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Job Stress and Risk of Type 2 Diabetes Mellitus in Nurses of Public Hospitals in Los Mochis, Mexico

Estrés Laboral y Riesgo de Diabetes Mellitus Tipo 2 en Enfermeras de Hospitales Públicos de Los Mochis, México

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ABSTRACT

Introduction: nurses provide comprehensive care that exposes them to work-related stress and risk of developing chronic diseases, including Type 2 diabetes. The aim of the study was to analyze the association between work stress and the risk of developing type 2 diabetes in clinical nurses from 3 public hospitals in Ahome, Sinaloa, Mexico.
Method: descriptive, correlational and cross-sectional study in 167 nurses assigned to three second level hospitals in the municipality of Ahome, Sinaloa. The Job Content Questionnaire scale was used to measure job stress. The questionnaire consists of six items for psychological demands, nine for job control and seven for job support. The Findrisc questionnaire was used for Type 2 diabetes risk. The association between dimensions of work stress and risk of Type 2 diabetes was analyzed by means of multiple linear regression.
Results: the sample consisted of 167 clinical nurses, with a mean age of 40,68 years (SD = 9,15). 23,4 % of the participants were at high risk and 24 % at moderate risk of Type 2 Diabetes. age presented a positive coefficient (ß = 0,196, p = 0,001) and control over work showed a negative relationship (ß = -0,226, p = 0,047) on the risk of Type 2 Diabetes.
Conclusions: these findings highlight the relevance of individual factors such as age, and of the psychosocial environment, particularly perceived control, in the prevention of Type 2 Diabetes among clinical nurses.

Keywords: Nurse; Public Hospitals; Occupational Stress; Working Women; Risk; Diabetes Mellitus Type 2.

RESUMEN

Introducción: las enfermeras brindan atención integral que las expone a estrés laboral y riesgo de desarrollar enfermedades crónicas, entre ellas Diabetes Tipo 2. El objetivo del estudio fue analizar la asociación entre el estrés laboral y el riesgo de desarrollar Diabetes tipo 2 en enfermeras clínicas de 3 hospitales públicos de Ahome, Sinaloa, México.
Método: estudio descriptivo, correlacional y transversal en 167 enfermeras adscritas a tres hospitales de segundo nivel del Municipio de Ahome, Sinaloa. Para la medición del Estrés Laboral se utilizó la escala Job Content Questionnaire. El cuestionario consta de seis ítems para las demandas psicológicas, nueve para el control sobre el trabajo y siete para el apoyo en el trabajo. Para riesgo de Diabetes Tipo 2 se empleó el cuestionario Findrisc. Se realizó la asociación entre dimensiones del estrés laboral y riesgo de Diabetes Tipo 2 mediante regresión lineal múltiple.

Resultados: la muestra estuvo conformada por 167 enfermeras clínicas, con un promedio de edad de 40,68 años (DE = 9,15). El 23,4 % de las participantes se encontraba en riesgo alto y el 24 % en riesgo moderado de Diabetes Tipo 2. La edad presentó un coeficiente positivo (ß = 0,196, p = 0,001) y el control sobre el trabajo mostró una relación negativa (ß = -0,226, p = 0,047) sobre el riesgo de Diabetes Tipo 2.
Conclusiones: estos hallazgos resaltan la relevancia de factores individuales como la edad, y del entorno psicosocial, particularmente la percepción de control, en la prevención de la Diabetes Tipo 2 entre enfermeras clínicas.

Palabras clave: Enfermera; Hospitales Públicos; Estrés Laboral; Mujeres Trabajadoras; Riesgo; Diabetes Mellitus Tipo 2.

INTRODUCTION

Type 2 diabetes (T2D) is recognized globally as a severe health crisis due to its high incidence and prevalence, as well as its potential complications, disability, and premature death.[1] According to the American Diabetes Association[2], T2D is a chronic, non-communicable, degenerative disease of multifactorial origin characterized by elevated blood glucose levels due to a deficit in insulin secretion or action, or both. T2D accounts for more than 90 % of all cases of diabetes and represents a public health challenge.

The International Diabetes Federation[3] has estimated that globally, there are 537 million adults over 20 living with T2DM, with projections suggesting an alarming increase of 46 % by 2045, reaching 783 million cases. Of these, 296 million are women, highlighting a serious health problem in this group. Women face additional challenges related to power dynamics, gender roles, and socio-economic inequalities, which make them more vulnerable to TD2 by exposing them to inadequate diets, nutritional deficiencies, and lack of physical activity.[4] These cultural and social factors can hinder the control and treatment of the disease in women.[5] In Mexico, the National Health Survey of Mexico (National Health Survey of Mexico's National Health Service, SNS), published in the National Health Survey of Mexico.

National Health Survey of Mexico),found that women are more vulnerable to TD2 than men.

In Mexico, the National Health and Nutrition Survey[6] estimates that 10,6 % of the population over 20 years of age has a previous diagnosis of TD2, with women being slightly more affected with 11,6 % compared to 9,4 % in men. Mexico ranks seventh in the world in cases of DT2 among people aged 20-79 years, with approximately 14,1 million people diagnosed, being considered a health emergency since 2016.[5,7] In Sinaloa, the prevalence of DT2 stands at 10,7 %, showing a steady increase in recent years.[8]

Globally, in 2021, seven of the ten leading causes of death were non-communicable diseases, with NTDs being the leading cause of death.[5] Although progress has been made in identifying risk factors for early detection of NTDs, the current situation suggests the need to address psychosocial factors in studying risk, especially in young and working populations.[9]

Identified risk factors for the development of DT2 include overweight and obesity, high blood pressure, older age, family history, low HDL cholesterol or high triglyceride levels, gestational diabetes, history of having a macrosomic child (>4000 kg at birth), depression, polycystic ovary syndrome, and membership in certain ethnic groups, such as Hispanic/Latino.[10,11]

Given that most adults are in the 40-59 age group, an increase in the prevalence of glucose intolerance, obesity, physical inactivity, and dietary changes that predispose to the development of this disease is expected in younger people. This group includes the working population, who may be affected by TD2 and develop vascular complications that limit their ability to work and socialize.[5] Although studies have been conducted on the health of the working population, little attention has been paid to the group of health professionals, such as clinical nurses. These professionals, central to health systems, face high work demands that may result in high absenteeism rates and affect their physical, psychological, and social well-being. Directly responsible for managing and caring for patients 24 hours a day, clinical nurses represent the majority of staff in healthcare institutions.[12,13]

In several previous studies conducted in Latin American countries, it has been found that women experience higher levels of work-related stress compared to men (44,8 % vs. 37,6 %). This is mainly attributed to the additional workload they face in their professional roles and their home responsibilities, which are influenced by gender roles.[14] According to the United Nations[15] and the World Labour Organisation,[16] women may face greater difficulties in balancing work and personal life compared to men due to social expectations that place a double burden on them, combining home and family care with multiple simultaneous responsibilities, created by social influence.

This scenario is aggravated when women work in health care and are exposed to high work demands. This

can modify their emotional state, increase work-related stress, expose them to an increased risk of developing TD2, and may require modifications in their personal growth activities, eating habits, physical activity, and interpersonal relationships. [17]

Job stress is defined as a dangerous condition that arises when the demands of the job exceed the capabilities and resources of the worker, resulting in physical, emotional, or social instability. [18] This phenomenon, characterized by an imbalance between psychological demands and control over work, has significant negative repercussions, affecting workers' lifestyles, including their interpersonal relationships, eating, and physical activity. [19,20]

In particular, clinical nurses face high levels of work stress due to the complexity of the current epidemiological context, which has been little explored about the risk of developing TD2. [21] This situation is of concern given that work stress may contribute to developing diseases, such as TD2, exacerbated by long working hours, shift rotation, and difficulties in adopting healthy habits. [22]

Previous studies have shown that high work stress is associated with a significant increase in the risk of TD2 in working women, especially in sectors such as health and education, where they face intense workloads and a double burden of responsibilities. [23,24,25] This risk is exacerbated by long working hours, which are additional risk factors for this disease.

In this context, it is crucial to understand the specific risk factors and their interactions with clinical nurses, thus contributing to nursing knowledge. The proposed research aims to determine the association between work-related stress and the risk of developing TD2 in clinical nurses from three public hospitals in Los Mochis, Sinaloa, Mexico. The results of this study can not only inform occupational health policies and practices but also improve the well-being and quality of life of this vulnerable group of health professionals.

METHOD
Study design
The study design was descriptive, correlational, and cross-sectional. The study population consisted of 605 clinical nurses over 20 years of age, belonging to three second-level public hospitals in Los Mochis, Sinaloa, Mexico. The sample was selected through a non-probabilistic convenience sampling. [26]

Population, Sampling, and Sample
Sample size calculation was performed using nQuery Advisor version 4.0 statistical software, with a significance level of 0,05, 95 % confidence, and 50 % heterogeneity, [27] resulting in a sample of 167 clinical nurses. Clinical nurses in active employment without a previous medical diagnosis of Type 2 diabetes were included. Clinical nurses who were pregnant, on holiday, or on medical leave during data collection and those who could not independently step on and stand on a scale were excluded. Instruments were also removed from clinical nurses who chose not to continue participation mid-interview or who did not complete the questionnaires fully.

Instruments and Measurements
To investigate the individual characteristics of the clinical nurses, a data sheet that included sociodemographic and clinical aspects was used. The sociodemographic part included information such as folio, date of application, age, marital status, academic degree, working hours and shift, service, and length of service. As for the clinical data, weight, height, abdominal circumference, and Body Mass Index (BMI) were recorded.

Job stress was assessed with the Job Content Questionnaire [28], adapted by Escribá. [29] This instrument, designed specifically for nursing staff, consists of three dimensions: psychological demands, control over work, and job support. The psychological demands dimension assesses workload, intellectual demands, and time pressure. The control over work dimension considers decisional autonomy, creativity, and skill development. Finally, the job support dimension assesses the support received from colleagues and superiors.

The questionnaire consists of six items for psychological demands, nine for job control, and seven for job support. Each item is answered on a four-point Likert scale (1 = strongly disagree to 4 = strongly agree). The reliability of the questionnaire in nursing staff has been established with a Cronbach's alpha coefficient of 0,7. [29]

The risk of developing Type 2 diabetes was assessed using the Finnish Diabetes Risk Score (FINDRISC), [30] which consists of eight items. This scale estimates the risk of developing T2DM in the next 10 years, considering variables such as age, BMI, abdominal circumference, physical activity, fruit and vegetable consumption, use of antihypertensive medication, history of hyperglycemia, and family history of T2DM. The scores obtained classify risk into five levels: low to very high. [30,31]

Anthropometric measurements
Considering a circumference of less than 80 cm as the cut-off point for women. [32]

Data Collection Process

To carry out the study, consent was obtained from the Research Ethics Committee and the Research Committee of the Nursing Faculty of Los Mochis, belonging to the Autonomous University of Sinaloa. Permission was formally obtained from the superiors of the health institutions in Los Mochis, Sinaloa, Mexico. The second-level health institutions in Los Mochis, Sinaloa, were visited to establish communication with the directors and heads of nursing, as well as with the nursing professionals to whom the objective of the study was explained and who were asked for authorization to apply the instruments and carry out the measurements on the clinical nurses.

The visit to the health institutions was organized to gather the participants, summoning them an hour or half an hour before the start of their work shift. They were invited to collaborate in the study, the purpose of the study was explained in detail, and those clinical nurses willing to participate were assessed against the inclusion criteria. Eleven their participation was approved, they were informed about the procedure they would follow in the research and were provided with and asked to read and sign the informed consent form.

The participant selection process began with prior visits to inform about the study and to schedule appointments with those interested. A tour of the facilities of the health institutions was carried out to ensure that the place where the measurements would be taken had inadequate conditions for the application of the instruments. Each participant was assigned a comfortable, individual, and adequately equipped cubicle to apply the instruments and procedures related to the study. It is important to note that clinical nurses on holiday or medical leave during data collection were not considered for participation in this study.

Ethical Considerations

The present study adhered to the ethical-legal regulatory framework established for health research in Mexico by the Regulations of the General Health Law on Health Research.[33] The primary objective of complying with these regulations was to ensure and protect the dignity and well-being of the subjects of the research, as well as to contribute to the advancement of nursing knowledge through the study of work-related stress and the risk of Type 2 diabetes in clinical nurses in the city of Los Mochis, Sinaloa, as established in Article 3, sections I, II and III. In line with these principles, the study adhered to ethical and scientific standards and received approval from the Research Committee and the Research Ethics Committee of the Nursing Faculty of Los Mochis, part of the Autonomous University of Sinaloa.

Data Analysis Strategy

The Statistical Package for the Social Sciences (SPSS) version 27 for Windows in Spanish (IBM SPSS, Inc., Chicago, IL, USA) was used for data analysis. The internal consistency of each instrument was assessed using Cronbach's Alpha coefficient. Before analysis, the normality of the data distribution was checked using the Kolmogorov-Smirnov test with Lilliefors correction. Descriptive statistics were used to describe the socio-demographic and clinical characteristics of the nurses, including frequencies, proportions, point estimates with 95 % confidence intervals, and measures of central tendency. To determine the influence of various dimensions of job stress on the risk of diabetes in clinical nurses, a multiple linear regression model was applied using the stepwise method. The dependent variable was the TD2 risk score. The predictor variables included working hours per week, length of service (in years), nurse age, job support (from colleagues and supervisors), psychological demands, and control over work.

RESULTS

The sample consisted of 167 clinical nurses, with a mean age of 40,68 years(SD = 9,15). Regarding marital status, 59,3 % reported having a partner. Regarding academic degrees, 53,3 % had a bachelor's degree in nursing, 36,5 % were general nurses, and 10,2 % reported having postgraduate studies at master's level. About weekly working hours, a mean of 38,51(SD = 8,03) hours per week was found. In terms of length of service, the mean was 14,92(SD = 9,4) years. By shift, 37,3 % of the nurses were found to work the night shift, followed by 33,5 % in the evening shift (table 1).

Table 1. Sociodemographic Characteristics of Clinical Nurses		
Socio-demographic characteristics	**No. (n=167)**	**%**
Academic degree General Nurse	61	36,5
Bachelor of Nursing	89	53,3
Master's Degree in Nursing	17	10,2
Marital status Single	36	21,6
Married	99	59,3

	Common-law marriage	11	6,6
	Widower	6	3,6
	Divorced	15	9,0
Work shift	Morning shift	34	20,4
	Afternoon shift	56	33,5
	Night shift	63	37,7
	Special daytime guard shift	14	8,4

Most of the nurses assessed were younger than 45 years; however, they had relevant risk factors for type 2 diabetes, such as overweight or obesity (74,8 %), high abdominal circumference (55,1 %), and sedentary lifestyle (65,3 %). Although 59,9 % consumed fruit and vegetables daily, 18,6 % had a history of hypertension, and 14,4 % had a history of high blood glucose. In addition, 74,3 % reported a family history of diabetes (table 2).

Table 2. Clinical characteristics of the clinical nurses according to the FINDRISC scale			
Clinical Characteristics		**No.**	**%**
Age Risk DT2	Under 45 years old	108	64,7
	Between 45-54 years old	48	28,7
	Between 55-64 years old	11	6,6
	Over 64 years old	0	0,0
BMI Risk DT2	Less than 25 kg	42	25,1
	Between 25-30 kg	68	40,7
	More than 30 kg	57	34,1
Abdominal girth	Less than 80 cm	41	24,6
	Between 80-88 cm	34	20,4
	More than 88 cm	92	55,1
Do you normally engage in at least 30 minutes of physical activity per day?	Yes	58	34,7
	No	109	65,3
How often do you eat fruit and vegetables?	Daily	100	59,9
	Not every day	67	40,1
Have you ever been prescribed anti-AHT medication?	No	136	81,4
	Yes	31	18,6
Have you ever had high blood glucose levels detected in your blood??	No	143	85,6
	Yes	24	14,4
Has there been any diagnosis of Diabetes Mellitus?	No	43	25,7
	Yes grandparents, aunts, uncles, cousins, siblings	60	35,9
	Yes parents, siblings or children	64	38,3

Table 3 shows that 74,8 % of the clinical nurses were overweight, 42,5 % overweight, and 32,3 % obese, while only 24 % had a BMI within the normal range. Regarding the risk of developing type 2 diabetes mellitus, 23,4 % of the participants were in the high-risk category (15 to 20 points on the FINDRISC scale), and 24 % were at moderate risk. Furthermore, 32,3 % were at slightly elevated risk, while only 20,4 % were at low risk.

Table 3. Body Mass Index, Level of Job Stress and Risk of Type 2 Diabetes in Nurse Clinicians			
		No.	**%**
IMC	Below 18,5 (Underweight)	2	1,2
	18,5-24,9 (Normal)	40	24,0
	25,0-29,9 (Overweight)	71	42,5
	30,0 o more (Obesity)	54	32,3
Diabetes Mellitus Type 2 Risk Level	Low risk (less than 7 points)	34	20,4
	Slightly elevated risk (7-11 points)	54	32,3
	Moderate risk (12-14 points)	40	24,0
	High risk (15 to 20 points)	39	23,4

Finally, the multiple linear regression test was applied to determine the influence of job stress on the risk of TD2 in clinical nurses (table 4). The model was significant (F = 10,78, gl = 6, p = 0,001) and explained 22,7 % of

the variance. It was identified that, among the dimensions of work stress analyzed, the clinical nurse's age and control over work showed a statistically significant association with the risk of TD2. In particular, age presented a positive coefficient($ß = 0,196$, $p = 0,001$), indicating that older age increases the risk of developing TD2 in clinical nurses. On the other hand, control over work showed a negative relationship ($ß = -0,226$, $p = 0,047$), suggesting that a higher level of job autonomy is associated with a decreased risk of TD2.

Table 4. Dimensions of work-related stress for Diabetes Risk in Clinical Nurses

Predictor variables	ß	SE	t	IC 95 %		Sig.
Working hours per week (hours)	-0,006	0,038	-0,145	-0,081	0,070	0,885
Length of service (years)	0,097	0,064	1,522	-0,029	0,223	0,130
Nurse's age (years)	0,196	0,059	3,299	0,079	0,313	0,001
On-the-job support (Peers and supervisors)	-0,013	0,089	-0,149	-0,189	0,162	0,882
Psychological demands	0,012	0,107	0,113	-0,199	0,223	0,911
Control over work	-0,226	0,113	-1,996	-0,449	-0,003	0,047
n: 167. ß: unstandardized regression coefficient; SE: standard error; t: test statistic; CI: confidence interval; p: significance.						

DISCUSSION

The present study aimed to determine the association between work-related stress and the risk of developing TD2 in clinical nurses from three public hospitals in Los Mochis, Sinaloa, Mexico. First, the sociodemographic characteristics are addressed. Then, the descriptive data of the variables of interest, the findings of the variables of interest, limitations of the study, recommendations for future studies, and finally, the conclusion.

Regarding the sociodemographic characteristics of the nurses, the findings of this study are consistent with those reported in the population of clinical nurses in Brazil, Canada, Mexico, and the USA; it was identified that the average age was 40,0 years, higher than the national average of 29 years in women, which indicates a transition process in which in the coming decades there will be a process of generational replacement, for which strategies will have to be addressed to enable clinical nurses to maintain an adequate lifestyle.[34,35] In terms of marital status, married clinical nurses predominate, which implies a double burden of work and other activities aimed at maintaining the home.

In terms of academic degrees, clinical nurses with a bachelor's degree in nursing stand out, which indicates a growth in the educational level of clinical nurses.[36]

In terms of working hours, it was reported that they work 40 hours per week, similar to that reported by INEGI in 2022 and the report on the situation of nursing in the Region of the Americas of the Pan American Health Organization.[37] This situation may be a psychosocial risk factor, such as work stress, due to the frequency of long working hours. This can be attributed to long working hours, which generate work stress in clinical nurses and cause healthy eating problems due to the lack of food services available in hospitals, leading to consuming foods rich in sugars and, subsequently, weight gain and obesity.[38]

Regarding the clinical conditions observed, the results obtained in this research show a combined prevalence of overweight and obesity of 72,6 %, which is consistent with the National Health and Nutrition Survey (ENSANUT) in Mexican women.[6] This high proportion could be explained by adopting unhealthy lifestyle habits, including low physical activity, excessive consumption of foods rich in fats and sugars, and a predominantly sedentary routine. It is also recognized that exposure to rotating night shifts increases the risk of developing TD2 because nursing professionals must work long hours to ensure continuous care, which interferes with circadian and social rhythms, negatively impacting health.[35,39]

Regarding family history, comparable studies have documented that a significant number of participants have at least one first- or second-degree blood relative with a previous diagnosis of TD2.[39,40,41] Based on these findings, it is pertinent to propose strategies that contribute to reducing the alterations detected in the group of clinical nurses with a high probability of developing TD2 within ten years, aiming to delay the course of the disease and prevent the onset of cardiovascular complications. The findings of the regression model showed that, within the dimensions analyzed, age and level of control over work emerge as significant predictors of the risk of developing TD2 in clinical nurses.

These results allow us to reflect on the interaction between personal and psychosocial factors in the work environment, which directly impact the metabolic health of nurses. These associations can be attributed to biological, organizational, and psychosocial factors. The clinical nursing work environment, characterized by high demands, low autonomy, and low capacity for recovery between shifts, is a favorable setting for developing chronic diseases. Age acts as an aggravating factor. Low control over work represents a modifiable psychosocial risk that should be addressed through institutional policies to reorganize work, strengthen participative

leadership and self-care programs, and promote occupational health.

Existing literature shows that nurses who show less responsibility towards self-care and higher levels of occupational stress are at high risk of developing TD2. Factors such as perceived work overload, rotating shifts, and longer working hours increase emotional exhaustion, reduce job satisfaction, and increase stress levels, conditions that are linked to increased susceptibility to metabolic diseases such as TD2.[42,43]

Limitations

The main limitation of this study is that only the FINDRISK instrument was used to assess the risk of TD2 in clinical nurses. Biochemical tests such as glycosylated hemoglobin or fasting plasma blood glucose measurement could be considered for future studies.

Recommendations.

For future studies, it is recommended that the research be replicated in first-level primary care hospitals to obtain a broader view of work-related stress and its association with the risk of type 2 diabetes. In addition, the phenomenon should be addressed based on the experiences of clinical nurses in future research.

CONCLUSIONS

The results obtained conclude that age and level of job control are key factors in understanding the risk of type 2 diabetes in the clinical nurses studied. The evidence suggests that older clinical nurses and those who perceive low control over their work environment are exposed to greater vulnerability to the risk of TD2. These findings underline the importance of implementing occupational intervention strategies focused on professional empowerment and organizational autonomy, as well as occupational health policies focused on early detection and prevention of chronic non-communicable diseases among health care workers.

On the other hand, clinical nurses are at moderate and high risk of developing TD2 within 10 years. Modifiable risk factors such as overweight, obesity, insufficient physical activity, and low fruit and vegetable consumption have been identified. They could be addressed through educational and behavioral modification programs for nurses. Therefore, the hospital prevention service must prioritize the monitoring of risk factors associated with stress, as well as their potential impact on nurses' health and quality of life. Therefore, it is essential that clinical nurses receive educational interventions for lifestyle modification to reduce the risk of TD2 and that nursing leaders and managers in health institutions consider the results of this study to establish strategies to help reduces the risk in this population.

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CONFLICT OF INTEREST
The authors declare that there is no conflict of interest.

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