

Predicted Complications Factors among Patients with Diabetes Mellitus: Suggested Nursing Map of Care

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Abstract: Background: Diabetes mellitus is one of the most threatening diseases with increasing incidence worldwide; and its onset raises the risk of several complications. **The aim** of the current research was to predict the factors leading to complications among patients with diabetes mellitus as well suggest nursing map of care at a selected University Hospital-Egypt. **Research Questions: Q1:** What are the predicted complications factors among patients with diabetes mellitus? **Q2:** What is the suggested nursing map of care for patients with diabetes mellitus? **Design:** Predictive-Non-experimental-cross sections design was utilized to achieve the aim of the current research. **Tools: I:** Demographic & Medical Data form; pertinent to age, gender, medications, blood glucose level, physical symptoms as polydipsia, polyphagia...etc. **II:** Diabetes Self-Management Questionnaire (DSMQ). **Setting:** The study was conducted in the medical departments and the out-patient clinic at a selected University Hospital-Egypt. **Subjects:** A convenient sample of 194 adult male & female patients over six months; who diagnosed with type I or type II diabetes mellitus were recruited in the current study. **Results:** 35.6% of the study sample their age was 40 to less than 50 years with the Mean+SD = 44.8+11.5. Females represented 60.8% and 79.9% of the study sample had no family history of diabetes Mellitus. The study draw attention to polyuria as it was the highest predictor regarding physical symptoms of diabetes mellitus $R^2 = 0.52$ with prediction 52%. While HgA1C was the least predictor $R^2=0.073$ with prediction 7.3% at $P=0.000$. Regarding physical illnesses, hypertension was the highest predictor regarding physical illness of diabetes mellitus as $R^2=0.23$ as predicts it with 23%, with moderate correlation as $r = 0.48$. While Diabetic foot was the least predictor $R^2=0.079$ with prediction 7.9% at $P=0.000$. Also, checking blood glucose level was the highest predictor regarding diabetes self-management as $R^2= 0.22$ as predicts it with 22%, with moderate correlation as $r=0.47$ in addition; BMI was the least predictor $R^2=0.066$ with prediction 6.6% at $P=0.000$. **Conclusion:** The findings documented the following as the most physical symptoms, physical illness and self-management predictors that predict the factors leading to diabetes mellitus complications: Polyuria, hypertension and checking blood glucose level respectively. **Recommendation:** Understanding factors leading to complications among diabetic patients either with type I or type II is required. In addition to follow the nursing instructions according to the nursing map of care for those patients to enhance quality of patient's care and decline further complications. **Key words:** Diabetes mellitus, complications, Predicted factors of D.M's complications, nursing map of care.

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I. Introduction

Diabetes mellitus (DM) is a chronic disease caused by hereditary and/or acquired deficiency in the production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. Such as deficiency results in increased concentrations of glucose in the blood, which damage many of the body's systems, particularly the blood vessels and nerves (World Health Organization [WHO]-Fact sheet138, 2018). Several types of diabetes mellitus are existed; however, there are two major forms of the disease. Type 1 diabetes, formerly referred to as insulin-dependent diabetes mellitus (IDDM) or juvenile-onset diabetes, usually arises in childhood. Type 2 diabetes formerly called non-insulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes, usually occurs after age 40 and becomes more common with increasing age (Britannica School, 2018).

The United States, estimated prevalence of diabetes mellitus is between 4.4% and 17.9 %. While diabetes has a major impact on quality of life and economics, the associated vascular complications result in approximately 14 % of US health care expenses (Tan, Malik, Nand, Tan, Basina, 2018). An additional study which conducted on 1405 individuals aged between 18 to 97 year; revealed that the prevalence of diabetes mellitus was 3.3%; while it was 2.0% for rural and 4.6% for urban dwellers. Urban dwellers, centrally obese, overweight, and hypertensive individuals have higher odds of getting diabetes mellitus. Also, diabetes mellitus is noticeably as an alarming disease subsequently, attention should be given to the control and prevention of diabetes mellitus and related complications (Anemaw and Seyoum, 2017). It has been remarked that nearly 425

million adults were living with diabetes mellitus and by 2045 this will rise to 629 million. Alongside most of them (79%) were living in low-and middle-income countries (International Diabetes Federation, 2017)

Acute and chronic Complications of diabetes mellitus are common among patients with type I or type II diabetes and all together, are responsible for significant morbidity and mortality. Risk factors for those patients can be modifiable or non-modifiable. Generally, diabetes complications are far less common and less severe in people with well-controlled blood sugar levels (Banach, Bekiari, Rizzo and Edmonds 2018 & International Diabetes Federation, 2019). However, (non-modifiable) risk factors such as age at diabetes onset, type of diabetes, gender and genetics play a role. Some genes appear to provide protection against diabetic complications, as seen in a subset of long-term diabetes type 1 survivor without complications (Porta, et al. 2016).

Furthermore a study conducted over 100,606, with newly diagnosed type II diabetes enrolled in the Swedish National Diabetes aimed to assess the risk factors changes over time from diagnosis of type II diabetes revealed that; there was differences in Body Mass Index (BMI), blood glucose and lipid levels remained with adjustment for potential confounders, including marital status, education and country of birth, and, where relevant, differential treatments by age, and in those with at least 5 years of follow-up (Steinarsson, Rawshani, Gudbjörnsdottir, Franzén, Svensson and Sattar, 2018). Treatment of diabetes can decrease the risk of developing the complications of diabetes (American Diabetes Association, 2018). Also, A study conducted by (Asif, 2014) related to the modification of the effective lifestyle, added that the healthy dietary pattern, physical activity...etc. must be emphasis on promoting a healthier lifestyle and finding solutions in order to increase adherence and compliance to the lifestyle modifications; especially for high-risk diabetic patients.

All risk factors which might worsen the diabetic patients' condition must be into consideration so, the nurse as one of the health team care should apply and use all these factors in the form of nursing map of care and build the logic relations. And as nursing map of care is an easy-to-construct, visual tool; based on multifactor as disease, patient life style ...etc., it helps the nurse to organize patients' assessment data, identify patient problems, determine the appropriate nursing diagnoses and interventions, and assess the outcomes as well it is covering the diseases and disorders which will be encountered most often in the clinical practice. It also helps the nurse to develop the critical-thinking skills that she needs to plan safe and effective nursing care. In addition, it is immediately enabling the nurse to figure out the relationship between the patient's problem, the underlying condition and the clinical response and also highlights the relationships between medical and nursing diagnoses, history and physical assessment data, treatments, medications and laboratory data (Wittmann-Price, Thompson, Sutton and Eskew, 2013).

Recently; it was found, by following the prediction studies that they could help in such forecasting health condition of similar patients with the same health problems and enable them to avoid or delay occurrence of these related health problems; in other word predictive modeling can be applied to any type of unknown event; as it is more commonly referred to in academic or research and development contexts (Final, 2014). A predictive study was conducted by Usta, Dikmen, Songül and Berdo (2019) but focusing on predictors foot care behavior for patients with diabetes mellitus only and suggested that health personnel should not ignore the factors associated with diabetic foot care behaviors. Apparently; using predictive models in health considers a recent perspective as in 2009 Parkland Health & Hospital System began analyzing electronic medical records in order to make use of predictive modeling to lend a hand in identifying patients who are at high risk of readmission. Primarily the hospital focused on patients with congestive heart failure, but the program has expanded to include patients with diabetes, acute myocardial infarction, and pneumonia. (Healthcare Research and Quality, 2014).

Thus, the aim of the current study was to predict the factors leading to complications among patients with diabetes mellitus as well suggest nursing map of care at a selected University Hospital.

Theoretical framework

Predictive model was the framework which the researchers applied. In deed many references set the predictive model in too concise three main steps and others elaborated it into ten steps. After thorough reading the researchers follow the focused six main steps as it is a process involves running algorithm on data for prediction as the method fit knowledge for fulfillment. Below are the applied phases of the predictive model which were followed by the researchers.

1. Scope and define the predictive analytics model: By set the objective and identify the target. **2. Data Gathering and Cleansing:** Initially it started by gather data from related sources to extract needful information by cleansing operations to remove noisy data so that prediction can be accurate. **3. Data Analysis/Transformation:** For the normalization of the data; it needs to be transformed for efficient processing. Scaling the values to a range normalization so that significance if data is not lost; as well by removing irrelevant elements by correlation analysis to determine final outcome. **4. Building a Predictive Model:** Predictive model uses regression technique to build the predictive model by the use of classification algorithm. **5. Evaluate the**

data: Identify test data and apply the classification rules to check the efficiency of classification model against test data. **6. Inferences/Evaluation:** To make inferences perform cluster analysis/map and create data groups (EDUCAB, 2019 & Visionedge, 2019).

Significance of the study:

Based on WHO, (2019). There are 422 million patients with diabetes mellitus all over the world and there is globally agreed target to stop the rise in diabetes and obesity by 2025. Also WHO, (2018) found that diabetes was the seventh leading cause of death in 2016. They added that diabetes prevalence has been rising more rapidly in middle-and low-income countries. Furthermore, WHO aim is surveillance, prevention and control of diabetes and its complications, particularly in low and middle-income countries. And they recommend providing scientific guidelines for the prevention of major non-communicable diseases including diabetes; develops norms and standards for diabetes diagnosis and care in addition to conducts surveillance of diabetes and its risk factors.

It could not found sufficient recent studies focus on multifactor's research results which might worsen the diabetic patients' condition as most of these studies only highlighted one factor as nutrient or physical activity independently...etc. On the other hand no adequate Egyptian nursing studies built their management on mapping of care for patients with diabetes mellitus related clinical, medication adherence...etc. Thus, in the light of the above; it was crucial to conduct such a study aims to find related diabetes complications factors in order to develop a suggested nursing map of care which could help in the building of both the identification of the predicted risk factors and support the nursing care process, which consequently enhance the quality of nursing care and improve outcomes for patients with diabetes mellitus by minimizing the occurrence of further future complications subsequent to their illness.

II. Subjects & Methods

Aim of the study:

The aim of the current study was to predict the factors leading to complications among patients with diabetes mellitus as well suggest nursing map of care at a selected University Hospital-Egypt

Research Questions:

Q1: What are the predicted complications factors among patients with diabetes mellitus?

Q2: What is the suggested Nursing Map of Care among patients with diabetes mellitus?

Research design:

Predictive-Non-experimental-cross sections study; aimed to predict and primary focus on some variables of interest. It investigates the use of risk prediction in health care for informing individuals and for assisting decision making. This intended health care use has implications for the choice of variables (predictors), outcome and study population (Janssens & Martens, 2018). Thus in the current study the factors leading to complications progression considers the predictors; among patients with diabetes mellitus then suggest nursing map of care in the light of that results; at a selected University Hospital.

Setting:

The study was conducted at the medical departments and the out-patient clinic at one of Educational Hospital; Egypt.

Subjects:

A convenient sample over 6 consecutive months, (194) adult male & female patients was included. To attain diversity; the inclusion criteria which the researchers followed were; patients diagnosed with type I or type II diabetes mellitus. Their age was 18 years old and /or above.

Tools:

In order to achieve the purpose of the research; two tools were used to gather data pertinent to the study variables as follows:

Tool I: Demographic & Medical Data form; developed by the researchers including **A-**Questions related age, gender...etc. in addition to other questions related to medical part; Medications, sugar level...etc. Lab investigations as Vitamin D, folic acid...etc. **B-1-** Questions of physical symptoms as polydipsia, polyphagia...etc. **B-2-** Medical/physical diseases: as obesity, hypertension, kidney...etc. Content Validity of the tool was established by juries of expertise also its reliability was tested by the current researchers; as Cronbach's alpha= 0.67.

Tool II: Diabetes Self-Management Questionnaire (DSMQ) developed by Schmitt, Gahr, Hermanns, Kulzer, Huber & Haak, (2013) and its validity and reliability was established with high of the overall internal consistency (Cronbach's alpha=0.84).

Ethical consideration:

An official permission was taken from the ethical committee. The study was conducted in accordance with the Helsinki Declaration. Each patient was informed about the nature and purpose of the study. Then consent was obtained from all patients to participate in the study. The researchers emphasized that participation in the study is entirely voluntary; anonymity and confidentiality are assured though coding the data.

Pilot study:

Once permission was granted to proceed with the proposed study, a pilot study was carried out before starting data collection twice; the first pilot was performed on 20 targeted patients who were excluded from the study because (Tool I) was not clear enough and need modification; the researchers modified it and re-performed the second pilot on another 20 patients to re-evaluate its clarity, feasibility and applicability as well as estimate the time needed to collect data. Also, panel of three juries' expertise were review the utilized tools for its validity; the 2nd pilot study was included in the current study. Finally the used tools were valid and reliable before proceeding in the research data collection.

Procedure:

Once permission of the study was obtained; the researcher was proceed in the study and initiated data collection by following the above mentioned theoretical framework. Predictive Model steps was applied pragmatically as follows: **1. Scope and define the predictive analytics model;** the researchers defined the target population who met the inclusion criteria which was patients with Diabetes Mellitus either type 1 or type 2 then informed them about the nature and the aim of the current study; after that got their consent. **2. Data Gathering and Cleansing (the data collection phase);** by using Tools (I & II) the researchers gathered the data individually using structured interview. **3. Data Analysis/Transformation (Analytical phase);** the researchers analyzed the gathered data by using descriptive for the normalization of the data and inferential statistics by removing irrelevant elements by correlation analysis to determine the final outcome. **4. Building a Predictive Model;** (Predictive model Phase) by using the regression technique to build the prediction, built and communicated the results. **5. Evaluate the data:** The researchers checked efficiency of classification model against test data in research questions. **6. Inferences/Evaluation (Constructive phase);** the researchers built the Nursing map of care based on the predictors results.

Operational Definition:

Predicted Complications Factors:

All found factors which either could have negative impact on the diabetic patients' condition which might lead to further complications or already start its negative effect for patients with diabetes mellitus in the future.

Nursing Map of Care:

In the current study nursing map of care is a method to identify goals, outcomes, & interventions for diabetic patient's related complications in a form of diagram based on the predicted factors and its relations with diabetic complications.

Statistical analysis:

The data was coded and tabulated using a personal computer. Statistical Package for Social Science (SPSS) version 20 was used. Data was presented using descriptive statistics in the form of frequencies and percentage...etc. Inferential tests were utilized as correlation tests and regression analysis...etc., in relation to research variables. Statistical significance was considered at P-value < 0.05.

III. Results

Statistical findings of the current study are presented in three main sections as following: **Section 1:** Represents subjects demographic characteristics and their Medical data (Tables: 1, 2-a, 2-b, 3, 4 & 5); while **Section 2:** Answers the first question in form of correlations and regression result in order to predict the complications factors among patients with diabetes mellitus; (Tables; 6-a, 6-b, 6-c). Finally **Section 3:** Elaborate nursing map of care based on the current study predictors (Figure 1 & 2).

Section (1):

Table (1): Personal demographic characteristics among the study subjects (n= 194).

Variables		No.	%
Age:			
1.	20 yrs < 30 yrs	17	8.8%
2.	30 yrs < 40 yrs	44	22.7%
3.	40 yrs < 50 yrs	69	35.6%
4.	50 yrs < 60 yrs	38	19.6%
5.	60 yrs < 70 yrs	23	11.9%
6.	≥ 70 yrs	3	1.5%
Mean ± SD		44.8+11.5	
Gender:			
1.	Male	76%	39.2%
2.	Female	118	60.8%
Marital Status:			
1.	Single	35	18%
2.	Married	138	71.1%
3.	Widowed	17	8.8%
4.	Divorces	4	2.1%
Education Level:			
1.	Cannot read or write	9	4.6%
2.	Can read and write	53	27.3%
3.	Primary School	23	11.9%
4.	Preparatory School	40	20.6%
5.	Secondary School	31	16%
6.	Diploma	8	4.1%
7.	Bachelor	2	1%
8.	Post graduate	28	14.4%
Profession:			
1.	Does not work	28	14.4%
2.	House wife	79	40.7%
3.	Casual Work	43	22.2%
4.	Technical	27	13.9%
5.	Employer	4	2.1%
6.	Retired	13	6.7%
Smoking			
1.	Yes	40	20.6%
2.	No	149	76.8%
3.	Stopped smoking	5	2.6%
Place of residence:			
1-	Cairo	101	52.1%
2-	Giza	79	40.7%
3-	Alexandria	1	0.5%
4-	Al-Fayoum	3	1.5%
5-	Swiss Canal	1	0.5%
6-	Port Saeid	2	1%
7-	Qaliubeya	5	2.6%
8-	Al-Sharkeia	2	1%
Family history of Diabetes Mellitus			
1.	Yes	39	20.1%
2.	No	155	79.9%

It was observed from table-1 that the mean of age was 44.8+11.5 and 35.6% of the patients' age was 40 yrs. to < 50 yrs. Females was 60.8%; 71.1% of them was married. 27.3%, can read and write while 20.6% had the preparatory level of education. 40.7% was house wife while 22.2% had a casual work. 76.8% of them were not smokers. Also 52.1% of them were living at Cairo, while 79.9% had no family history of diabetes Mellitus.

Table (2-a): Medical data of DM duration (yrs.) of illness, type, blood glucose measurements among the study subjects (n= 194).

Variables		No.	%
Since how many yrs. having DM?			
1-	<10 yrs.	117	60.3%
2-	10 yrs. < 20 yrs.	51	26.1%
3-	20 yrs. < 30 yrs.	21	10.8%
4-	30 yrs. < 40 yrs.	4	2%
5-	40 yrs. ≤ 50 yrs.	1	0.5%
Type of DM:			
1-	Type (I)	30	15.5%
2-	Type (II)	164	84.5%
Regularly measure blood glucose:			
1-	Yes	129	66.5%

2-	No	65	33.5%
Recent blood glucose Measurements levels:			
-Recent Blood glucose levels:			
1-	≤ 135 mg/dl	49	24.5%
2-	136 mg/dl < 170 mg/dl	42	19.2%
3-	170 mg/dl < 205 mg/dl	48	22.31%
4-	205 mg/dl < 240 mg/dl	36	17.9%
5-	240 mg/dl < 275 mg/dl	5	2.5%
6-	275 mg/dl < 310 mg/dl	8	4%
7-	310 mg/dl < 345 mg/dl	3	1.5%
8-	≥ 345 mg/dl	3	1.5%
Mean+SD		176.3+61.2	
Type of Recent Blood Glucose measurement:			
1-	Does not remember	1	0.5%
2-	Fasting	93	47.9%
3-	Post Prandial	42	21.6%
4-	Random	58	29.9%

From the above table; 60.3% of the patients had DM for less than 10 years. 84.5% had type II. 66.5% measures their blood glucose level regularly; 24.5% and 22.31% their blood glucose recently was less than 135 and between 170 up to 205 respectively; with Mean+SD=176.3+61.2. Also; 47.9% measured fasting blood glucose.

Table (2-b): Medical data of HbA1c among the study subjects (n= 194).

Variables	No.	%
Past HbA1c Measurements levels:		
- HbA1c Levels:		
1-	Never performed it	27.8%
2-	Performed	72.2%
Total Studied Patients		100%
Among performed HbA1c results (Patients=140)		
1-	Result Not available	13.5%
2-	< 6 %	0%
3-	6 % < 7 %	2.9%
4-	7 % < 8 %	15.7%
5-	8 % < 9 %	19.3%
6-	9 % < 10 %	27.9%
7-	10 % < 11 %	7.9%
8-	11 % < 12 %	12.1%
9-	≥ 12	0.7%
Total Studied Patients		100%
Mean + SD		5.7+4.6
Since how many yrs. measured HbA1c (Patients=140)		
1-	Did not remember	
2-	One yrs.	27.2%
1-	Two yrs	53.6%
2-	Three yrs	15%
3-	Four yrs	0%
4-	Five yrs	2.1%
5-	Six yrs	0.7%
6-	Seven yrs	0%
7-	8 yrs	0.7%
8-	9 yrs	0%
9-	10 yrs	0%
Total Studied Patients		100%
Mean + SD		0.7+1.2

*HbA1c 6= Mean of blood sugar =135, 7=170, 8=205, 9=240, 10=275, 11=310, 12=345 by; Davis (2019).

Table (2-b) Showed up that 72.2% performed the HbA1c and out from those patients 27.9% their HbA1c between 9-10 and 53.6% performed it up to one year ago.

Table (3): Medical data of the taken medications, BMI, taken Vit. Mineral and other existed diseases among the study subjects (n= 194).

Variables	No.	%
*Taken medications		
- Pain killer	23	11.9%
- Eyes drops	14	7.2%
- Atour	20	10.3%
- Asposide	22	11.3%
- Marivan	5	2.6%
- Concor	24	12.4%
- Capoten	12	6.2%
- Vit. B12	85	43.8%
- Melga	14	7.2%
- Aldactone	13	6.7%
- Zantac	23	11.9%
Mean + SD	1.4+1.2	
BMI Categories:		
1- Normal	82	42.3%
2- Over weight	53	27.3%
3- Obese class I	52	26.8%
4- Obese class II	6	3.1%
5- Obese class III	1	0.5%
Mean + SD	26.6+4.8	
Blood test of Vit. & minerals:		
1- Yes	9	95.5%
2- No	185	4.6%
*Other diseases:		
- Kidney stones	16	8.2%
- Urinary tract Infection (UTI)	34	17.5%
- Pulmonary	19	9.8%
- Vascular	21	10.8%
- Diabetic foot	30	15.5%
- Eyes	44	22.7%
- Neuritis	100	51.5%
Mean + SD	2.6+1.5	

*Total numbers is not mutually exclusive

*BMI Normal =18-24.9, Over weight =25-29.9, Obese class I 30-34.9, Obese class II =35-39.9 and Obese class III = ≤40. WHO expert consultation (2004).

Table (3) revealed that 43.8% take Vit. B12 and 42.3% followed by 27.3% their BMI was normal and overweight respectively. However 95.5% never examine vitamins D or minerals. 51.5% of them followed by 22.7% had neuritis and eyes problems respectively.

Table (4): Medical data of signs and symptoms associated with diabetes mellitus among the study subjects (n= 194).

Variables	Never		Rare		Sometimes		Always	
	No	%	No	%	No	%	No	%
-Polydipsia	116	59.8%	4	2.1%	58	29.9%	16	8.2%
-Polyuria	107	55.2%	6	3.1%	61	31.4%	20	10.3%
-Polyphagia	109	56.2%	5	2.6%	62	32%	18	9.3%
-Hypoglycemia	167	86.1%	9	4.6%	14	7.2%	4	2.1%
-Hyperglycemia	106	54.6%	24	12.4%	58	29.9%	6	3.1%
-Fatigue	57	29.4%	5	2.6%	29	14.9%	103	53.1%
-General weakness	51	26.3%	2	1%	16	8.2%	125	64.4%
-Skin dryness	173	89.2%	4	2.1%	7	3.6%	10	5.2%
Mean + SD	3.8+2.4							

*Total numbers is not mutually exclusive

The above table shows that Mean+SD of signs and symptoms associated with diabetes mellitus =3.8+2.4 and 64.4% had always general weakness; while 32% had sometimes polyphagia.

Table (5): Medical data of Diabetic Self Management Questionnaire total score (DSMQ) among the study subjects (n= 194).

Variable	Does not apply to me		Applies to me to some degree		Applies to me to a consider-able degree		Applies to me very much	
- Total Score of DSMQ	0	0%	160	82.5%	34	17.5%	0	0%
Mean + SD	12.5+3.7							

Table (5) Presents that Self-Management Questionnaire total score Mean+SD =12.5+3.7. Also 82.5% of them the diabetic self management parameters apply on them to some degree.

Section II:

Presents the correlations and the regression results which predicted the complications factors among patients with diabetes mellitus.

Table (6-a): Predictors of physical symptoms and related blood test among the study subjects (n= 194).

Predictors	r	R ²	ANOVA	P-Value	t-Value	P-value	Unstandardized Coefficient	
							B	SE
-Fatigue	0.57**	0.32	93.2**	0.000	9.6**	0.000	2.9	0.30
-Polydipsia	0.72**	0.52	210.4**	0.000	14.5**	0.000	3.4	0.24
-Polyuria	0.72**	0.52	209.8**	0.000	14.4**	0.000	3.4	0.23
-Polyphagia	0.69*	0.48	180.1**	0.000	13.4**	0.000	3.3	0.24
-Hypoglycemia	0.35*	0.12	27.8**	0.000	5.2**	0.000	2.5	0.49
-Hyperglycemia	0.44*	0.19	47.8**	0.000	6.9**	0.000	2.1	0.30
-General weakness	0.45*	0.21	51.0**	0.000	7.1**	0.000	2.4	0.34
-Sweating	0.53*	0.28	75.5**	0.000	8.6**	0.000	2.9	0.34
-Flushing	0.49*	0.24	60.8**	0.000	7.8**	0.000	3.5	0.45
-Skin dryness	0.36*	0.13	29.8**	0.000	5.4**	0.000	2.7	0.51
-HbA1c level	0.27*	0.073	15.2**	0.000	3.9**	0.000	-0.016	0.004
-Blood glucose level	0.020	0.000	0.075	0.78	0.27	0.78	-0.001	0.003

* P ≤ 0.05

Table (6-a) represents that there was ascending hierarchy in physical symptoms predictors as follows; HbA1c, hypoglycemia, skin dryness, hyperglycemia, general weakness, sweating, fatigue, polyphagia, and polyuria and polydipsia. HbA1c was the least predictor R²=0.073 with prediction 7.3%, while Polyuria was the highest predictor regarding physical symptoms of diabetes mellitus which = (0.52) as predicts it with 52%, a high correlation as r=0.72, with highly sig. variance and different of means at p=0.000 as 210.4 and 14.5 of ANOVA and t tests respectively. And every increase of standard error SE= (0.24) with one unit of polydipsia will increase the prediction of the physical symptoms as the B=3.4.

Table (6-b): Predictors of physical illnesses with age and duration of DM among the study subjects (n= 194).

Predictors	r	R ²	ANOVA	P-Value	t-Value	P-value	Unstandardized Coefficient	
							B	SE
Hypertension	0.48*	0.23	57.3**	0.000	7.5**	0.000	1.4	0.19
UTI	0.29*	0.089	18.7**	0.000	4.3**	0.000	1.2	0.27
DVT	0.32*	0.10	23.5**	0.000	4.8**	0.000	1.7	0.36
Diabetic foot	0.28*	0.079	16.5**	0.000	4.0**	0.000	1.1	0.28
Neuritis	0.21	0.049	9.7**	0.002	3.1**	0.002	-0.018	0.006
Age	0.34*	0.11	25.5**	0.000	5.0**	0.000	0.45	0.009
Duration of DM	0.20	0.04	8.7**	0.003	2.9**	0.003	0.43	0.015

* P < 0.05

Table (6-b) represents that there was ascending order in physical illnesses and age predictors as follows; diabetic foot, UTI, DVT, age and hypertension Diabetic foot was the least predictor R²=0.079 with prediction 7.9%, while hypertension was the highest predictor regarding physical illness of diabetes mellitus which =(0.23) as predicts it with 23%, with moderate correlation as r=0.48, with highly sig. variance and different of means at p=0.000 as it equal 57.3 and 7.5 of ANOVA and t tests respectively. And every increase of standard error SE = (0.19) with one unit of hypertension will increase the prediction of the physical illness as the B=1.4.

Table (6-c): Predictors of Diabetes Self-Management, BMI, type of DM & age among the study subjects (n= 194).

Predictors	r	R ²	ANOVA	P-Value	t-Value	P-value	Unstandardized Coefficient	
							B	SE
-Check blood sugar level	0.47*	0.22	57.0**	0.000	7.5**	0.000	2.2	0.29
-The chosen food	0.47*	0.22	54.5**	0.000	7.3**	0.000	2.2	0.30
-Keep doctors appointments'	0.47*	0.22	55.9**	0.000	7.4**	0.000	1.8	0.24
-Take DM medication(s)	0.39*	0.15	34.3**	0.000	5.8**	0.000	1.5	0.26
-Occasionally eat sweets	0.40*	0.16	38.6**	0.000	6.2**	0.000	1.0	0.16
-Record blood sugar level	0.34*	0.12	26.4**	0.000	5.1**	0.000	1.5	0.29
-Avoid Diabetes doctors	0.20	0.041	8.2**	0.005	2.8**	0.005	0.9	0.33
-Regular physical activity	0.37*	0.13	30.5**	0.000	5.5**	0.000	3.3	0.61
-Follow strict dietary	0.39*	0.15	35.1**	0.000	5.9**	0.000	2.2	0.37
-Do Not check blood sugar level frequently	0.047	0.002	0.43	0.51	0.65	0.511	0.18	0.28
-Avoid physical activity	0.22	0.052	10.5**	0.001	3.24**	0.001	1.5	0.47
-Forget to take DM medications	0.035	0.001	0.23	0.63	0.48	0.63	-0.72	1.50
-Sometimes having real food binges	0.27*	0.073	15.1**	0.000	3.8**	0.000	1.3	0.33
-See medical practitioner often	0.32*	0.102	21.8**	0.000	4.6**	0.000	2.2	0.47
-Tend to skip planned physical activity	0.32*	0.10	22.6**	0.000	4.7**	0.000	2.5	0.53
-BMI	0.25*	0.066	13.5**	0.000	3.6**	0.000	0.22	0.061
-Type of DM	0.06	0.00	0.76	0.38	0.87	0.38	-0.12	0.14
-Age	0.13	0.019	3.7	0.54	1.93	0.05	-0.49	0.25

* $P < 0.05$

Table (6-c) represents that there was ascending order of factors related to diabetes self-management as follows; BMI, having food binges, see medical practioner, skip planned physical activity, record blood sugar level, regular physical activity, take DM medication, follow strict diet, occasionally eats sweets, the chosen food, Keep doctors appointments' and check blood sugar level. BMI was the least predictor $R^2=0.066$ with prediction 6.6%, while checking blood sugar level was the highest predictor regarding diabetes self-management which $=0.22$ as predicts it with 22%, with moderate correlation as $r=0.47$, with highly sig. variance and different of means at $p=0.000$ as it equal 57.0 and 7.5 of ANOVA and t tests respectively. And every increase of standard error $SE= (0.29)$ with one unit of checking blood sugar level will increase the prediction of the diabetes self-management as the $B=2.2$.

IV. Discussion

Apparently the diabetes mellitus considers one of the most popular diseases; which increases dramatically all over the world. And developing diabetes has several risk factors as obesity, hereditary, unhealthy diet...etc (Piemonte, 2019). However rare evidenced nursing researches enrich studies focusing on the prediction of complications factors which accompanied the patients who already had diabetes mellitus either developing other subsequent diseases beside the diabetes mellitus or physical factors deterioration or mounting any other complications on the long term...etc. Thus the current discussion in three parts illustrated and discussed these founded factors as follows; **Section 1:** Represented studied subjects demographic characteristics and their Medical data. While; **Section 2:** Answered the first question which was; "What are the predicted complications factors among patients with diabetes mellitus?" Finally **Section 3:** Elaborated and discussed the second question which was "What is the Suggested Nursing Map of Care?" based on the result at section 2.

Section 1: Represented studied subjects demographic characteristics and their Medical data. It was clearly observed that their mean of age was $44.8+11.5$ and more than one third of the patients' age was between forty up to fifty years old. And in the light of their medical result; the most of them had type II diabetes mellitus; regarding age and the type of diabetes it supported the previous research which mentioned that most of type II diabetes mellitus developed by becoming older; as the Global Diabetes Community, (2019) supported that finding; as reporting that type II diabetes mellitus affects about 85%; while some studies mentioned that it is closer to 90% of people with diabetes, which is usually diagnosed at a later age than type 1 diabetes mellitus.

On the other hand females represented two third of the studied subjects, the majority of them was married. More than one quarter can read and write; while less than the quarter only had educated until the preparatory level. More than one third was house wife while merely quarter of the subjects had a casual work which means there was no permanent income. A positive finding that the majority of them were not smokers; which might reflect their awareness of avoiding the smoking hobbits; in spite of their modest educational level.

Also more than the half of them was living at Cairo which could put them under stress because of its crowdedness which might affect negatively on their blood sugar maintenance. However the researchers found interested finding that the most of them had no family history of diabetes Mellitus; but the hereditary factor still remain one of the diabetes mellitus factors. In deed Huizen (2019) reported that according to the Centers for Disease Control [CDC], adults between 45 up to 64 years of age receive the majority of new diabetes diagnoses; also they added that variation of developing type II diabetes and the age of diagnosis may also depend on gender or race.

Also the study revealed that; two third of the patients had DM for less than ten years; which might reflect their awareness or the developing of DM signs and symptoms which let them check their blood glucose level. More than two third of them measured their blood glucose regularly; around one quarter their blood glucose recently was less than 135 mg/dl and between (170 up to 205) mg/dl. Which considers for the diabetic patient accepted as based on Mayo Foundation for Medical Education and Research [MFMER] (2019), reported that the American Diabetes Association recommends the blood sugar to be below 154 mg/dl/ HgA1c=7; to consider it normal blood sugar level but for the diabetic patients. As well around half of the subjects measured their fasting blood glucose and in spite that; the most of them had type II diabetes mellitus but merely half of the studied sample undertaken insulin treatment; which means that some of patients who diagnosed as type II take insulin treatment rather than the known information that type II receive only oral hypoglycemic agent; actually Leontis and Hess-Fischl (2017) and Tremblay, (2016) supported the same findings as; they reported that usually oral hypoglycemia agent are enough for type II diabetes mellitus however in some cases it might require insulin when patients' meal plan, weight loss, exercise and antidiabetic drugs do not achieve targeted blood glucose levels.

On the other hand most of those patients developed other diseases beside the DM as Urinary Tract Infection (UTI), pulmonary problems as asthma, vascular diseases as heart problems or diabetic foot; while the most observed diseases with DM was neuritis as more than the half of them developed it for years and this reflect the negative effect of the DM and how it affects harmfully on the peripheral nerves and interfere against the daily function as some of them reported that they could not use their extremities especially hands efficiently; thus merely half of them had to use Vit. B12 as daily supplement A review article performed by Charalabopoulos, Charalabopoulos, and Papaioannides (2009) reported that DM has also been associated with other conditions such as progressive systemic sclerosis, rheumatoid arthritis, mixed connective disease and systemic lupus erythematosus. Also, DM may be associated with endocrine diseases such as thyroiditis, cushing syndrome, Crohn Disease and hypophysis. On the other hand the researchers found that almost one third of the studied subjects they were overweight; same finding regarding their age which was between 40 up to 50 years old; in spite it was minute ratio however it still dangerous factors which interfere negatively against the uses of insulin and could accelerate the susceptibility of developing further health problems; as Jura and Kozak (2016) reported that ageing is associated with an increase in abdominal obesity, a major contributor to insulin resistance and the metabolic syndrome. Also an astonished result the researchers discovered that the most of them never test any minerals or vitamins blood level however; Vit. D; recently considers one of the main vitamins which play a vital role in human body function since; low levels of vitamin D, and insufficiency and deficiency of vitamin D are recognized as global health problems worldwide as supported by Nakashima, Yokoyama, Yokoo, and Urashima (2016); also they added that vitamin D deficiency has been linked to onset and progression of DM. patients with DM, the relationship between vitamin D and insulin secretion, insulin resistance, and β -cell dysfunction are pointed out.

Regarding symptoms associated with DM; the researchers found that polydipsia, polyuria, hypo/hyperglycemia, fatigue, skin dryness were common symptoms in spite of taking their DM medication which might related to the uncontrolled blood sugar but the most repeated symptoms were polyphagia and general weakness. A study conducted by Lien, Hwang and Jian (2017) congruent with the current finding and even they connected it with Vit. D. deficiency as they discovered that Vitamin D deficiency is common in people with diabetes, and low vitamin D status is associated with a reduced health related quality of life, fatigue and depressive symptoms. And Added that Diabetes related fatigue can lead to frailty, including self reported exhaustion, low physical activity, slow walk speed, low grip strength and weight loss, which will increase the risk of falls.

Regarding the diabetic self management questionnaire; and based on the used questionnaire scale; the researchers revealed that the most of them; their self management items apply on them to some degree as more than one third of them avoid physical activity, more than one third reported that diabetes self-care was poor but occasionally they eat lots of sweets. On the other hand the majority of them do regular physical activity. In deed CDC (2018) supported that to control the diabetes self-management idea the patient should join program to teach them how to care to themselves by Lower their HgA1C levels, prevent or reduce diabetes complications, improve their quality of life.

Section 2: Answered the first question which was; related to the prediction of complications factors among patients with diabetes mellitus.

It represented that there was mounting hierarchy regarding physical symptoms predictors as follows; HbA1c, hypoglycemia, skin dryness, hyperglycemia, general weakness, sweating, fatigue, polyphagia, polyuria and polydipsia were predictors of physical symptoms' deterioration of diabetes mellitus and frequently might occurred; and it was an add to found that using HbA1c is a more efficient predictor of monitoring any predicted DM complication rather than using the daily blood glucose measures as the HbA1c give a wide chart about the patient blood glucose stability; besides polyuria which was the highest predictor regarding these physical symptoms of diabetes mellitus with more than fifty percent of prediction. This gave a clue that increasing urination "polyuria" could be an early sign of any further future physical symptoms might happen for the diabetic patients; thus both the health care providers and the patients equally must be caution regarding that symptom. Global Diabetes Community (2019) considers that the major signs of diabetes mellitus; when the kidneys filter blood to make urine, it reabsorbs all of the sugar, returning it to the bloodstream. Furthermore a research performed by McCulloch (2018) supported the current research finding; as they stated that Classic symptoms of hyperglycemia include polyuria, polydipsia, nocturia, blurred vision, and, infrequently weight loss. These symptoms are often noted only retrospectively after a blood glucose value has been shown to be elevated. While polyuria occurs when the serum glucose concentration rises significantly above 180 mg/dL (10 mmol/L), exceeding the renal threshold for glucose, which leads to increased urinary glucose excretion. So they support the current finding as; it is one of the early predictor of uncontrolled physical symptoms of patient with diabetes mellitus.

Additionally the current research discovered that there was escalating order in physical illnesses and the aging as predictors among patients with DM as follows; diabetic foot, UTI, DVT, age and hypertension. While the diabetic foot was the least predictor and the hypertension was the highest predictor regarding physical illness of diabetes mellitus was twenty three percent of prediction; which means with the uncontrolled DM there is a high chance for those patients to develop hypertension more than any other physical illness; so monitoring of blood pressure level must be one of the highly nursing priority during their follow-up as a vital nursing plan factor. A research was evidenced by De Boer, Bangalore, Benetos, Davis, Michos, Muntner, Rossing, Zoungas and Bakris (2017) at the American Diabetes Association revealed that hypertension is common among patients with diabetes, with the prevalence depending on type and duration of diabetes, age, gender, race/ethnicity, BMI, history of glycemic control, and the presence of kidney disease, among other factors; thus they supported the current research finding that Blood pressure should be measured at every routine clinical care visit. Patients found to have an elevated blood pressure ($\geq 140/90$ mmHg) should have blood pressure confirmed using multiple readings

Moreover there was rising order of diabetes self-management predictors as follows; BMI, having food binges, see medical practitioner, skip planned physical activity, record blood sugar level, regular physical activity, take DM medication, follow strict diet, occasionally eats sweets, the chosen food, Keep doctors appointments' and check blood sugar level. Actually the researchers found that checking blood sugar level was the highest predictor regarding diabetes self-management with twenty two percent predictions. So close and frequent monitoring of an objective assessment as blood glucose levels is the most predictor which direct the patients with DM either he/she is on the right way or not for early protection of any future diabetic complications. A recent research conducted by Kurniaa, Amatayakulb & Karuncharernpanitc (2017) related to predictors of diabetes self management agreed with the current finding as they found that actively monitoring blood glucose level be one of predictors of diabetes self management.

Section 3: This section involved the Suggested Nursing Map of Care (fig: 2) based on the predictors results (fig: 1) that illustrated the main predictors risk factors of diabetes complications among the studied subjects and the relationship between each one in addition to the main nursing care which should be provided and educated to those patients to minimize occurrence of any future subsequent diabetes mellitus complications.

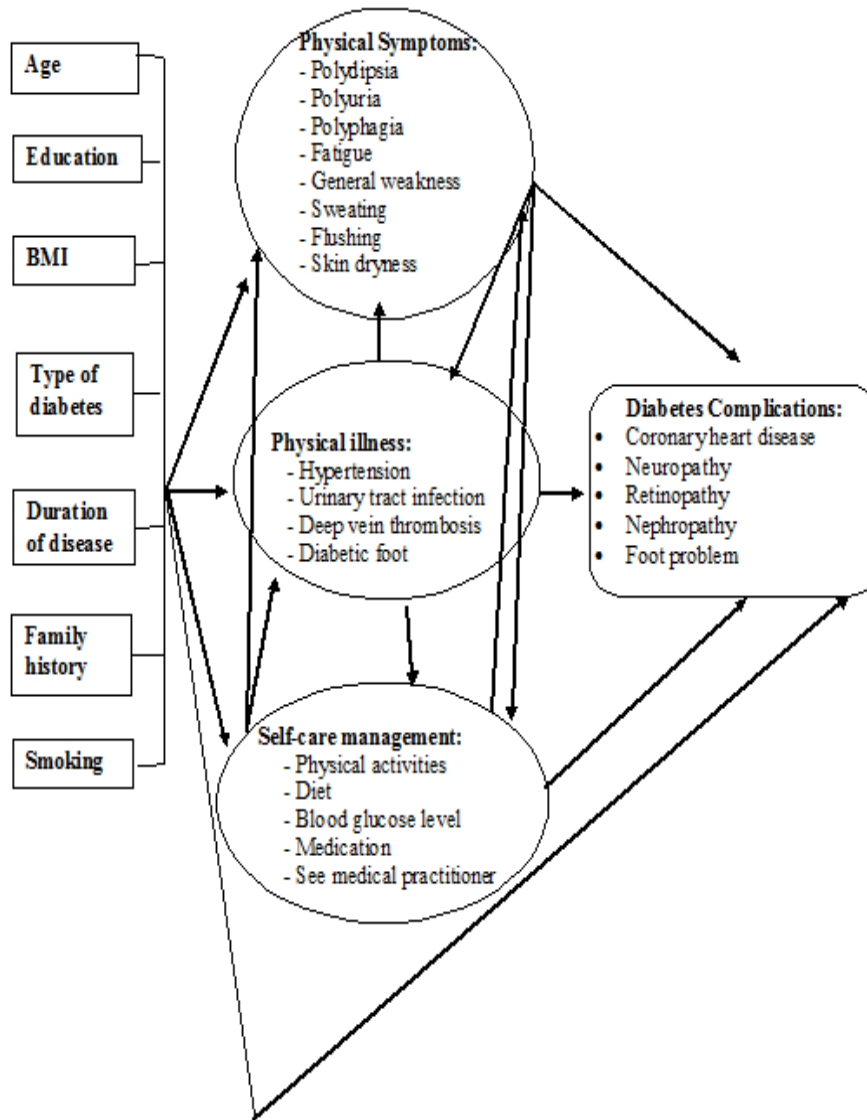


Fig 1: Predictor factors diagram based on established relationships which concluded from the current research finding by *Hassanein & El-Sayed, (2019)* for estimating the complications of diabetes mellitus.

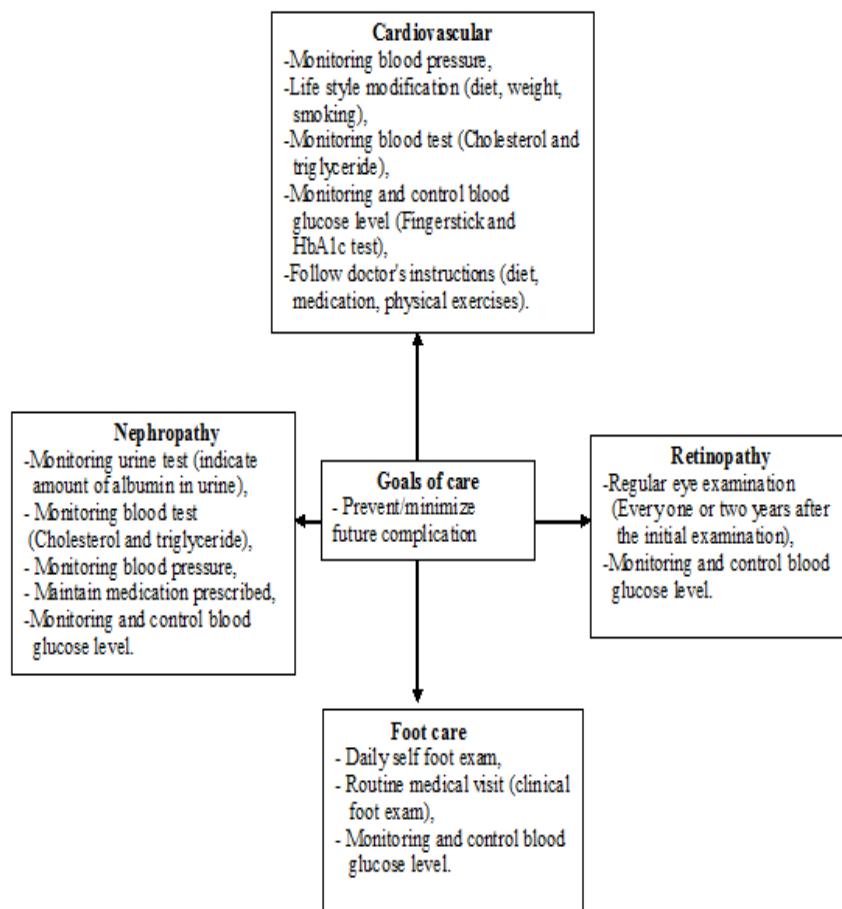


Fig 2: Nursing map of care to Prevent/minimize future complication of diabetes mellitus by the current researchers *Hassanein & El-Sayed, (2019)*.

Based on the current finding; Fig. (2) Clarified the main Nursing Map of Care goal; which should be provided and instructed to patients with DM to Prevent/minimize future complication in order to improve their life based on predictors' risk factors relations at Fig (1) of diabetes complications among the studied subjects.

Conclusion of the study

The findings documented the following as the most physical symptoms, physical illness and self-management predictors that predict the factors leading to diabetes mellitus complications: polyuria, hypertension and checking blood sugar level respectively.

VI. Recommendation of the study

Understanding factors leading to complications among patients with DM; either with type I or type II is required. In addition to follow the nursing instructions according to the nursing map of care for those patients to enhance their health status.

VII. Nursing Implication of the study

The nurse plays an essential role in preventing diabetes complications. Therefore, they should be oriented by the predictor complication risk factors among patients with diabetes mellitus and its relation. Nursing Map of Care is one of objective method to instruct those patients and put them on the right way of management to prevent further complications which consequently improve their health.

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