*http://rjdnmd.org*
Rom J Diabetes Nutr Metab Dis. **26**(1):021-030
doi: 10.2478/rjdnmd-2019-0003

# EVALUATING THE DIRECT AND INDIRECT EFFECTS OF SF-36 DOMAINS SCORE ON TWO MAIN FACTORS IN DIABETIC PATIENTS WITH PATH ANALYSIS: HEALTH-RELATED QUALITY OF LIFE STUDY

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*received*: December 27, 2018 *accepted*: March 10, 2019
*available online*: April 10, 2019

## Abstract

***Background and aims:*** *Diabetes mellitus (DM) patients have a lower quality of life. This study aimed to examine the direct and indirect effect of eight domains score of the SF-36 questionnaire on two main factors, i.e., overall physical health (GH_M) and overall mental health (MH_M), in DM patients. To the best of our knowledge, this issue has been rarely studied so far.* ***Material and method:*** *A total of 1037 DM patients filled out the Persian version of the SF-36 questionnaire. The path analysis was used in this study.* ***Results:*** *In this research, only social functioning (SF) domain has significantly lower the men compared to women (P=0.06). Physical functioning (PF), bodily pain (BP), general health (GH) and vitality (VT) have a negative significant direct effect on the GH_M factor. GH domain also has a positive indirect and total effect on MH_M factor, and other domains have no significant total effect on MH_M factor.* ***Conclusion:*** *It is better that physicians, focus on regulating physical activity and reducing body pain in diabetes patients, which have the most direct impact on HRQoL, to achieve a more effective outcome in improving quality of life in this patient.*

**key words**: *Quality of life, diabetes mellitus, SF-36 questionnaire, path analysis*

## Background and aims

Diabetes mellitus (DM) is a chronic disease with long-term treatment to reduce the complications of the disease [1]. The prevalence of DM in many societies is on the rise, especially in developing countries. In Iran, about 4.4 million adults have suffered from diabetes [2]. Diabetic patients suffer severe complications such as hypoglycemia that constrain them and make changes in their lifestyle. Moreover, the continuous use of drugs for regulating their blood glucose makes them dependent to stress [3]. Several studies have revealed the association between diabetes and psychological complications such as sleep disorders, depression, and anxiety [4,5]. In addition to psychological complications and management of level of glucose, sexual and work dysfunction [6,7] affect HRQoL of diabetic patients. Studies have shown that people with diabetes have a lower HRQoL, particularly physical functioning,

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compared to those with no other chronic disease [8]. According to the definition of the WHO (1948), health is not just an absence of disease but requires physical, mental, and social health [9]. In fact, HRQoL studies are necessary for describing a health condition, offering a prognosis [10], and estimating the cost-effectiveness of various treatments. Moreover, the importance of HRQoL research has been recognized for assessing the effect of new medical treatments and healthcare services for diabetic patients [11-13]. In previous studies, numerous generic questionnaires have been used for evaluating HRQoL in diabetic patients. One of the most frequently used tools in this regard is SF-36 [14]. The most advantage of this generic instrument that makes it famous is that it can be useful for measuring the quality of life in various diseases [15]. These eight dimensions could be summarized in two main domains, i.e., general health and mental health, which show the whole HRQoL perfectly. Certainly, focusing on two main domains makes the analytical process of HRQoL simpler. Although many studies have been conducted on the quality of life in diabetic patients[16-20], there is no study examining the direct and indirect effects of each of the dimensions affecting the quality of life. The purpose of this study is to investigate the direct and indirect effects of the SF-36 questionnaire domain scores on two summarized main factor (i.e., MH_M, and GH_M) based on path analysis, to find most important domain that influence the HRQol in DM patients.

## Material and Method

### *Study design and patients*

A total of 1037 patients (881 women, and 156 men) with diabetic symptoms referring to the Besat Laboratory, as the main laboratory for diabetes patients in Kerman (southern Iran), were recruited from May 2016 to October 2016. The patients who came to the laboratory to check their routine blood sugar test were asked to participate in the study. Written informed consent was obtained from patients before participating in the study. The patients older than 18 years, with DM for at least 1 month, and without any other chronic diseases were included in the study. No clinical evaluation was performed to determine the health status of the participants in the study. Rather, they were assessed only based on the response of individuals to their health status. The individuals who reported a chronic disease were not recruited. The study was in adherence with the 1964 Heliski declaration and approved by the Ethics Committee of Kerman University of Medical Sciences.

### *Measures*

#### *SF-36 questionnaire*

The “developmental” form of SF-36 was accessed in 1988 and the “standard” form in 1990 [21,22]. A SF-36 questionnaire has eight domains, including physical functioning (PF) (10 items), role-physical (RP) (4 items), bodily pain (BP) (2 items), general health (GH) (5 items), except vitality (VT) (4 items), social functioning (SF) (2 items), role emotional (RE) (3 items), and Mental Health (MH) (5 items). These eight domains were summarized into 2 factors, including GH_M (PF, RF, BP, and GH) and MH_M (VT, SF, RP, and MH) [22]. Each domain has an equal weight scored between 0 and 100, with 0 meaning the worst HRQol and 100 the best HRQol [22]. The SF-36 used in this study had previously been translated into Persian and its reliability and validity had been defined in a previous study in Iran [23,24].

### *Statistical analysis*

Path analysis, an extension of the regression model, was used in this study to investigate the

direct and indirect effects of eight domains of the SF-36 questionnaire on two main factors including that physical and mental health factors in people with diabetes.

*Path analysis*

The path analysis was used to generate a model for determining the direct and indirect effects of each of the independent variables on the dependent variable. The standardized regression coefficient showed the direct effect of studied variables [25]. In fact, it is better to use the path analysis when a causal variable association with a set of variables is suspected, the sequence of variables is available, or to separate the spurious effect by an intervening factor from the observed associations [26]. Goldsmith [27] and Berglund [28] defined that path analysis may be useful in epidemiological studies for recognizing the risk factors for chronic disease, but the interaction is not understood. In this regard, the advantage of path analysis is that the developed path diagram describes the hypothetical causality graphically [25]. In path analysis, the association between two variables is denoted by straight or curve arrows – straight arrows show a direct causal relationship and curve arrows show a simple correlation between independent variables [17].

## Results

Table 1 presents the demographic characteristics of diabetic patients in this study. As can be seen, the mean (SD) age of diabetic woman and men was 43.80 ± 13.56 and 42.76 ± 14.36, respectively, and women were not significantly older than man (P= 0.490). The average age of the entire people indicates that diabetes is more common in middle-aged people. The mean (± SD) BMI in women and men was respectively 48.36 ± 13.28 and 25.31 ± 4.32, and men had significantly lower BMI than the women (P < 0.0001). Women in this study had a BMI higher than normal (BMI=25) and are more likely to be overweight (BMI>30) than men. For education, men and women's groups were significantly different (P < 0.0001). In general, women had higher education degrees than the men. Moreover, 881 out of 1037 patients (84.95%) were women and the rest (151/1037, 14.56 %) were men.

**Table 1.** Subject characteristics.

| Education | Total (n=1037) | Women (n=881) | Men (n=156) | P-value |
|---|---|---|---|---|
| Under diploma | 19(1.8) | 6(0.7) | 13(8.7) | |
| Diploma | 67(6.5) | 45(5.1) | 22(14.1) | |
| Associate Degree | 327(31.5) | 260(29.5) | 67(42.9) | <0.0001 |
| Bachelor | 370(35.7) | 322(36.5) | 48(30.8) | |
| M.S | 254(24.5) | 248(28.1) | 6(3.8) | |
| BMI | 26.85± 5.19 | 29.29 ± 5.53 | 25.31 ± 4.32 | < 0.0001 |
| Age | 43.3 ± 13.94 | 43.80 ± 13.56 | 42.76 ± 14.36 | 0.490 |

Table 2 presents the HRQol scores (mean ± SD) of the for diabetes patients in both woman and man groups for each domain and two main factors. Only the SF domain presented significantly lower scores in the men compared to the women (P=0.061). For other domains, there were no statistically significant differences between men and women. GH_M and MH_M

were significantly different between men and women (P=0.07).

**Table 2.** Mean and standard deviation of SF-36 score for DM patients.

| SF-36 Domains | Total (Mean ± SD) | Woman (Mean ± SD) | Men (Mean ± SD) | P-value |
|---|---|---|---|---|
| Physical functioning (PF) | 59.94 ± 28.88 | 60.45 ± 28.77 | 57.07 ± 29.43 | 0.182 |
| Role physical (RP) | 57.58 ± 22.19 | 57.54 ± 22.19 | 57.77 ± 22.31 | 0.911 |
| Bodily pain (BP) | 47.71 ± 27.77 | 58.68 ± 21.28 | 57.27 ± 21.11 | 0.443 |
| General health (GH) | 46.48 ± 18.17 | 43.93 ± 16.74 | 43.75 ± 15.44 | 0.891 |
| Vitality (VT) | 43.91 ± 16.54 | 51.98 ± 13.74 | 51.19 ± 13.19 | 0.512 |
| Social functioning (SF) | 56.29 ± 26.19 | 56.92 ± 26.23 | 52.72 ± 25.81 | 0.061 |
| Role emotional (RE) | 58.47 ± 21.25 | 48.18 ±27.78 | 45.86 ± 27.63 | 0.194 |
| Mental Health (MH) | 51.86 ± 13.76 | 46.58 ± 18.28 | 45.86 ± 17.53 | 0.651 |
| Overall physical health (GH_M) | 53.93 ± 19.43 | 61.77 ± 24.82 | 64.71 ± 24.29 | 0.072 |
| Overall mental health (MH_M) | 67.03 ±24.19 | 66.18 ± 23.24 | 70.67 ±29.12 | 0.071 |

**Table 3.** Goodness of fit indexes.

| CMNI ($\chi^2$) | DF | P-value | GFI | NFI | CFI | RMSEA | $CMNI/_{DF}$ |
|---|---|---|---|---|---|---|---|
| 1.409 | 5 | 0.924 | 1 | 1 | 1 | 0.000 | 0.281 |

*Goodness of fit indexes*

According to Table 3, CMIN statistic was equal to 1.409 and P-value was more than 0.05, suggesting that all null hypotheses are accepted and the reduced and saturated models fit the data (P= 0.924). Since a large sample size was used in this study for ensuring its reliability, another index was also assessed. The results confirm the good fit of the model (RMSEA = 0.000, CFI = 1, and NFI= 1, CMIN/DF= 0.281).

*Impact of path analysis*

Table 4 demonstrates the direct, indirect, and total effect of eight domains on two main factors of HRQoL measured by path analysis. All eight domains had just a direct effect on the GH_M factor and there was no indirect effect for them. Also, all of them had just the indirect effect on the MH_M factor, except VT and RE domains that had both direct and indirect effects on the MH_M factor. Only PF, BP, VT, and GH domains had a significant negative effect on the GH_M factor (P < 0.001), other domains had no significant effect. The negative sign of coefficient indicated that if PF, BP, VT, and GH domains scores increase, the GH_M factor will decrease. Only the GH (P=0.048) domain had a positive significant indirect and total effect on the MH_M factor, and other domains had no significant indirect and total effect on the MH_M factor.

**Table 4.** The direct, indirect and total effects of dependent and independent variables.

| | Direct | | | Indirect | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Effect | C.I | P-value | Effect | C.I | P-value | Effect | C.I | P-value |
| PF → GH_M | -0.263 | (-0.34, -0.19) | 0.001 | | | | -0.236 | (-0.34, -0.19) | 0.001 |
| RP → GH_M | 0.023 | (-0.05, 0.091) | 0.611 | | | | 0.023 | (-0.05, 0.091) | 0.611 |
| BP → GH_M | -0.218 | (-0.29, -0.14) | 0.001 | | | | -0.218 | (-0.29, -0.14) | 0.001 |
| GH → GH_M | -0.196 | (-0.26, -0.14) | 0.001 | | | | -0.196 | (-0.26, -0.14) | 0.001 |
| SF → GH_M | -0.045 | (-0.12, 0.03) | 0.331 | | | | -0.045 | (-0.12, 0.03) | 0.331 |
| VT → GH_M | -0.073 | (-0.14, -0.01) | 0.041 | | | | -0.073 | (-0.14, -0.01) | 0.041 |
| RE → GH_M | 0.061 | (0.02, 0.11) | 0.061 | | | | 0.061 | (0.02, 0.11) | 0.061 |
| MH → GH_M | 0.013 | (-0..04, 0.07) | 0.741 | | | | 0.013 | (-0..04, 0.07) | 0.741 |
| PF → MH_M | | | | 0.007 | (0.02,0.48) | 0.48 | 0.007 | (0.02,0.48) | 0.481 |
| RP → MH_M | | | | -0.001 | (0.02,0.78) | 0.78 | -0.001 | (0.02,0.78) | 0.782 |
| BP → MH_M | | | | 0.006 | (0.01,0.48) | 0.48 | 0.006 | (0.01,0.48) | 0.481 |
| GH → MH_M | | | | 0.005 | (0.02,0.48) | 0.48 | 0.005 | (0.02,0.48) | .0481 |
| SF → MH_M | | | | 0.001 | (0.51,0.65) | 0.65 | 0.001 | (0.51,0.65) | .0653 |
| VT → MH_M | -0.039 | (-0.11, 0.03) | 0.381 | 0.002 | (0.02,0.53) | 0.51 | -0.037 | (0.03,0.39) | 0.391 |
| RE → MH_M | 0.011 | (-0.05, 0.07) | 0.722 | -0.002 | (0.01,0.53) | 0.52 | 0.012 | (0.07,0.76) | 0.761 |
| MH → MH_M | 0.331 | (-0.03, 0.09) | 0.381 | 0 | (0.02,0.86) | 0.78 | 0.033 | (0.09,0.39) | 0.382 |
| GH_M → MH_M | -0.026 | (-0.08, 0.03) | 0.482 | | | | -0.026 | (0.03,0.48) | 0.482 |

Table 5 presents differences between HRQoL of DM patients in this study with some other countries, Sweden and Portuguese and also with Hemodialysis patient HRQoL in another southest city in Iran (Shiraz). The Shiraz city has the same social and medical equipments as Kerman city, so the comparison between them is logical. The results show that Iranian (Kerman) MD patients had a statistically significantly higher HRQOL score in each domain score of Sf-36 than Hemodialysis patients in Iran (Shiraz) except, VT domain that DM patients have a better score, but it is not statistically significant (P = 0.3525). The Sweden DM patients have significantly higher scores in all domains except RP and RE domains, in which Iranian has better scores and also Iranian have higher scores in Pf domain than Portuguese DM patients, but in the other domains have no significant difference between Portuguese and Iranian DM patients.

Figure 1 represents the path model diagram. In this diagram, the straight lines display the direct path from the independent variables toward the dependent variables and curve arrows show a simple correlation between independent variables. Dependent variables are overall

mental health and overall physical health factors. Independent variables are eight domains, including PF, RP, RE, MH, GH, SF, VT and BP.

**Table 5.** Comparison between DM patients' HRQOL in Iran and some other countries.

| SF-36 Domains | Iran (Kerman), DM N = 1037 | Sweden, DM (Ref. [29, 30]) N =102 | | Iran (Shiraz), Hemodialysis patient(Ref. [29]) N=150 | | Portuguese, DM (Ref.[31]) N=124 | |
|---|---|---|---|---|---|---|---|
| | Mean (SD) | Mean (SD) | P value | Mean (SD) | P value | Mean (SD) | P value |
| Physical functioning (PF) | 59.94 ± 28.88 | 55±26.6 | P = 0.0973 | 34.86 ± 10.88 | P < 0.0001 | 41.9 ±37.1 | P < 0.0001 |
| Role physical (RP) | 57.58 ± 22.19 | 34.1±40.7 | P < 0.0001 | 37.85 ± 9.43 | P < 0.0001 | 39.3 ±48.6 | P < 0.0001 |
| Bodily pain (BP) | 47.71 ± 27.77 | 59.9±27.8 | P < 0.0001 | 31.58 ± 9.48 | P < 0.0001 | 45.1 ±33.8 | P = 0.3349 |
| General health(GH) | 46.48 ± 18.17 | 60.1±24.2 | P < 0.0001 | 39.88 ± 6.47 | P < 0.0001 | 46.6 ±17.5 | P = 0.9477 |
| Vitality (VT) | 43.91 ± 16.54 | 61.2±24.2 | P < 0.0001 | 45.18 ± 6.41 | P = 0.3525 | 46.0 ±26.6 | P = 0.2188 |
| Social functioning (SF) | 56.29 ± 26.19 | 80.7±26.4 | P < 0.0001 | 30.02 ± 8.26 | P < 0.0001 | 57.4 ±28.2 | P = 0.6583 |
| Role emotional (RE) | 58.47 ± 21.25 | 48.5±50.3 | P = 0.0001 | 39.20 ± 13.62 | P < 0.0001 | 61.8±48.0 | P = 0.1689 |
| Mental Health (MH) | 51.86 ± 13.76 | 71.1±16.5 | P < 0.0001 | 36.48 ± 7.47 | P < 0.0001 | 51.9 ±24.5 | P = 0.9780 |

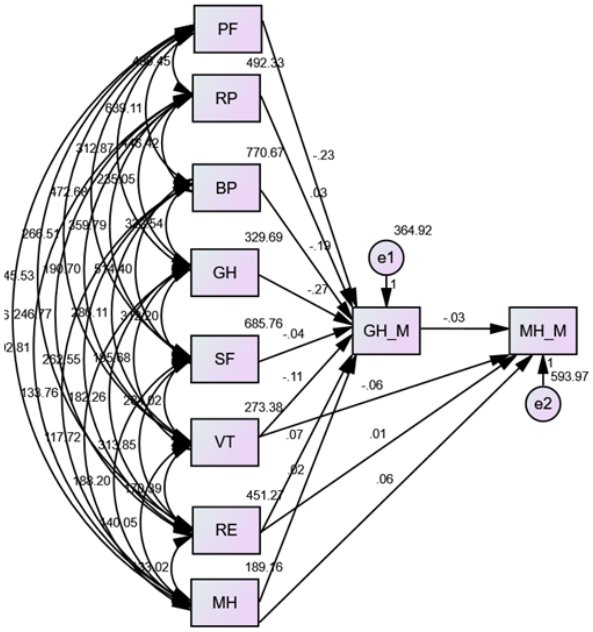


**Figure 1.** *The path diagram of SF36 domain scores.*

## Discussions

The purpose of this study was to detect and confirm the direct and indirect effect and total effect of eight domains of SF-36 on two main factors of quality of life. To the best of our knowledge, this is the first study to assess the direct and indirect effect of eight domains of SF-

36 on two main factors of quality of life among diabetic patients. The results showed that all of the eight domains had just a direct effect without any indirect effect on GH_M factor. Even so, all of the eight domains had just the indirect effect on MH-H factor, but VT and RE domains had both direct and indirect effects on the MH_H factor. Only PF, BP, GH, and VT domains had significant direct and also the total effect on GH_M. Amazingly, only the GH domain had positive indirect and total effect on the MH_M factor, and other domains had no significant effect.

A number of studies in some countries show that women have a higher prevalence of DM, mainly in older persons [2]. This result is in agreement with the findings of the present work that show a higher percentage of DM in women. Also, researchers have shown that diabetic men have a better HRQol than diabetic women [8]. Women had higher levels of education than men in this study. According to Glasgow et al., people with more education had higher scores on all domains of the SF-20. Thus, it is necessary to consider the relationship between education and diabetes in assessing HRQol [20]. The average age of the patient in this study was about 42-43 years and the younger diabetic patient had significantly higher scores than the older ones, especially on PF and SF domains, and had lower scores than older patient on MH domain of the SF-20 [20]. Klein et al. found that older patients show lower levels of PF and PR domain than younger ones on the SF-36 [32]. It is better to consider that patient in this study were not old enough, so they may have better scores in PF domain. Glasgow et al showed that lower levels of physical activity were among the factors related to lower quality of life in adults with diabetes and suggested that moderate or severe physical activity programs may commence diabetic patients at risk of low quality of life [20]. This finding was similar to the results of the current study, which showed PF domain that shown limitation of physical activity, had just a negative significant direct effect on GH_M.

Several studies have demonstrated that diabetic patients have higher levels of depression, anxiety, and other psychological disorder than the normal people [33]. Robert et al. reported that the prevalence of depression in the diabetic people was 24% and comparing both depressed diabetic and depressed nondiabetic groups reported significant statistical differences in the GH_M and MH_M factors of the SF-36 [34]. Our finding is in line with other studies. Diabetic patients may have low levels of VT due to the psychological disorder. A negative and significant direct and total effect of the GH and VT domains on the GH_M factor may cause the psychological problems, the chronic complications of diabetes, and food restrictions. Hence, managing the symptom of disease as well as difficult and expensive therapeutic would make diabetes patients have a negative opinion about their general health [35]. It is really important that physician helps the diabetic patient to change their negative opinion about general health to improve their quality of life. Diabetes, like other chronic illnesses, causes body pain. Clearly, having a body pain can reduce physical activity. Consistent with the present results, BP domain had a negative statistically significant direct effect on GH_M factor.

Several studies that used SF-36 or the SF-20 to evaluate the quality of life determined that those with diabetes had a lower quality of life on domains assessing PF, RF, and GH, but SF and MH domains had no significant differences in this regard [8]. Accordingly, to our results, only the SF domain and GH_M and MH_M factors had significant differences between adult men and woman with diabetes.

The path analysis, in addition to demonstrating the causal relationship, also explained the relative importance of the paths of the variable on the outcome; so it is superior to ordinary regression analysis [36]. The path coefficient indicated that PF and BP domains have the major direct on GH_M. A unit increase PF score made a decrease in GH_M factor by 0.24 units, while a unit increase in BP domain score made the GH_M decrease by 0.22 unit.

Our findings define significantly higher scores in some of Sf-36 domains than some studies on MD patients in other countries, but it is important to consider that it is only a statistical comparison and does not have enough confirmation for making decision for whole HRQOL scores between MD patients in these countries. In fact, we cannot correct potential confounders, which can clarify these differences. Therefore, these statistically significant differences may have no clinical importance. For a more accurate comparison, it is necessary to adjust result for important confounders. The DM patients had better score in all domains than Hemodialysis patients, and it is similar to other studies that showed DM patient have better HRQOL score than other chronic diseases [8].

## Conclusions

In conclusion, the findings of the present study show that PF and BP are the most important domains in the scoring of the SF-36 questionnaire. Since the quality of life in diabetic patients is of particular importance, SF-36 is one of the important tools for assessing the quality of life of diabetic patients. Therefore, determining the effect of each domain of this questionnaire is of particular importance. Only four domains, including PF, BP, GH, and VT domains had significant direct and also the total effect on GH_M, and GH domain had a positive effect on the MH_M factor. The path coefficient indicated that PF and BP domains have the major direct on GH_M and also on the HRQoL. So, it is necessary for primary health care services to include Physical activity and body pain, as effective key on the quality of life, in diabetes self-management programs to improve HRQoL of the diabetic patients, and try to change a negative opinion about their general health in DM patients.

## REFERENCES


1. **American Diabetes Association.** Standards of medical care for patients with diabetes mellitus. *Diabetes Care* 23: S32, 2000

2. **Esteghamati A, Gouya MM, Abbasi M et al.** Prevalence of diabetes and impaired fasting glucose in the adult population of Iran: the national survey of risk factors for non-communicable diseases of Iran. *Diabetes Care* 31(1): 96-8, 2008

3. **Nyanzi R, Wamala R, Atuhaire LK.** Diabetes and quality of life: a Ugandan perspective. *J Diabetes Res* 2014: p402012, 2014

4. **Al Hayek AA, Robert AA, Al Saed A, Alzaid AA, Al Sabaan AS.** Factors associated with health-related quality of life among Saudi patients with type 2 diabetes mellitus: a cross-sectional survey. *Diabetes Metab J* 38(3): 220-229, 2014

5. **Daniele TM, Bruin VM, Oliveira DS, Pompeu CM, Forti AC**. Associations among physical activity, comorbidities, depressive symptoms and health-related quality of life in type 2 diabetes. Arg Bras Endocrinol Metab 57(1): 44-50, 2013

6. **Boyer JG, Earp JA.** The development of an instrument for assessing the quality of life of people with diabetes: Diabetes-39. *Med Care* 35(5): 440-453, 1997

7. **Weinberger M, Kirkman MS, Samsa GP et al.** The relationship between glycemic control and health-related quality of life in patients with non-insulin-dependent diabetes mellitus. *Med Care* 32(12): 1173-1181, 1994

**8. Rubin RR, Peyrot M.** Quality of life and diabetes. *Diabetes Metab Res Rew* 15(3): 205-218, 1999

**9. World Health Organization.** *Constitution of the world health organization.* 1995.

**10. Testa MA**. Quality-of-life assessment in diabetes research: interpreting the magnitude and meaning of treatment effects. *Diabetes Spectrum* 13(1): 29-35, 2000

**11. Hörnquist JO, Wikby A, Andersson PO, Dufva AM.** Insulin-pen treatment, quality of life and metabolic control: retrospective intra-group evaluations. *Diabetes Res Clin Pract* 10(3): 221-230, 1990

**12. Andersson PO, Wikby A, Sternstomb U, Horniquist JO.** Pen injection and change in metabolic control and quality of life in insulin dependent diabetes mellitus. *Diabetes Res Clin Pract* 36(3): 169-172, 1997

**13. Testa MA, Simonson DC.** Health economic benefits and quality of life during improved glycemic control in patients with type 2 diabetes mellitus: a randomized, controlled, double-blind trial. *Jama* 280(17): 1490-1496, 1998

**14. Golicki D, Dudsinzka M, Zwolak A, Tarach JS.** Quality of life in patients with type 2 diabetes in Poland-comparison with the general population using the EQ-5D questionnaire. *Adv Clin Exp Med* 24(1): 139-46, 2015

**15. Ware Jr JE.** SF-36 health survey update. *Spine* 25(24): 3130-3139, 2000

**16. Bradley C, Lewis K.** Measures of psychological well-being and treatment satisfaction developed from the responses of people with tablet-treated diabetes. *Diabetic Med* 7(5): 445-451, 1990

**17. Jacobson AM, De Groot M, Samson JA.** The evaluation of two measures of quality of life in patients with type I and type II diabetes. *Diabetes Care* 17(4): 267-274, 1994

**18. Wändell PE**. Quality of life of patients with diabetes mellitus an overview of research in primary health care in the Nordic countries. *Scand J Prim Health Care* 23(2): 68-74, 2005

**19. Schram MT, Baan CA, Pouwer F.** Depression and quality of life in patients with diabetes: a systematic review from the European depression in diabetes (EDID) research consortium. *Curr Diabetes Rew* 5(2): 112-119, 2009

**20. Glasgow RE, Ruggiero L, Eakin EG, Dryfoos J, Chobanian L.** Quality of life and associated characteristics in a large national sample of adults with diabetes. *Diabetes Care* 20(4): 562-567, 1997

**21. Ware Jr JE.** How to score the revised MOS short-form health scale (SF-36®). *New Engl Med Centr Hosp* 10: 17-18, 1988

**22. Ware Jr JE Sherbourne CD**. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med Care* 30 (6): 473-483, 1992

**23. Montazeri A, Goshtasebi A, Vahdaninia M, Gandek B.** The Short Form Health Survey (SF-36): translation and validation study of the Iranian version. *Qual Life Res* 14(3): 875-882, 2005

**24. Jafari H, Lahsaeizadeh S, Jafari P, Karimi M.** Quality of life in thalassemia major: reliability and validity of the Persian version of the SF-36 questionnaire. J Postgard Med 54(4): 273-5, 2008

**25. Hamta A, Khalilian AR, Farhadi R, Ranjbaran H.** Path Analysis of the Risk of Low Birth Weight for Multipara. *Iran Red Crescent Med J* 15(6): 462-6, 2013

**26. Vasconcelos AG, Almeida RM, Nobre FF.** The path analysis approach for the multivariate analysis of infant mortality data. *Ann Epidemiol* 8(4): 262-71, 1988

**27. Goldsmith JR.** Paths of association in epidemiological analysis: application to health effects of environmental exposures. *Int J Epidemiol* 6(4): 391-399, 1977

**28. Goldsmith JR. Berglund K.** Epidemiological approach to multiple factor interactions in pulmonary disease: the potential usefulness of path analysis. *Ann N Y Acad Sci* 221: 361-375, 1974

**29. Bagheri Z, Jafari P, Faghih M, Allahyari E, Dehesh T.** Testing measurement equivalence of the SF-36 questionnaire across patients on hemodialysis and healthy people. *Int Urol Nephrol* 47(12): 2013-2021, 2015

**30. Gift HC, Atchison KA.** Oral health, health, and health-related quality of life. *Med Care* 30(1): NS57-NS77, 1995

**31. Sepúlveda E, Poinhos R, Constante M, Pais-Ribiero J, Freitas P, Carvalho D.** Health-related quality of life in type 1 and type 2 diabetic patients in a Portuguese central public hospital. Diab Metab Syndr Obes 8: 219, 2015

**32. Klein BE, Klein R, Moss SE.** Self-rated health and diabetes of long duration: the Wisconsin

Epidemiologic Study of Diabetic Retinopathy. *Diabetes Care* 21(2): 236-240, 1998

**33. Peyrot M, Rubin RR.** Levels and risks of depression and anxiety symptomatology among diabetic adults. *Diabetes Care* 20(4): 85-590, 1997

**34. Goldney RD, Phillips PJ, Fishel LJ, Wilson DH**. Diabetes, depression, and quality of life: a population study. *Diabetes Care* 27(5): 1066-1070, 2004

**35. Kakhki AD**. Health-related quality of life of diabetic patients in Tehran. Int J Endocrinol metab 11(4): e7945, 2013

**36. Olobatuyi ME.** *A user's guide to path analysis*. Lanham, MD : University Press of America, 2006