	34 (32.38)	

 # p-value <0.05 = statistically significant, *χ^2 value

In the present study out of (400, diabetic type 2) study subjects the proportion of 239(59.75%) male were more than 161 (40.25%) female. This finding is comparable with study conducted by Patel M et al[11] who reported that out of the 622 subjects, 384 (62%) were male and rest 238(38%) were female. Similarly in the study conducted by Balakrishnan Valliyot et al[12], it was found that that diabetes is common among males than females. In the study Grover et al (2005)[13] showed a significant correlation between diabetes and educational status in India which is similar to the above study. In the present study, the difference in distribution of cases and controls among different occupation was found to be statistically significant (p=0.02). Reason for higher diabetics among unskilled study subjects may be higher possibility of drug abuse (e.g. alcohol, smoking) or high carbohydrate diet. In the National Urban Diabetic Survey (NUDS) an increased prevalence of diabetes was noticed among the retired and unemployed.[14]

In the present study, most of the subjects had multiple symptoms. Pain and numbness was the most common symptom which was 70.75%. Weakness was second most common symptom 62.50%. Frequent urination was symptom of approximately half of the subjects followed by other common symptoms. This finding is comparable to the study done by Mayega RW et al[15] where two clinical symptoms were present in almost all new patients: Frequent urination (100%) and frequent thirst (79%). This finding is comparable with that reported in the study by Patel M et al[11] in which it was found that that out of the 622 subjects, 273 (44%) had nocturia, 192 (31%) had polyuria, and 145 (23%) had polydypsia. However, 57 (9%) subjects presented with vision impairment. The proportion of cases is lesser among those with better physical activity and this was found to be statistically significant (P<0.001). Similar findings of significance of association of DM with physical activity were reported by studies done by Ramachandran A et al[16] and Majgi SM et al[17] who reported prevalence of diabetes decreased significantly as the physical activity level increased. In the present study, habit of smoking was almost double among cases 144(66.06%) than control group 74(33.94%). This

difference was found to be statistically highly significant (p<0.001) and odds ratio 2.48, CI 95% (1.79-3.43). In a study done by MA Rahim et al[18], almost 13% of newly detected diabetic patients were smokers in this study and this rate was over 25% for those having diabetic nephropathy.

In the present study, out of 400 cases, 155(38.75%) had no family history of Type II DM, 90(22.50%) had history of Type II DM in father, 82(20.50%) had history of Type II DM in mother, 43(10.75%) had history of Type II DM in both parents and 30(7.50%) had history of Type II DM in cousins. Out of total 400 controls, 352(88%) had no history of Type II DM, 25(6.25%) had history of Type II DM in father, 17(4.25%) had history of Type II DM in mother, 3(0.75%) had history of Type II DM in both parents and 3(0.75%) had history of Type II DM in cousins. This difference was found to statistically significant.(P <0.001) In a study conducted by Patel M et al [12] found that out of the 622 subjects 67% had a positive family history of diabetes. Sanjay D Bhalerao et al., 2014 reported that the odds of diabetes among those with family history of T2DM (in terms of parental history) were 35.97 times as compared to those without a family history of T2DM.[19]

It was found in the present study that diabetes was higher in the subjects who were overweight and obese. This difference was found to statistically highly significant(p<0.001). This study is comparable with study done by Patel M et al[11] found that out of the 622 subjects, the majority (68%) of the T2DM subjects were obese. Similar findings were reported by many studies. In a case control study conducted by A. Awasthi et al[20] in South India, the proportion of cases with Body Mass Index (BMI) e" 25 kg/m^2 was 55% as compared to 22% of controls and this asso-ciation was statistically significant (p < 0.05).Similarly, Ramchandran A et al [16] and Sumanth MM et al [17] studies reported independent predictor nature of BMI for development of diabetes. Hence early identification of high BMI, would give opportunity for primary prevention and early diagnosis of the diabetes. Also, it would suggest that Indians, especially, have to maintain lower BMI to prevent diabetes.

Study Limitations:

A key limitation of this study was the sample size estimation which was based on the convenience sampling that is selecting study participants who were easily accessible at the time of study.

Conclusion:

The difference between education status and occupation of study subjects was found to be significant. Pain and numbness was the most common symptom which was 70.75% followed by weakness (62.50%), intense hunger(61%), increased thirst (55.25%) and frequent urination (54.40%). On assessing risk factors, physical inactivity, the habit of smoking, family history of diabetes and Body mass Index (BMI) had a positive association.

Recommendations:

Simple steps such as awareness will increase the knowledge of Diabetes among care givers. Health education regarding diabetes should be provided to improve knowledge and to bring about positive attitude. Education programs for improvement in modification of life styles may be done by providing leaflets on prevention of complications of diabetes which include activities like aerobic exercise, gardening, mopping etc. Quality physical education supports children to develop behaviour patterns that will keep them physically active throughout their lives. Recreation facilities and sports provide opportunities for everyone to keep physically active. IEC (Information Education and Communication) /BCC (Behaviour change communication) should be developed particularly in rural areas/among less educated/unemployed or unskilled persons in terms of campaigns on diabetes.

Declaration:

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Conflict of interest: None

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