

Research Article

**Management of Type-2 Diabetes Mellitus According To Age, Gender,
Socioeconomic Status and Health Practices among
the Diabetic Patients of Faisalabad**

**Muhammad Noman Ashiq, Muhammad HarisTipu
and Muhammad RehanAdrees**

Independent Medical College Faisalabad, Pakistan

ABSTRACT

OBJECTIVE: The objective of the research paper was to establish the relation among health behaviors, socio-economic status and gender in the management of Type-II diabetes cases in Faisalabad.

STUDY DESIGN: A cross sectional study.

PLACE AND DURATION: This research paper commenced from October, 2017 and ended on December, 2017 at the venue of Allied Hospital Faisalabad, Pakistan.

METHODOLOGY: A questionnaire was used as data collection tool for Type-II diabetes patients. The number of patients was 310. These patients were focused as they randomly visited the OPD department for the treatment of their diagnosed disease. Multivariate and Bivariate regression of logistic nature was administered with a confidence interval rate of ninety-five percent.

RESULTS: In the total sample of 310 participants, the female to male ratio was 51.3% and 48.7% respectively. The calculated mean age of the patients of Type-II diabetes was 41.36 years. A total of 37.1 percent of the patients belonged to a range of patients with the age factor from thirty-one years to Forty years. Number of urban area participants were 57.7 percent. Number of married participants was 94.2 percent. Educational level equal to middle and poor cases were 42.9 percent. Diabetes was managed poorly in 80 percent cases and 20 percent cases were treated well. Female dominated in the count of poor diabetes patients with a count of 96.2 percent. Diabetes was managed very poorly in illiterate and more than three years patients with respective proportions of 96.7 and 97.4 percent. Three years and above cases were 83.3 percent of the total. Complication was noticed in one case of Type-II diabetes. Non-awareness about diabetes was among 97.1 percent of the cases. Other factors include irregular exercise, irregular checkup and poor diet habits with respective proportions of 91.2, 95.2 and 91.4 percent.

CONCLUSIONS: Risky behavior about health, females and socio-economic standing cases of Type-II diabetes were mishandled. Awareness of the disease is vital for the remedial action and treatment of Type-II diabetes.

KEY WORDS: Diabetes Management, Gender, Type-II Diabetes and Socio-economic Health Behavior.

INTRODUCTION

Health experts are concerned about the spread of diabetes in public healthcare. Diabetes Mellitus is naturally progressive which demands appropriate administration for the eradication of its

complications. At present 199.5 million females and 215.2 million males have been diagnosed diabetes over the globe (Lindner, Rathmann, & Rosenbauer, 2018). Middle and low-income

countries comprise seventy-five percent of them. Pakistan is no exception in this regard as a total of 10.1 million cases are registered in Pakistan (Martinez, Lockhart, Davies, Lindsay, & Dempster, 2018).

Because of high glucose level in blood, dysfunctional pancreas and proper response to insulin level causes DM in patients. Obesity, Lack of physical exertion, bad diet routine, decreased secretion of insulin and resistance of insulin cause diabetes and increase the risk of DM (Fayet-Moore et al., 2018). Because of poor control of glycemic early death, leg amputation, kidney failure, blindness, stroke, artery coronary disease and other related complication can occur. For effective prevention and management of diabetes one's behavior about health is vital and important (McGovern et al., 2018). Any health management act that is missing comes under the term of behavior of health. Effective management depends on regular glucose monitoring, doctor checkup, medication, better diet routine and physical activities. Another contributing factor is socio-economic factor (Brown, García, Zuñiga, & Lewis, 2018). A well-established link among diabetes complications, management and social standing is evident in the developed world. In Pakistan diabetic unawareness also acts as vital management factor for the diabetes. Poor management of the diabetes is linked with unawareness in numerous international and national research studies (Keene, Guo, & Murillo, 2018).

In the current research paper glycated hemoglobin level ($HbA1C < 7$) is used for the scaling of diabetes inpatients and it is considered controlled but the same rate if ($HbA1C > 7$) is considered as un-controlled (Burner et al., 2018). Prevalence and complications of diabetes have been focused in the previous attempts in Pakistan. This particular attempt targets the establishment of the relation among health behaviors, socio-economic status and gender in the management of Type-II diabetes cases in Faisalabad. The findings will assist in the future planning for the improvisation of diabetes

management in general Pakistan and in particular Faisalabad (Ma et al., 2018).

METHODOLOGY

A cross sectional survey for the purpose of this research paper was conducted that commenced from October, 2017 and ended on December, 2017 at the venue of Allied Hospital Faisalabad, Pakistan. A questionnaire was used as data collection tool for Type-II diabetes patients. The number of patients was 310 selected through odd and even chit distribution to females and males. These patients were focused as they randomly visited the OPD department for the treatment of their diagnosed disease. Patients diagnosed diabetes from last 6 months at the age of twenty years and they visited OPD, were included in research paper. Type-I diabetes cases were not included in the research. Questions included in questionnaire were translated in Urdu language for easy understanding of patients. Demographic information was asked in those questions such as marital status, age, income, area and economical standing as poor, rich or middle class. Poor, middle and rich class was classified on the basis of monthly income 15000, 15000 – 25000 and more than 25000 respectively. Educational backgrounds were classified as illiterate, middle and higher education having no education, middle and higher than middle respectively. ≤ 3 years or > 3 years was selected duration. BMI was calculated for underweight, healthy and overweight respectively as $BMI < 18.5$ kg/m, $18.5-24.9$ kg/m and > 25 kg/m. Morbidities included foot ulcer, heart disease, nephropathy, retinopathy, no disease or any disease. Behavior of health included regular or irregular routine of diet, routine checkup, medicine intake and exercise. Knowledge of the disease was calculated as adequate or inadequate.

Management of diabetes was employed as dependent variable. It was scaled with the help of level of glycemic ($HbA1c$). Diabetes was classified in two categories as better and poorly managed diabetes. In the current research paper glycated hemoglobin level ($HbA1c < 7$) is used for

the scaling of diabetes inpatients and it is considered better managed but the same rate if (HbA1c >7) is considered as poorly managed. Data included the original values of (HbA1c). Height chart and digital weight machine was used by the researcher in the assistance of nurse for the measurement of BMI in terms of weight and height. Administrative head permitted in written for the conduct of research. Participants also provided written consent before every interview. Confidentiality and safety of the data was assured to participants. Head nurse office was used for the interview without the provision of any financial compensation. For the awareness and information participants were referred. For the identification of diabetic management, health behavior, comorbidities, BMI, diabetic history and socio-demographic an analysis of multivariate and bivariate was carried out. Results provided the p-value as > 0.2 and it was not included in the analysis of multivariate. For the assessment of various demographic management regression of logistic multivariate was performed, statistical analysis was done on SPSS V-19 and p-value was observed as < 0.05 .

RESULTS

In the total sample of 310 participant's female to male ratio was 51.3% and 48.7% respectively. The calculated mean age of the patients of Type-II diabetes was 41.36 years. A total of 37.1 percent of the patients belonged to a range of patients with the age factor from thirty-one years to Forty years. Diabetes was managed poorly in 80 percent cases and 20 percent cases were treated well. Female dominated in the count of poor diabetes patients with a count of 96.2 percent as reflected in Table-I and II. In males 56 (37.1%) managed diabetes well out of 151 (48.7%). In the females only six (3.6%) managed well out of 159 (51.3%) of the total. Gender association in the diabetes management was significant. The rural and urban participants of South Punjab were 57.7 and 42.3 percent respectively. The location of the patients had no association with diabetes. Significant association of marital status was noticed as only

eighteen participants were single whereas 292 cases were married. Only 54 married cases managed their diabetes. Economic standings also performed visible role in diabetes management as poor, mediocre and rich contributed with the proportion of 58.2, 32.9 and 8.4 percent respectively. Respective diabetes management was counted as 3.3, 32.4 and 88.5 respectively. Educational background also had a significant involvement in diabetes management as illiterate, up to middle and higher than middle participants were 37.4, 42.9 and 19.7 percent respectively. Higher qualification standing participants were much interested in the management of diabetes as their proportion was 86.9 percent. Less than three years' duration were observed in 63.1 percent of the patients among them better management was observed in 25.9 percent. More than 3 years' category participated in 63.9 percent among them 16.7 percent cases were managed better. BMI was presented as underweight, healthy and obese with 10, 24.2 and 65.8 percent respectively. Significant association of BMI was linked with the control of diabetes. Results also reflect that no diabetes was observed in 15.2 percent of the participants. Better management of the disease was observed in 57.4 percent of the participants. One or multiple diseases were observed in 13.3 participants with better management. Another factor of significant importance was diabetes awareness. 77.4 percent of the participants were not aware of the diabetes with better management rate of 2.9 percent. Well aware participants were 78.6 percent with additional better management of the disease. Daily exercise routine for half hour was observed by 19.7 percent of the participants with 65.6 percent better management rate, 80.3 percent were not in a routine of daily exercise with 8.8 percent better management proportion. Intake of medicine had no significant association with the diabetes management. Irregular visit of doctor was observed in 47.1 percent of the patients and 52.9 percent visited regularly in the last 6 months. Checkup was associated significantly as 4.8 percent who visited the doctor managed well; whereas, 33.5 not in a habit of routine checkup

managed diabetes poorly. Poor diet management was observed in 37.4 percent patients; whereas, 62.6 managed their diet intake with 8.6 and 26.8

percent of better diabetes management. Diet management had significant association with diabetes control.

TABLE-I: FREQUENCIES AND PERCENTAGES OF DEMOGRAPHIC INFORMATION AND OTHER CHARACTERISTICS WITH SIMPLE BINARY LOGISTIC REGRESSION ANALYSIS FOR THE PREDICTOR ASSOCIATED WITH DIABETIC CONTROL (HBA) AMONG TYPE II_{IC} DIABETIC PATIENTS AGED 20-78 YEARS (N= 310).

Variables	Frequency (%)	Diabetes management		OR with 95% CI
		Poor management n= 248 (80%)	Better management n= 62 (20%)	
Gender	151 (48.7)	95 (62.9)	56 (37.1)	5.03 (4.23-8.23)***
Male	159 (51.3)	153 (96.2)	6 (3.8)	1
Female				
Age groups (mean= 41.36 Years)	50 (16.1)	41 (82)	9 (18)	1.76 (1.43-3.12)*
20-30	115 (37.1)	90 (78.3)	25 (21.7)	2.22 (0.61-4.98)
31-40	81 (26.1)	63 (77.8)	18 (22.2)	2.28 (0.61-4.46)
41-50	37 (11.9)	30 (81.1)	7 (18.9)	1.87 (0.43-1.99)
51-60	27 (8.7)	24 (88.9)	3 (11.1)	1
60+				
Area	179 (57.7)	137 (76.5)	42 (23.5)	1.70 (0.94-3.06)
Urban	132 (42.3)	111 (84.7)	20 (15.3)	1
Rural				
Marital status	18 (5.8)	10 (55.6)	8 (44.4)	3.52 (1.32-4.35)**
Single	292 (94.2)	238 (81.5)	54 (18.5)	1
Married				
Monthly Income level in (Rs.)	182 (58.7)	176 (96.7)	6 (3.3)	1
Poor	102 (32.9)	69 (67.6)	33 (32.4)	2.03 (1.62-3.97)***
Middle	26 (8.4)	3 (11.5)	23 (88.5)	3.89 (2.22-6.07)***
Rich				
Education level	116 (37.4)	113 (97.4)	3 (2.6)	1
Illiterate	133 (42.9)	127 (95.5)	6 (4.5)	1.78 (0.44-1.28)
Middle	61 (19.7)	8 (13.1)	53 (86.9)	5.54 (3.64-8.54)***
Higher				
Duration of diabetes	112 (36.1)	83 (74.1)	29 (25.9)	1.75 (1.01-3.07)*
Less than 3 Years	198 (63.9)	165 (83.3)	33 (16.7)	1
More than 3 Years				
BMI (kg/m ²)	31 (10)	19 (61.3)	12 (38.7)	4.42 (2.14-5.54)***
Underweight	75 (24.2)	48 (64)	27 (36)	4.97 (2.33-6.40)***
Healthy	204 (65.8)	181 (88.71)	23 (11.3)	1
Overweight/Obese				
Comorbidities	47 (15.2)	20 (42.6)	27 (57.4)	6.79 (4.46-8.34)*
Having no disease	263 (84.8)	228 (86.7)	35 (13.3)	1
Having 1 or more diseases				
Awareness about diabetes	240 (77.4)	233 (97.1)	7 (2.9)	1
Inadequate knowledge	70 (22.6)	15 (21.4)	55 (78.6)	12.05 (9.48-13.70)*
Adequate knowledge				
Daily exercise more than 30 mints	249 (80.3)	227 (91.2)	22 (8.8)	1
Irregular	61 (19.7)	21 (34.4)	40 (65.6)	9.65 (6.89-12.02)***
Regular				
Pattern of medicine take daily	39 (12.6)	35 (89.7)	4 (10.3)	1
Irregular	271 (87.4)	213 (78.6)	58 (21.4)	2.38 (0.81-6.98)
Regular				

Doctor checkup in last six months	146 (47.1)	139 (95.2)	7 (4.8)	1
Irregular	164 (52.9)	109 (66.5)	55 (33.5)	10.02 (4.39-12.8)***
Regular				
Manage diet plan daily	116 (37.4)	106 (91.4)	10 (8.6)	1
Irregular	194 (62.6)	142 (73.2)	52 (26.8)	3.88 (1.89-4.99)***
Regular				

abbreviations: BMI, HbA1c, Kg, m respectively body mass index; glycated hemoglobin level; kilogram and meter; Rest., Pakistani rupee. *p < 0.05, **p < 0.01, ***p < 0.001

When binary logistic regression is applied, most of the male respondents were having better diabetes management (OR, 5.03; 95% CI, 4.23-6.08) as compared to female respondents.

Variables	Control HbA1c AOR (95% CI)
Gender	2.48 (1.67-4.21)**
Male	1
Female	
Area	1.44 (1.51-4.08)*
Urban	1
Rural	
Marital status	1.31 (0.52-2.04)
Single	1
Married	
Duration of diabetes	1.50 (1.15-2.33)*
Less than 3 Years	1
More than 3 Years	
BMI (kg/m ²)	2.44 (1.79-4.44)*
Underweight	1.94 (0.58-2.57)
Healthy	1
Overweight/Obese	
Comorbidities	2.90 (1.12-3.64)*
None	1
Having 1 or more	
Awareness about diabetes	1
No	4.73 (2.40-5.18)**
Yes	
Daily exercise more than 30 mints	1
No	2.61 (1.97-4.02)***
Yes	
Pattern of medicine take daily	1
Irregular	0.84 (0.63-2.86)
Regular	

TABLE-II: ADJUSTED ODD RATIO FOR MULTIVARIABLE LOGISTIC REGRESSION OF FACTORS INDEPENDENTLY ASSOCIATED WITH DIABETIC CONTROL (HBA) AMONG TYPE II DIABETIC PATIENTS AGED 20-78 YEARS (N=310)_{IC}

abbreviations: 1, reference category; AOR, adjusted odd ratio; CI, confidence interval; BMI, HbA1c, Kg, m respectively body mass index; glycated hemoglobin level; kilogram and meter. All these variables were adjusted for age (continuous variable), education and monthly income level to perform multivariable logistic regression analysis to obtain adjusted odds ratio. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Multivariate logistics regression analysis including AOR was gathered through the participants age, diabetes management, economic status and education are reflected in Table-II. In the age between twenty to thirty years' management of diabetes was better in comparison to elder stage of the age (OR, 1.76; 95% CI, 1.43-3.12). Income was also associated for better management of diabetes middle class, rich and poor respectively (OR, 2.03; 95% CI, 1.62-3.97) and (OR, 3.89; 95% CI, 2.22-6.07); whereas in married and singlerespectively (OR, 3.52; 95% CI, 1.32-4.35). Higher education had better results than the less educated in the management of diabetes (OR, 5.54; 95% CI, 3.64-8.54). Diabetes duration < 3 and > 3 , BMI less than 24.9 kilogram per meter square and no other disease also had significant effect on the diabetes control (OR, 1.75; 95% CI, 1.01-3.07), (OR, 4.97; 95% CI, 2.33-6.40) and (OR, 6.79; 95% CI, 2.33 - 6.40) respectively. Adequate and in adequate awareness of diabetes for the management of diabetes (AOR, 12.05; 95% CI, 9.48-13.70). Exercise, checkup and diet managed participated in the management of the disease (OR, 9.65; 95% CI, 6.89-12.02), (OR, 10.02; 95% CI, 4.39-12.88) and (OR, 3.88; 95% CI, 1.89-4.99) respectively. Pattern of medication had no link with the diabetes better handling.

This multivariate regression analysis was carried out for the participants age, income and education were used for to get AOR values as reflected in Table-III. Urban participants had better control over the rural areas respectively (AOR, 2.48; 95% CI, 1.67-4.21) and (AOR, 1.44; 95% CI, 1.51-4.08). Diabetes duration for

BMI less than 18.5 kilogram per meter square in < 3 years in comparison to no disease had better management of the diabetes in participants respectively (AOR, 1.50; 95% CI, 1.15-2.33), (AOR, 2.44; 95% CI, 1.79-4.44) and (AOR, 2.90; 95% CI, 1.12-3.64). Health behavior of the participants in the variables of exercise, intake of medicine, regular checkup in the last 6 months had better diabetic control respectively (AOR, 2.61; 95% CI, 1.97-4.02), (AOR, 1.64; 95% CI, 1.00-3.37) and (AOR, 1.56; 95% CI, 1.09-3.99).

DISCUSSION

Findings of the research paper provided numerous factors that participated in the management of diabetes control are medication routine, diet, exercise, age, education, BMI, awareness, history of family, income and area (do Nascimento Andrade & Alves, 2018). Young had better management in comparison to elder in Pakistan. Duration increases the the management of disease in higher HbA1c and decreased levels of glycemic control (Wu et al., 2018).

Good diabetes control is observed in males when compared to females with poor control of glycemic as explained by international and national researches (Mangla et al., 2018). Urban areas had better management of the disease than rural areas because more chances of availing better treatment are persistently available in urban areas such as literacy and health (Salinas, Gonzalez, & Al Snih, 2018). Significant association of higher qualification and income was also linked with the better management of the Type-II diabetes in comparison to lower qualification and income groups because they had opportunities to grasp the necessities and facilities that help in the management of the diabetes (Panagioti et al., 2018). Poor management is less privileged is associated with the persistence diet routine as there is no change in physical exertions and diet pattern restricts them in the better handling of diabetes (Salsberry, Tanda, Anderson, & Kamboj, 2018).

Poor glycemic control also had strong relation with obesity as obesity leads to enhanced chances of Type-II diabetes and associated comorbidities (Landi, Ivaldi, & Testi, 2018). Inactive life routine and absence of exercise leads to glycemic level increase that contributed in the poor management of diabetes. Blood glucose is significantly associated with exercise and reduction of weight, hypertension and cardiovascular diseases. Active life style had positive management in comparison to inactive life style (Al-Hamoudi et al., 2018). Physical activity and healthy diet routine effectively manages the required level of weight and glycemic levels. Irregular or limited care of the health leads to disturbed glycemic readings attributed to absence of doctor's visits. Better management is possible through regular intake of medicine and checkups in comparison to irregular and disturbed routine of medicine and checkup (Glezeva et al., 2018).

In Pakistan, awareness about the diabetes is another significant factor that is required for the management of diabetes. Awareness about health behavior, medicine use, and diet is mandatory (Yoo, Boas, & Choi, 2018). Participants with less or no awareness had a tendency of elevation in the glycemic level leading to complications related to diabetes (Wan, 2018).

CONCLUSION

Risky behavior about health, socio-economic status, females managed the diabetes poorly. Awareness about the Type-II diabetes was mandatory and significant in the management of the disease for the transformation of unhealthy health behavior into healthy one.

RECOMMENDATIONS

Attention by the government sector is required in the management of diabetes at national level specially in the knowledge and awareness sector about the disease. Health educators and professionals can play their part in this regard.

Quality life-style, prevention of disease and its complications, knowledge campaigns, free of cost medical camps, expert dietician's consultation and provision of awareness can help in the better management of the Type-II diabetes. Special attention is to be diverted in the improvement of health behavior, diet routine, regular exercise, regular screening of blood, checkup by experts, intake of medicine and in the weight reduction programs. Quality life style and positive healthcare behavior leads to better results and chances of any risk are decreased.

REFERENCES

1. Al-Hamoudi, N., Abduljabbar, T., Mirza, S., Al-Sowygh, Z. H., Vohra, F., Javed, F., & Akram, Z. (2018). Non-surgical periodontal therapy reduces salivary adipocytokines in chronic periodontitis patients with and without obesity. *Journal of Investigative and Clinical Dentistry*.
2. Brown, S. A., García, A. A., Zuñiga, J. A., & Lewis, K. A. (2018). Effectiveness of Workplace Diabetes Prevention Programs: A Systematic Review of the Evidence. *Patient Education and Counseling*.
3. Burner, E., Lam, C. N., DeRoss, R., Kagawa-Singer, M., Menchine, M., & Arora, S. (2018). Using Mobile Health to Improve Social Support for Low-Income Latino Patients with Diabetes: A Mixed-Methods Analysis of the Feasibility Trial of TEXT-MED+ FANS. *Diabetes technology & therapeutics*, 20(1), 39-48.
4. do Nascimento Andrade, C. J., & Alves, C. d. A. D. (2018). Influence of socioeconomic and psychological factors in glycemic control in young children with type 1 diabetes mellitus. *Jornal de pediatria*.
5. Fayet-Moore, F., George, A., Cassettari, T., Yulin, L., Tuck, K., & Pezzullo, L. (2018). Healthcare Expenditure and Productivity Cost Savings from Reductions in Cardiovascular Disease and Type 2 Diabetes Associated with Increased Intake of Cereal

- Fibre among Australian Adults: A Cost of Illness Analysis. *Nutrients*, 10(1), 34.
6. Glezeva, N., Chisale, M., McDonald, K., Ledwidge, M., Gallagher, J., & Watson, C. J. (2018). Diabetes and complications of the heart in Sub-Saharan Africa: An urgent need for improved awareness, diagnostics and management. *Diabetes research and clinical practice*, 137, 10-19.
 7. Keene, D. E., Guo, M., & Murillo, S. (2018). "That wasn't really a place to worry about diabetes": Housing access and diabetes self-management among low-income adults. *Social Science & Medicine*, 197, 71-77.
 8. Landi, S., Ivaldi, E., & Testi, A. (2018). Socioeconomic status and waiting times for health services: An international literature review and evidence from the Italian National Health System. *Health Policy*.
 9. Lindner, L., Rathmann, W., & Rosenbauer, J. (2018). Inequalities in glycaemic control, hypoglycaemia and diabetic ketoacidosis according to socio-economic status and area-level deprivation in Type 1 diabetes mellitus: a systematic review. *Diabetic Medicine*, 35(1), 12-32.
 10. Ma, Y., Li, X., Zhao, D., Wu, R., Sun, H., Chen, S., . . . Li, X. (2018). Association between cognitive vulnerability to depression-dysfunctional attitudes and glycaemic control among in-patients with type 2 diabetes in a hospital in Beijing: a multivariate regression analysis. *Psychology, health & medicine*, 23(2), 189-197.
 11. Mangla, A., Doukky, R., Richardson, D., Avery, E. F., Dawar, R., Calvin, J. E., & Powell, L. H. (2018). Design of a bilevel clinical trial targeting adherence in heart failure patients and their providers: The Congestive Heart Failure Adherence Redesign Trial (CHART). *American heart journal*, 195, 139-150.
 12. Martinez, K., Lockhart, S., Davies, M., Lindsay, J. R., & Dempster, M. (2018). Diabetes distress, illness perceptions and glycaemic control in adults with type 2 diabetes. *Psychology, health & medicine*, 23(2), 171-177.
 13. McGovern, A., Hinton, W., Calderara, S., Munro, N., Whyte, M., & de Lusignan, S. (2018). A class comparison of medication persistence in people with type 2 diabetes: a retrospective observational study. *Diabetes Therapy*, 1-14.
 14. Panagioti, M., Skevington, S. M., Hann, M., Howells, K., Blakemore, A., Reeves, D., & Bower, P. (2018). Effect of health literacy on the quality of life of older patients with long-term conditions: a large cohort study in UK general practice. *Quality of Life Research*, 1-12.
 15. Salinas, J. J., Gonzalez, J. M. R., & Al Snih, S. (2018). Type 2 diabetes, depressive symptoms and disability over a 15-year follow-up period in older Mexican Americans living in the southwestern United States. *Journal of diabetes and its complications*, 32(1), 75-82.
 16. Salsberry, P., Tanda, R., Anderson, S. E., & Kamboj, M. K. (2018). Pediatric type 2 diabetes: Prevention and treatment through a life course health development framework *Handbook of Life Course Health Development* (pp. 197-236): Springer.
 17. Wan, T. T. (2018). Poly Chronic Disease Epidemiology: A Global View *Population Health Management for Poly Chronic Conditions* (pp. 69-84): Springer.
 18. Wu, F.-L., Wu, E.-C., Chang, Y.-C., Hu, W.-Y., Juang, J.-H., & Yeh, M. C. (2018). Factors Affecting the Ability of People With Diabetes to Avoid Hypoglycemia. *Journal of Nursing Research*, 26(1), 44-51.
 19. Yoo, Y. G., Boas, J. Y., & Choi, E.-H. (2018). A Comparison Study: The Risk Factors in the Lifestyles of Thyroid Cancer Patients and Healthy Adults of South Korea. *Cancer nursing*, 41(1), E48-E56.