Original Article

# Clinical and Sociodemographic Predictors of the Quality of Life among Patients with Type 2 Diabetes Mellitus on the East Coast of Peninsular Malaysia

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## Abstract

***Background*: The quality of life (QoL) describes the multidimensional self-perceived well-being of a person, which is an important diabetes outcome. This study aimed to measure the QoL scores among patients with type 2 diabetes mellitus (T2DM), as well as their clinical and sociodemographic predictors.**

***Methods*: This cross-sectional study involved 180 randomly sampled patients at a primary care clinic on the East Coast of Peninsular Malaysia. A self-administered questionnaire containing the Audit of Diabetes Dependent Quality of Life-18 (ADDQoL-18) was used.**

***Results*: Most of the respondents (96.7%) were Malay, with a median (interquartile range, IQR) age of 54.0 (14.0) years old. The majority of them were females (60.0%), married (81.1%) and from low-income families (63.3%), who attained a secondary education or lower (75.6%). Only 49.4% of them were employed. The mean (standard deviation, SD) ADDQoL-18 average weighted impact score was −4.58 (2.21) and all 18 domains were negatively affected, particularly the living condition, family life and working life. The multiple linear regression analysis showed that the age (adjusted B = 0.05, *P* = 0.004) and insulin use (adjusted B = −0.84, *P* = 0.011) were QoL predictors.**

***Conclusion*: T2DM negatively impacts the patient's QoL in all aspects of their life. The QoL improvement with age suggests that the older patients had accepted and adapted to their illness. The need to improve the QoL among insulin users was also highlighted.**

***Keywords:*** *diabetes mellitus, quality of life, Malaysia, insulin, age*

## Introduction

The general aim of diabetes care is to achieve good biopsychosocial outcomes. Having good glycaemic control and reducing the risk of diabetes complications must be achieved in tandem with preserving the patient's quality of life (QoL) (1, 2). The QoL has become an important measure in diabetes management because the treatment itself may affect the patient's physical and psychosocial well-being (2, 3).

The QoL describes the multidimensional self-perceived well-being of a person, and it includes the general well-being, physical health and functioning, mental health and emotional functioning, social functioning and satisfaction with treatment (1, 2, 4). It is usually regarded as a synonym for the health status and satisfaction (4), and it reflects the patient's satisfaction with


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regard to how well their needs and expectations are met. Therefore, it is influenced by the patient's personal goals and life concerns (5). The QoL is also shaped by the patient's culture, social context, environment, values, belief system and tendency toward acceptance (5, 6).

Generally, individuals with type 2 diabetes mellitus (T2DM) have poorer QoLs when compared to those who are healthy (1, 7). The QoLs among patients with T2DM can be negatively affected to various degrees and in various domains of life (8–13). Nevertheless, different studies have used different tools to measure the QoL, and thus, it is difficult to compare and generate conclusions from these findings (1, 2, 7, 14).

Various sociodemographic and diabetes-related factors have been found to affect the QoL of patients with T2DM. These include the diabetes severity (indirectly indicated by the duration of diabetes, glycaemic control and number of complications), co-morbidities, treatment types (insulin use versus non-insulin use), treatment compliance and hypoglycaemic episodes (1, 7, 10, 15–17).

In Malaysia, studies examining the QoL predictors among patients with T2DM are still needed (11–13, 18–20). By identifying these determinants, more focused strategies to improve the health outcomes of diabetes management could be implemented, and these outcomes include the QoL. Therefore, this study aimed to measure the QoL scores among patients with T2DM at a primary care clinic on the East Coast of Peninsular Malaysia. The QoL score predictors among the respondents were also determined.

## Materials and Methods

This cross-sectional study was conducted at a primary care clinic on the East Coast of Peninsular Malaysia. This clinic provides a structured programme for patients with T2DM run by a trained diabetes team. It is the referral centre for fundus camera examinations from other clinics under the jurisdiction of the District Health Office of Administration.

Prior to the data collection period (October 2011 until January 2012), there were 1,722 registered diabetes patients in this clinic. These registered patients were randomly selected through a computer-generated list of random numbers. Their diabetes records were retrieved, and their criteria for participation were examined. The inclusion criteria for this study were adult patients older than 18 years who had been diagnosed with T2DM for more than one year. Those who were unable to read or understand Bahasa Malaysia or had cognitive impairments, substance abuse disorders, and non-diabetes related co-morbidities that could affect their QoLs were excluded. Those patients who met the criteria were contacted via the telephone. Those who agreed to participate were given appointments to meet the researchers at the clinic.

### *Audit of Diabetes Dependent Quality of Life*

In this study, the Audit of Diabetes Dependent Quality of Life-18 (ADDQoL-18) was used. It is a diabetes-specific measurement of the QoL that was developed by Bradley et al. (21). The ADDQoL-18 has been widely used due to its good psychometric properties (2), and it was translated to the Malay language (i.e. Bahasa Malaysia) and validated by Kamarul Imran et al. (13). The Cronbach's alpha of the Bahasa Malaysia version of the ADDQoL-18 was 0.943.

The ADDQoL-18 contains 18 items assessing the condition-specific domains of life (Table 1) (21). These specific items were assessed by asking the respondents to rate the impacts on 18 specific conditions if they did not have diabetes. The response options used a seven-point Likert scale, ranging from −3 (very much better) to +3 (very much worse). However, three of the condition-specific domains of life, the 'working life and work-related opportunities', 'family life' and 'sex life', had 'not applicable' options. Thus, if the respondents felt that these items were not applicable to them, the items were not included in the final score. All the applicable domains of life were weighted according to the importance perceived by the respondents. This importance rating ranged from 0 (not at all important) to 3 (very important).

For each domain, the impact and importance ratings were multiplied to calculate the weighted impact rating. Subsequently, the final average weighted impact (AWI) score was calculated by dividing the sum of the weighted impact ratings by the number of applicable domains. This AWI score ranged from −9 (maximum negative impact of diabetes) to +9 (maximum positive impact of diabetes). Thus, more negative scores indicated poorer QoLs due to diabetes (21).

**Table 1.** Domains of ADDQOL-18

| | | |
|---|---|---|
| General QOL Domain | 1. | Present QOL |
| | 2. | If I did not have diabetes |
| Condition-specific domains of life | 3. | Working life and work related opportunities[a] |
| | 4. | Family life[a] |
| | 5. | Friendships and social life |
| | 6. | Sex life[a] |
| | 7. | Physical appearance |
| | 8. | Physical activities |
| | 9. | Holidays and leisure activities |
| | 10. | Ease of travelling (local or long distance) |
| | 11. | Confidence in ability to do things |
| | 12. | Motivation to achieve things |
| | 13. | The way society reacts to me |
| | 14. | Worries about the future |
| | 15. | Finances |
| | 16. | Unwanted dependence on others |
| | 17. | Living condition |
| | 18. | Freedom to eat as I wish |
| | 19. | Enjoyment of food |
| | 20. | Freedom to drink as I wish |

[a]Domains that have a 'not applicable' option

### *Quality of Life Determinants*

The independent variables in this study included the respondents' sociodemographic factors (age, gender, educational level, monthly family income and living status, i.e., living alone or with others). The other independent variables were clinical factors, including the type of treatment received (non-insulin therapy or insulin therapy), duration of diabetes (< 5 years, 5–10 years or > 10 years), diabetes control (HbA1C ≤ 7% or > 7%), number of diabetes-related complications (0, 1 or ≥ 2) and the presence of diabetes-related hospitalisation. These data were retrieved from the respondents' medical records.

### *Statistical Analysis*

The data analysis was performed using the IBM SPSS Statistics version 19. A bivariate analysis was done using the Spearman correlation test (for the numerical independent variables), as well as the independent *t*-test and one-way analysis of variance (ANOVA) (for the categorical independent variables). Subsequently, a multivariate analysis using multiple linear regressions was done to determine the predictors that significantly influenced the respondents' QoLs.

### *Ethical Consideration*

This study was registered with the National Medical Research Registry (NMRR-11-753-9623). Approvals from the Research and Ethics Committee of the Universiti Kebangsaan Malaysia (FF-333-2011) and the Medical Research Ethics Committee at the Ministry of Health Malaysia were obtained. This study received permission to use the original and Bahasa Malaysia versions of the ADDQoL-18 from the authors. In addition, written informed consent was obtained from each respondent.

## Results

### *Respondents' Characteristics*

There were 180 patients included in this study, and the response rate was 91.8%. Approximately 96.7% of the respondents were Malays, which is the predominant ethnic group on the East Coast of Peninsular Malaysia (Table 2). Their median (interquartile range, IQR) age was 54.0 (13.0) years old. Three-fifths of the participants were females, and 81.1% were married. Only 10.0% of them lived alone. Approximately three-fourths (75.6%) of the respondents had attained a secondary education or lower, and 63.3% came from low-income families. Less than a half of them (49.4%) were employed.

Approximately 55.0% of the respondents had T2DM for 5 years or more, and 42.8% had at least one diabetes-related complication (Table 2). The glycaemic control was poor in most of them (82.2%); however, only two-fifths (39.4%) were taking insulin. Almost one-tenth (9.4%) had a history of diabetes-related hospitalisation.

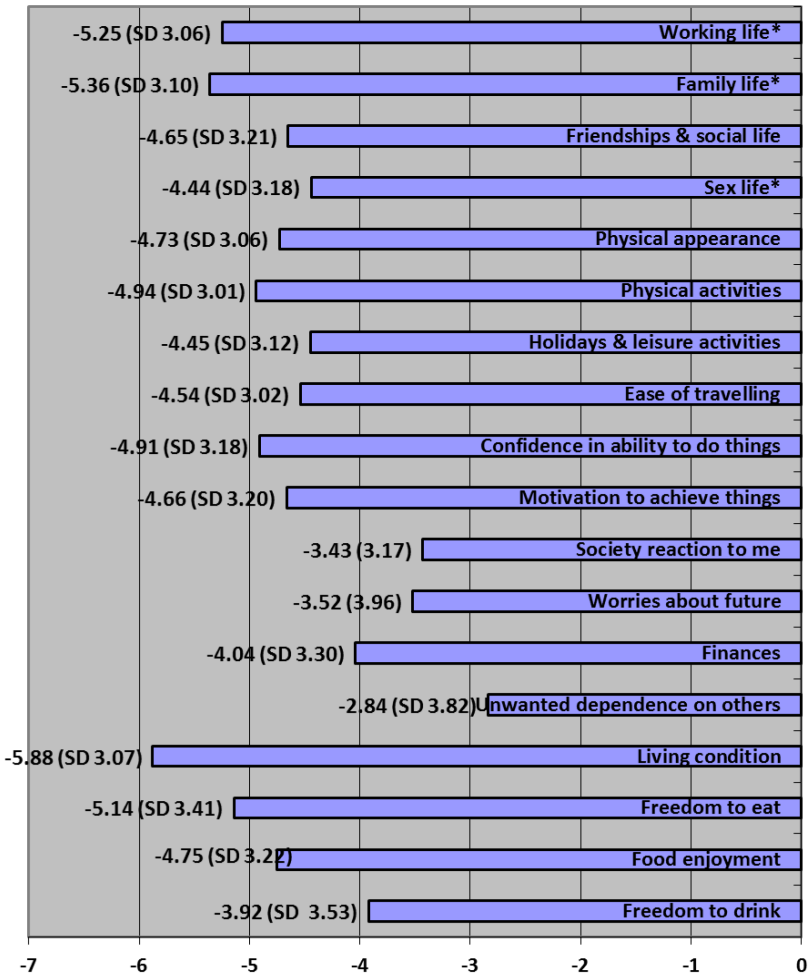
### *Quality of Life of the Respondents*

The ADDQoL-18 AWI scores for all the participants in this study were negative. The mean (standard deviation, SD) ADDQoL-18 AWI score was −4.58 (2.21). The mean (SD) ADDQoL-18 weighted impact ratings for the 18 condition-specific domains of life ranged between −2.84 (3.82) and −5.88 (3.07) (Figure 1). Overall, the three most negatively affected domains of life were the living condition, family life and working life (Figure 1).

**Table 2.** Socio-demographic and diabetes-related characteristics of the participants ($n$ = 180)

| Variables | $n$ (%) | Median (IQR) |
|---|---|---|
| Age (year)[a] | | 54.0 (13.0) |
| Younger adults (20–39 years) | 16 (8.9) | |
| Middle-age adults (40–64 years) | 144 (80.0) | |
| Elderly (≥ 65 years) | 20 (11.1) | |
| Gender | | |
| Male | 72 (40.0) | |
| Female | 108 (60.0) | |
| Ethnicity | | |
| Malay | 174 (96.7) | |
| Non-Malay | 6 (3.3) | |
| Education level | | |
| No formal or primary education | 41 (22.8) | |
| Secondary education | 95 (52.8) | |
| Tertiary education | 44 (24.4) | |
| Employment status | | |
| Employed | 89 (49.4) | |
| Unemployed/Pensioner | 91 (50.6) | |
| Monthly family income (RM)[a] | | 1500.0 (2250.0) |
| Low income (< RM2000) | 114 (63.3) | |
| Middle or high income (≥ RM2000) | 66 (36.7) | |
| Marital status | | |
| Married | 146 (81.1) | |
| Non-married | 34 (18.9) | |
| Living status | | |
| Stayed alone | 18 (10.0) | |
| Stayed with family or others | 162 (90.0) | |
| Duration of diabetes mellitus | | |
| < 5 years | 81 (45.0) | |
| 5–10 years | 62 (34.4) | |
| > 10 years | 37 (20.6) | |
| Types of diabetic treatment | | |
| Non-insulin use | 109 (60.6) | |
| Insulin use | 71 (39.4) | |
| Diabetes controlled (HBA1C)[a] | | 8.7 (3.0) |
| Controlled (HBA1C ≤ 7%) | 32 (17.8) | |
| Uncontrolled (HBA1C > 7%) | 148 (82.2) | |
| Number of diabetes-related complications | | |
| No complication | 103 (57.2) | |
| 1 complication | 56 (31.1) | |
| 2 and more complications | 21 (11.7) | |
| Diabetes-related hospital admission | | |
| No | 163 (90.6) | |
| Yes | 17 (9.4) | |

[a]Data was not normally distributed




*Domains that have a 'not applicable' option

**Figure 1.** The ADDQOL-18 weighted ratings for 18 condition-specific

### *Bivariate Analysis of the Determinants of the Quality of Life*

From the bivariate analysis, the age ($r$ = 0.21, $P$ = 0.004), gender ($P$ = 0.041), living status ($P$ = 0.032), type of treatment ($P$ = 0.003), HbA1C ($r$ = −0.21, $P$ = 0.004), number of diabetes-related complications ($P$ = 0.020) and history of hospitalisation due to diabetes-related illness ($P$ = 0.027) were significantly associated with a lower average weighted ADDQoL-18 (Table 3, Figures 2 and 3). However, there were no associations between the ADDQoL-18 AWI scores and the other variables.

### *Multivariate Analysis of the Determinants of the Quality of Life*

A multiple linear regression using a stepwise model selection was done to identify the predictors of the ADDQoL-18 AWI scores. The independent variables included in the analysis were those found to have $P$ values of < 0.250 (age, gender, education level, living status, type of treatment, number of diabetes-related complications and presence of diabetes-related hospitalisation). Only the age (adjusted B = 0.05, $P$ = 0.004) and insulin use (adjusted B = −0.84, $P$ = 0.011) were found to be predictors of the ADDQoL-18 AWI score after controlling for the gender, educational level, living status, number of diabetes-related complications and presence of diabetes-related hospitalisation (Table 4). An age increase of 10 years led to an increase in the ADDQoL-18 AWI score of 0.5 points, suggesting that younger patients have poorer QoLs when compared to older patients. The ADDQoL-18 AWI scores of the insulin users were lower by 0.8 when compared to the non-insulin users. The model explained

**Table 3.** Association of the average weighted ADDQOL-18 scores among participants with their socio-demographic and diabetes-related factors

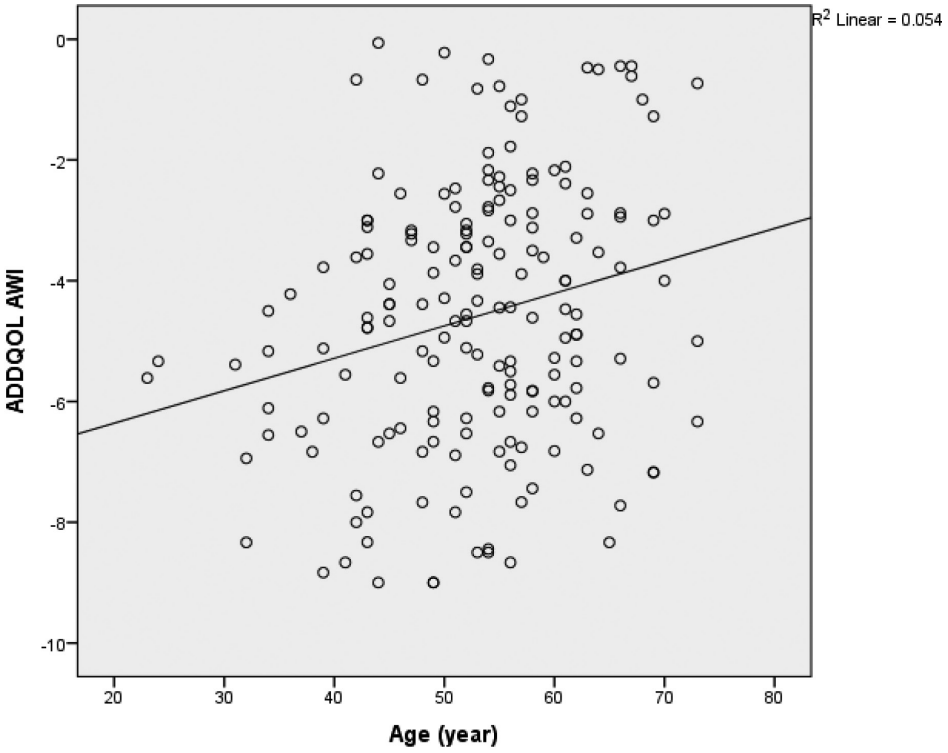
| Variables | Mean (SD) or *r*[a] | *P*-value* |
|---|---|---|
| Age[a] (*n* = 180) | 0.21 | 0.004* |
| Gender[b] | | |
| Male (*n* = 72) | −4.17 (2.29) | 0.041* |
| Female (*n* = 108) | −4.86 (2.11) | |
| Ethnicity | | |
| Malay (*n* = 174) | −4.59 (2.21) | 0.699 |
| Non-Malay (*n* = 6) | −4.24 (2.32) | |
| Education level[c] | | |
| No formal or primary education (*n* = 41) | −4.09 (2.25) | 0.229 |
| Secondary education (*n* = 95) | −4.79 (2.19) | |
| Tertiary education (*n* = 44) | −4.59 (2.19) | |
| Employment status[b] | | |
| Employed (*n* = 89) | −4.48 (2.24) | 0.552 |
| Unemployed/pension (*n* = 91) | −4.68 (2.18) | |
| Monthly family income[b] | | |
| Low income (< RM2000) (*n* = 114) | −4.54 (2.20) | 0.752 |
| Middle or high income (≥ RM2000) (*n* = 66) | −4.65 (2.24) | |
| Marital status[b] | | |
| Married (*n* = 146) | −4.88 (2.13) | 0.389 |
| Non-married (*n* = 34) | −4.51 (2.23) | |
| Living status[b] | | |
| Staying with family or others (*n* = 162) | −4.70 (2.20) | 0.032* |
| Staying alone (*n* = 18) | −3.53 (2.08) | |
| Duration of diabetes mellitus (years)[c] | | |
| < 5 (*n* = 81) | −4.65 (2.06) | 0.700 |
| 5–10 (*n* = 62) | −4.40 (2.45) | |
| > 10 (*n* = 37) | −4.75 (2.14) | |
| Types of diabetic treatment[b] | | |
| Non-insulin use (*n* = 109) | −4.21 (2.30) | 0.003* |
| Insulin use (*n* = 71) | −5.16 (1.93) | |
| HbA1C[a] (*n* = 180) | −0.21 | 0.004* |
| Number of diabetes-related complications[c] | | |
| No complication (*n* = 103) | −4.24 (2.36) | 0.020* |
| 1 complication (*n* = 56) | −4.81 (2.02) | |
| 2 or more complications (*n* = 21) | −5.63 (1.50) | |
| History of diabetes-related hospital admission[b] | | |
| No (*n* = 163) | −4.47 (2.19) | 0.027* |
| Yes (*n* = 17) | −5.71 (2.11) | |

*Significant level at 0.05

[a]Spearman's rho correlation; [b]Independent *t*-test; all assumptions met; [c]One-way ANOVA, all assumptions met; post hoc analysis:

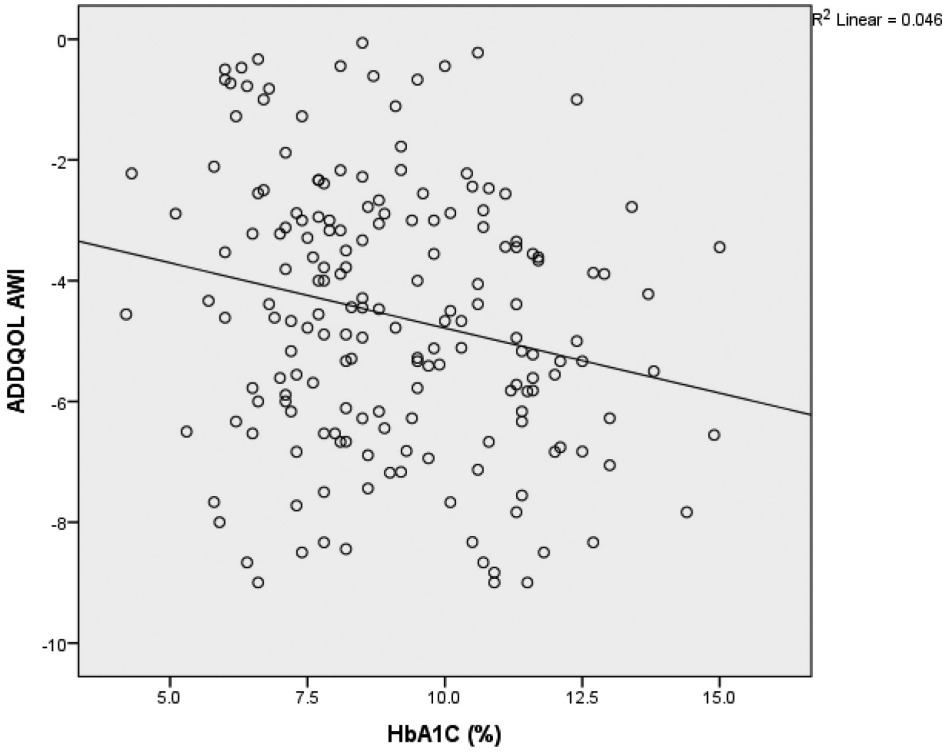
Using Scheffe: **No/primary education versus Secondary education: *P* = 0.23**; No/primary education versus Tertiary education: *P* = 0.57; Secondary education versus Tertiary education: *P* = 0.88

Using Dunnet C: No complication versus 1 complication: *P* > 0.05; **No complication versus ≥ 2 complication**: ***P* < 0.05**; 1 complication versus ≥ 2 complication: *P* > 0.05




Spearman's rho correlation: −0.21, $P = 0.004$

**Figure 2.** Correlation between age and the average weighted ADDQOL-18




Spearman's rho correlation: 0.21, $P = 0.004$

**Figure 3.** Correlation between HbA1C and the average weighted ADDQOL-18

9% of the variance in the ADDQoL-18 AWI scores of the respondents, and the fitness of this model was adequate. The absence of interactions between the predictors was demonstrated ($P$ = 0.08) and there was no problem with multicollinearity [both tolerance values were 0.98, above the value of 1-$R^2$ (0.91 whereby $R^2$ = 0.09); variance inflation factor (VIF) < 10, average VIF = 1.02]. The overall linearity of this model fit reasonably well, and the equal variance of the residual was met.

## Discussion

Many previous studies have shown that T2DM can impair the QoLs of these patients (8–13), and this study has provided additional evidence to support this observation. In fact, all aspects of these patients' lives were affected by diabetes, as shown previously by other studies (8–12, 15, 18, 22, 23). These findings indicate that T2DM is undeniably a demanding illness that can impair the sufferer's well-being. Not only do they have to tolerate the physical symptoms of the disease, its complications and the treatment side-effects, they must also struggle to adjust their lives to accommodate their self-care activities and conform to the recommended management (6).

The mean ADDQoL-18 AWI score and the ADDQoL-18 weighted ratings for all the domains in our study were similar to those of another local study (12). Since both of the studies were carried out on the East Cost of Peninsular Malaysia, the respondents could share similar socioeconomic conditions, cultures and beliefs. However, the QoLs of our respondents appeared to be the worst among the other studies that used the ADDQoL-18 questionnaire (15, 22, 23). As expected, the mean ADDQoL-18 AWI scores of the studies conducted in more developed countries, such as the USA and Ireland, were substantially higher than in the local studies, indicating better QoLs among their patients when compared to the Malaysian patients (12, 15, 22, 23). Even diabetes patients in China

**Table 4.** Factors predicting the ADDQOL-18 average weighted impact score among T2DM patients ($n$ = 180)

| Model* | SLR[a] | | | MLR[b] | | | |
|---|---|---|---|---|---|---|---|
| | *b* value[c] | 95% CI | *P*-value | *adj. b*[d] value | 95% CI | t-stat | *P*-value |
| **Constant** | | | | **−6.82** | **−8.64, −4.99** | **−7.38** | **0.00** |
| Age (year) | 0.05 | 0.02, 0.09 | 0.002 | 0.05 | 0.02, 0.08 | 2.90 | 0.004 |
| Female vs Male | −0.68 | −1.34, −0.03 | 0.041 | – | – | – | – |
| Secondary education versus No/ primary education | −0.45 | −1.90, 0.20 | 0.175 | – | – | – | – |
| Tertiary education versus No/ primary education | −0.01 | −0.77, 0.75 | 0.980 | | | | |
| Staying alone versus Staying with others | 1.17 | 0.10, 2.24 | 0.032 | – | – | – | – |
| HbA1C (%) | −0.22 | −0.36, −0.07 | 0.004 | – | – | – | – |
| Insulin users versus Non-insulin users | −0.96 | −1.61, 0.60 | 0.004 | −0.84 | −1.48, 0.20 | −2.57 | 0.011 |
| One complication versus No complication | −0.34 | −1.04, 0.37 | 0.346 | | | | |
| ≥2 complications versus No complication | −1.18 | −2.18, −0.18 | 0.021 | – | – | – | – |
| Had hospital admission versus No hospital admission | −1.24 | −2.34, −0.14 | 0.027 | – | – | – | – |

*Model only included variables with $P$ < 0.25
[a]Simple Linear Regression; [b]Multiple Linear regression using Stepwise method
[c]Crude regression coefficient; [d]Adjusted regression coefficient
MLR Final Model: $R^2$: 0.09; Adjusted $R^2$: 0.08; Model F statistic: 8.58, $P$ < 0.001; The model was reasonably fit; No interaction between independent variables; No multicollinearity problem

suffered lesser impacts than our respondents; their ADDQoL-18 weighted ratings for the 18 condition-specific domains ranged from −1.71 to −3.57, but the ratings among our respondents ranged between −2.84 and −5.88 (9). Different needs, life demands and expectations may be the causes of these various QoL levels because people from different countries have different cultures, socioeconomic conditions, societal beliefs and norms (5, 6). Those from developed countries might even receive more comprehensive and effective support from their advanced healthcare systems (23). This could ease their struggle and improve their well-being.

In this study, a younger age and insulin use were found to be predictors of lower ADDQoL-18 AWI scores after controlling for the confounding factors, which were the gender, education level, living status, number of diabetes-related complications and presence of diabetes-related hospitalisation. Contrary to the popular belief that the QoL deteriorates as we age (7), this current study showed otherwise. This finding was similarly demonstrated by other studies (8, 15, 23), and the lesser emotional distress experienced by older patients has been postulated to explain this finding (8). This is because older patients may have lower work and family demands when compared to younger patients who are still working, and who must take care of their young children and ageing parents (8). Older patients might also have accepted the disease and developed the ability to cope with the demands of a life with diabetes (15). Further studies are required to explore the reasons for this finding. Nevertheless, support should always be given to any patient who is struggling to live with diabetes. Based on this study, younger patients may need more support to adapt to the demands of life with diabetes.

Similar to previous studies, the insulin users were generally found to have poorer QoLs than the non-insulin users (14, 15, 24–26). However, some studies have demonstrated that the initiation of insulin did not impair the QoL; in fact, there are studies showing an improvement in the QoL instead (27–30). These contradictory findings may be related to the different types of insulin (human insulin versus analogues), delivery systems (multiple injections versus continuous pump) and insulin regimens ('before bed' insulin, twice daily insulin or basal bolus insulin) (1, 14). Nevertheless, there are patients who may have difficulties using insulin. One must ensure that they are taking the correct insulin dose, using the right technique and injection timing and storing their insulin properly. In addition, they must be disciplined with their mealtimes to prevent hypoglycaemia. Regular blood glucose self-monitoring is also recommended to help these patients to choose the required insulin dosage. With all of these considerations, some patients may feel that insulin use causes lifestyle restrictions, inconvenience and embarrassment (31). Their lives may become regimented, thus requiring significant adjustments, especially for those who are still working. Therefore, healthcare providers should explore these difficulties in using insulin to identify individualised support that can ease the struggle, such as the use of a simple insulin regimen, insulin analogues or a continuous pump. In addition, counselling that can improve their knowledge of insulin and empower their self-efficacy to deal with the challenges related to insulin use may benefit insulin users.

This study also highlights the possibility of other factors that could predict the QoL, other than the sociodemographic and diabetes-related factors, since the assessed factors could only explain 9% of the variance in the ADDQoL-18 AWI scores of the respondents. Psychosocial problems, healthcare system types and the patient's spirituality may play significant roles in determining the QoL. For example, depression, anxiety and stress can negatively affect the QoLs of patients with T2DM, and these problems are common among them (32–35). Certain diabetes care systems with a structured model of care could also improve their QoLs (23). Lastly, spirituality could enhance the inner strength, hope and acceptance of self-responsibility of these patients, which could influence their QoLs (36, 37). In view of this, future studies should include these factors for a more holistic assessment.

This study was conducted in a primary healthcare clinic on the East Coast of Peninsular Malaysia, and it involved mostly Malays. Because of this, the generalisation of the findings is limited. Furthermore, the findings of this study could not confirm the causal relationships between the predictors and QoLs because it used a cross-sectional design.

## Conclusion

T2DM negatively impairs the QoLs of these patients in all aspects of their lives, particularly their living conditions, family lives and working lives. Age and insulin use were found to be the

significant predictors of the ADDQoL-18 AWI score. Interestingly, the patients' QoLs improved as they aged, which suggests that adapting to life with diabetes may play an important role in maintaining their well-being. This study also highlights the needs to improve the QoLs among insulin users, because its use was found to be associated with poorer QoLs when compared to those who did not use insulin. It appears that other important factors, apart from the sociodemographic and diabetes-related factors, such as the duration of diabetes, diabetes control and the presence of diabetes-related complications, may play more significant roles in determining the QoL. Thus, future studies should include all possible factors to determine the best predictors of the QoLs among diabetes patients.

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## Authors' Contributions

Conception and design: ZJ, HT, KO
Analysis and interpretation of the data: ZJ, HT, NAM, SA
Drafting of the article: HT
Critical revision of the article for important intellectual content: HT, KO, NAM, SA
Final approval of the article: ZJ, HT, KO, NAM, SA
Provision of study materials or patients: ZJ
Statistical expertise: HT, NAM, SA
Obtaining of funding: KO
Administrative, technical, or logistic support: KO
Collection and assembly of data: ZJ

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