

Emotional Intelligence and Quality of Life in Elderly Diabetic Patients

Farideh Moradi

Kermanshah University of Medical Sciences

Sogan Tourani

Iran University of Medical Sciences School of Behavioral Sciences and Mental Health

Arash Ziapour

Kermanshah University of Medical Sciences

Jaffar Abbas

Shanghai Jiao Tong University

Maryam hematti

Kermanshah University of Medical Sciences

Elham Jamshidi Moghadam

Iran University of Medical Sciences School of Behavioral Sciences and Mental Health

Amin Aghili

Iran University of Medical Sciences School of Behavioral Sciences and Mental Health

Ali Soroush (✉ alisoroush569@gmail.com)

Kermanshah University of Medical Sciences <https://orcid.org/0000-0002-9485-9662>

Research

Keywords: Quality of life, Elders, Diabetes, Emotional Intelligence

Posted Date: December 7th, 2019

DOI: <https://doi.org/10.21203/rs.2.18065/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: Coordination of various physical and mental aspects of individuals, including the ability to control difficult conditions and situations has an effect in the prevention and development of various diseases, such as diabetes, and the improvement of the quality of life. Therefore, the purpose of this study is to determine the effect of emotional intelligence on the quality of life of elderly diabetic patients.

Methods: The statistical population in this cross-sectional study consisted of elderly people referred to the health centers of Kermanshah province in western Iran, who were divided via available sampling into two groups with diabetes and without diabetes. Data gathering tools were a couple of LIPAD Quality of Life and Shrink Emotional Intelligence standard questionnaires. The Data was analysed using software SPSS, 23 th version.

Results: The studied persons were divided into two groups of diabetic with 63 people (8.48%) and non-diabetic with 66 people (2.51%). Most of them were male and the mean age of the patients was $65/01 \pm 6.08$ years old and married. The quality of life score in diabetics and non-diabetics was respectively 51.9 and 50.37 with a standard deviation of 17.73 and 20.54. The mean total score of emotional intelligence in the elderly with diabetes was 99.42 with a standard deviation of 10.37 and non-diabetic subjects were 97.18 with a standard deviation of 18.49.

Conclusion: There was no significant difference between the mean scores of quality of life (.652) and emotional intelligence (.421) in diabetic and non-diabetic individuals. But, the emotional intelligence has an effect on the quality of life of the elderly people.

Background

Reduced fertility and improved life expectancy caused to increase the elderly population much faster than the general population and it's a global phenomenon[1]. In 2006, the United Nations announced that the total number of elderly people in the world was 687 million and 923 thousand, which will reach 1 billion, 968 million and 153 thousand by 2050. In fact, old people are facing many challenges. Most elderly people are subjected to diseases that endanger their independence and quality of lives[2].

Diabetes as one of these diseases is a serious public health problem that threatens the quality of life of patients and can lead to acute and chronic complications. This disease is a leading cause of disability and death in many countries[3]. The prevalence of diabetes among adults worldwide is around 2–21%, which varies according to socio-economic conditions. Studies show that in the next 20 years in the world, between 50% and 100% of people will have diabetes. It will increase as the world's population grows older. As the studies show, the incidence rate of diabetes in elderly people is ascending which was 6 per 1,000 people in 1990, 11.6 in 2000 and 12.4 in 2010[4]. Elderly people with chronic diseases, such as diabetes, have a lower quality of life than their peers. WHO defines Quality of Life as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns. It is a broad-ranging concept affected in a complex

way by the person's physical health, psychological state, personal beliefs, social relationships and their relationship to salient features of their environment. Quality of life is a multidimensional and relative concept influenced by time, place and individual values. Many social and cultural factors such as religious beliefs, social networks, and relations between them and the physiological, behavioural, and emotional factors are involved in quality of life of chronic patients in critical condition [5]. One of the emotional factors is emotional intelligence that it can an important role to manage and treat diabetic people.

Emotional intelligence is the kind of intelligence that involves the ability to recognize their own and others' feelings and emotions and use of them to make the right decisions in life[6].

Based on Goleman, emotional intelligence includes four skills of self-awareness, self-management, social awareness, and relationship management. Shortcomings and weaknesses in the field of emotional intelligence are the cause of many emotional, social, and health problems in today's world. High emotional intelligence is correlated with extraversion, flexibility, identifying different emotions and feelings and coordinating feelings and providing desired life[7] .

There are some studies that they investigated quality of life in elderly diabetic patients [8–10]and another's studied the effect of emotional intelligence in diabetic patients, not old diabetic ones[11, 12] and there is only one research that it determined the relationship between emotional intelligence and quality of life in old diabetic patients [1]. On the other hand, quality of life is one of the main concerns of policymakers and public health planners in the community and promoting a healthy life in old diabetic patients. So, the aim of this study is to determine the relationship quality of life and emotional intelligence in elderly diabetic patients referred to the Diabetes Centre of Kermanshah University of Medical Sciences.

Methods

Study design

This study is descriptive – correlational research that was done as a cross-sectional one. The subjects of the study were elderly people that referred to selected health centers of Kermanshah, in the west of Iran, in 2018. Inclusion criteria for this study were: full consent to cooperate, older than 60 years, having at least the ability of reading and writing, lack of confusion and use of drugs leading to consciousness disorder, and being diabetics at least one year. The research proposal of this study was approved by the Ethics Committee affiliated with Kermanshah University of Medical Sciences, that corroborated its ethical considerations (decree number: ?), and the allowance by health centers authorities and obtaining the written consent of patients, and ensuring them on protecting the information. Then, patients completed the questionnaires of demographic information, quality of life, and emotional intelligence. Due to the small size of the study population, sampling was performed through census and available samples the samples then were divided into two groups of elderly people with diabetes and non-diabetic patients.

Finally, 129 persons were included in the study. The sample size was calculated based on [1]. Considering the 99% confidence level, the 95% power, mean and standard deviation, quality of life in the diabetic and non-diabetic group were respectively 73.91 ± 14.85 and 83.84 ± 11.86 and the required minimum sample sizes in each group was 65 people. The sample size formula was as follows:

[Due to technical limitations, the formula could not be displayed here. Please see the supplementary files section to access the formula.]

Data were collected by two questionnaires: Lipad Quality of Life and Shrink Emotional Intelligence which was handed out to them and then collected. The Lipad Quality of Life Questionnaire is particularly for the elderly. This questionnaire consists of 31 questions that examine the quality of life in seven dimensions (physical function, self-care, depression and anxiety, mental performance, social function, sexual function, and life satisfaction). Lipad Questionnaire was made by Pordehkordi et al. In order to determine the reliability of the questionnaire, the re-test method was used. Therefore, the reliability of the questionnaire was 0.83 [13].

The Shrink emotional intelligence questionnaire consists of five subscales (including 33 questions) of self-motivation, self-awareness, self-management, self-control, coherence (social intelligence), and relationship management (social skills). This questionnaire was adjusted according to the theory of emotional intelligence by Goleman and then translated and standardized in Iran by Mansouri [14]. Its reliability coefficient was calculated using Cronbach's alpha calculation method for each component and the total test was as follows: Self-motivation = 54%, self-awareness = 69%, Self-management (Self-control) = 64%, Coherence (Social intelligence) = 51%, Relationship management (social skills) = 50% and the total test = 85%. These numbers indicate an acceptable level of reliability [14]. In the separate studies of reliability, Mahanian Khamene [15], Faraghdani [16], Nasrin Bonakdari [17] and Delpasand et al [18] reported this test through the calculation of Cronbach's alpha respectively at 83%, 87%, 84%, and 88%. The validity of the questionnaire was examined by conditional validity and structural validity, and then convergent and divergent factor analysis were examined. Also, in 1996, the validity and reliability of this questionnaire was examined by Gerabet and introduced as a valid and reliable questionnaire [19]. After completing these questionnaires by participants, the data was analyzed by SPSS software, version 23. The tests used in this study were T-test, Chi-square, Anova and regression.

Results

129 persons were enrolled in two groups of diabetic with 63 people (8.48%) and non-diabetic with 66 people (2.51%). The number of men was 68 and the number of women was 61. The mean age of the patients was 65.01 ± 6.08 years and the average income of patients was 12,572,350 Iranian Rials (under \$100). These persons received the necessary information about diabetes and ways to deal with it mostly from the media.

According to Table 1, the majority of subjects' education level was pre-diploma (59.7%) and a minority of them had a postgraduate degree (1.6%), Also the majority of the participants were married (66.7%) and

the minority were divorced (7%).

Table 1
Demographic finding about diabetic and non-diabetic groups

Demographic variables	Frequency (%)
Gender	61 (47.3%)
Female	68 (52.7)
Male	
Education	77 (59.7%)
Below diploma	34 (26.4%)
Diploma	7 (5.4%)
Bachelor	2 (1.6%)
Postgraduate	
Marital status	86 (66.7%)
Married	11 (8.5%)
Single	23 (17.8%)
Widowed	9 (7%)
Divorced	

Table 2
Mean and standard deviation of quality of life and emotional intelligence in two groups of studies

Variable	P-value	Non-diabetic Mean and standard deviation	Diabetic Mean and standard deviation
Quality of life	0.652	50.37 (20.54)	51.9 (17.73)
Emotional Intelligence	0.421	97.18 (18.49)	99.42 (10.37)

Based on Table 2, the mean quality of life score and emotional intelligence in the diabetic group was 51.9, with a standard deviation of 17.73 and 99.42, with a standard deviation of 10.37 respectively.

Also, there is no significant difference between the mean scores of quality of life (0.652) and emotional intelligence (0.421) in diabetic and non-diabetic individuals (Table2).

Chi-square test showed no statistically significant difference between the gender of the studied persons ($p = 0.94$) and marital status (0.213) in diabetic and non-diabetic groups. The level of education in two groups was not relatable (Table 3).

Table 3
Chi-square test findings in two groups of studies

Variable	P-value	Non-diabetic Frequency (%)	Diabetic Frequency (%)
Gender: Male Female	0.941	(31/2)31 (43/7)35	(29/8)30 (33/2)33
Marital Status: Married Single Widowed Divorced	0.213	(44) 44 (5.6) 3 (11.8) 15 (4.6) 4	(42) 42 (5.4) 8 (11.2) 8 (4.4) 5

Discussion

The present study was conducted to investigate the relationship and predict the quality of life based on emotional intelligence in elderly diabetic patients referred to the Diabetes Centers of Kermanshah University of Medical Sciences, in the west of Iran. The results of this study showed that there is no significant relationship between the quality of life in diabetic and non-diabetic patients. Since, in Iran, baseline index and normative criterion of quality of life in elderly people have not been determined, by considering the criterion of zero to 90 which is related to the quality of life questionnaire of the present study, the average score of 45 can be determined for the community as an acceptable indicator. Regarding that the mean of the overall quality of life score (51.9) was higher than the average of the questionnaire, the quality of life of the diabetic elderly patients can be evaluated as a desirable one.

The results of some studies indicate a good quality of life in diabetic patients[20], some studies indicate a moderate quality of life[21–23] and finally some others indicate a poor quality of life in these patients[24–27].

In general Diabetes can cause a lot of problems in individual, family, social, and high rate of mortality. This disease affects the quality of life of the patient due to the involvement of more organs including the heart, kidneys, eyes, etc. In addition, the chronic nature of boring and disabling treatments and threatening complications of diabetes affects the quality of life of the patient.

The results of this study showed that there is a direct and significant relationship between the emotional intelligence and the quality of life of the elderly diabetic patients, which is consistent with the results of Zysberg et al and Abbasabad et al [28, 29]. These studies indicated that with the increase of emotional intelligence, quality of life is also enhanced. The results are in line with the results of research conducted by Downey (2008) on the depression of 250 students in Romania[30], and the study conducted by Ciarrochi et al. (2003) on 302 students showed that people who have higher emotional intelligence cope with life's problems easier and have a higher quality of life[31]. Yalcin study in Turkey on 32 diabetic patients revealed that emotional intelligence reinforcement increases the quality of life of diabetic

patients[11]. If the criterion of 33 to 165 which is related to the questionnaire of the present study is considered, the mean score of 99 can be determined as the norm of society and an acceptable indicator for the state of emotional intelligence in the elderly. So, the emotional intelligence score (99.42) of this study was more than the norm index of society.

In this study, there is not a significant difference between the score of emotional intelligence in diabetic and non-diabetic individuals and it is in an acceptable state. Generally, considering the relationship between emotional intelligence and health, many previous studies have shown that people with high emotional intelligence are more likely to have higher physical and mental health than those with lower emotional intelligence and, consequently have a better quality of life.

On the other hand, there was no difference between the studied two groups in terms of quality of life and emotional intelligence based on gender, marital status, and educational levels. While studies have shown the effect of educational level on improving emotional intelligence and subsequently increasing the quality of life. So, people with a high level of education have better socio-economic positions and they can better interact with others and have a healthier life [29, 32–35]. About marital status, other studies showed that married people had a better quality of life than singles and divorced people [36–39]. Other studies showed that there was a statistically significant difference between two sexes based on emotional intelligence, so it was different with the present study results [40–42].

Generally, in explaining these results, it can be said that emotional intelligence and the quality of life are two areas are linked with each other very closely that the problems of each of these areas can be passed on to other area that the results of the studies mentioned indicate this fact.

The most important limitation of this study is the use of correlation method and the discovered relationships cannot be regarded as excellent relationships. Another limitation is the use of self-reporting tools. These tools usually collect responses that others think should be correct. Individuals who complete these tools may not have enough self-control and will not respond responsibly.

Conclusion

Diabetes as a chronic disease affects different age groups of people. Various factors affect the incidence of the disease, in addition to hereditary factors, healthy nutrition and mobility of people are effective in preventing disease progression. Meanwhile, elderly people may suffer irreparable complications due to age-related disabilities. Therefore, improving the quality of life of these patients and subsequently improving the emotional intelligence of people during the first years of the disease can prevent irreversible complications. For this reason, the direct relationship between emotional intelligence and its impact on the quality of life in different ages of diabetics, especially the elderly ones, can be effective in improving their health. So, it is recommended that administrators of nursing to consider educational and supportive programs and workshops in the field of emotional intelligence for diabetics, especially elderly diabetic patients. It is also suggested that future studies conduct research on patients with other chronic diseases such as cancer and multiple sclerosis. In addition, it is recommended that the relationship

between emotional intelligence and other aspects leaving chronic disease such as depression and anxiety and self-efficacy to be examined. Some limitations of this study include low sample size and the location of its implementation that cannot be generalized its results to other cities of Iran. Therefore, it is recommended that this study will be conducted on a higher number of population and in other Iranian cities.

Abbreviations

EI: Emotional Intelligence; QL:Quality of Life; DP:Diabetic Patients

Declarations

Acknowledgments

This paper is based on a research project sponsored by Kermanshah University of Medical Sciences. Therefore, researchers appreciate research deputy of Kermanshah University of Medical Sciences, all patients who cooperated honestly in conducting the research, and authorities of studied health centers, in Kermanshah, west of Iran.

Authors'contributions

FM, EJM, JA and ST conceived and designed the study and finalized the methodology and tools used. AS, AA, MH and AZ collected the data and analyzed and drafted the manuscript. All the authors made significant contributions in the manuscript writing and finalizing of the manuscript. The final manuscript has been read and approved by all the authors.

Funding

No funding.

Availability of data and materials

Authors report that the data supporting their findings can be publicly shared.

Ethics approval and consent to participate

This study sought ethical permission attained from the ethics committee of the university. The authors assured respondents that all information collected from this study would remain strictly confidential. All the research procedures in this study followed the ethical standards of the university research and ethics committee. The respondents of this study provided their consent to participate in the research and they actively involved in the survey.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests

Author details

¹Life Style Modification Research Center, Imam Reza Hospital, Kermanshah University of Medical Sciences, Kermanshah, Iran. ²School of health management and information sciences, Iran University of medical sciences, Tehran, Iran.

³PhD Student of Health Education and Health Promotion, Health Institute, Kermanshah University of Medical Sciences, Kermanshah, Iran. ⁴[Shanghai Jiao Tong University](#), Shanghai, China. ⁵MSC of statistics. Kermanshah University of Medical Science, Kermanshah, Iran. ⁶Ph.D. Candidate in Health Care Management, School of Health Management and Information Sciences, Iran University of medical sciences, Tehran, Iran.

References

1. Oken BS, Zajdel D, Kishiyama S, Flegal K, Dehen C, Haas M, et al. Randomized, controlled, six-month trial of yoga in healthy seniors: effects on cognition and quality of life. *Alternat Therap Health Med*. 2006;12(1):40-49.
2. Ofori-Asenso R, Zomer E, Curtis AJ, Zoungas S, Gambhir M. Measures of Population Ageing in Australia from 1950 to 2050. *J Populat Agein*. 2018;11(4):367-85.
3. Diabetes U. What is type 2 diabetes. Accessed. 2016;17:16.
4. Xu G, Liu B, Sun Y, Du Y, Snetselaar LG, Hu FB, et al. Prevalence of diagnosed type 1 and type 2 diabetes among US adults in 2016 and 2017: population based study. *Bmj*. 2018;362:k1497.
5. Karimi M, Brazier J. Health, health-related quality of life, and quality of life: what is the difference? *Pharmacoeconom*. 2016;34(7):645-9.
6. Peter PC. Emotional intelligence. *Wiley International Encyclopedia of Marketing*. 2010.
7. Goleman D. Emotional intelligence: Issues in paradigm building. *The emotionally intelligent workplace*. 2001;13:26.
8. Prazeres F, Figueiredo D. Measuring quality of life of old type 2 diabetic patients in primary care in Portugal: a cross-sectional study. *J Diabet Metabol Disorders*. 2014;13(1):68.
9. Nguyen HTT, Moir MP, Nguyen TX, Vu AP, Luong LH, Nguyen TN, et al. Health-related quality of life in elderly diabetic outpatients in Vietnam. *Patient preferen Adherence*. 2018;12:1347.
10. Ghassemzadeh R, Nasseh H, Arastoo AA, Kamali M, Foroushani AR, Arzaghi M. Quality of life in elderly diabetic: comparison between home and nursing home. *Acta Med Iran*. 2013:254-9.

11. Yalcin BM, Karahan TF, Ozcelik M, Igde FA. The effects of an emotional intelligence program on the quality of life and well-being of patients with type 2 diabetes mellitus. *Diabet Educ.* 2008;34(6):1013-24.
12. Schinckus L, Avalosse H, Van den Broucke S, Mikolajczak M. The role of trait emotional intelligence in diabetes self-management behaviors: The mediating effect of diabetes-related distress. *Person Indiv Differ.* 2018;131:124-31.
13. Pordehkordi A MR, Pormirza R. The effect of exercise on quality of life in elderly in Shahrekord. *Iran J Agein.* 2006;2(6):216-23.
14. M. Translation and Normalizing Cyberia- Shrink test in students of public universities. Tehran: Psychology and Educational Sciences of Allameh Tabatabai University;; 2001.
15. Mahanian Khameneh M BA, Salamizadeh M. The relationship between emotional intelligence and Marital Satisfaction. *J Psychology.* 2006;3(10):308-20.
16. A F. The relationship between emotional intelligence and social adjustment of female students in Faculty of Psychology and Educational Sciences, Allameh Tabatabai University. Tehran: Psychology and Educational Sciences of Allameh Tabatabai University; 2003.
17. B. The relationship between emotional intelligence of Parents and social adjustment in children. Tehran: Psychology and Educational Sciences of Allameh Tabatabai University.; 2004.
18. Delpasand M NA, Raiisi P, Shahabi M. Relationship between emotional intelligence and occupational burnout among nurses in Ctitical Care Units. *Iran J Crit Care Nurs.* 2011;4:79-86.
19. J. Emotional Intelligence Test. Retrieved from http://www.queendom.com/queendom_tests/transfer 1996]
20. Ahmadi A, Hasanzadeh J, Rahimi M, Lashgari L. Factors affecting the quality of life in patients with type 2 diabetes Chahar Mahal Bakhtiari. *J north khorasan univ Med sci.* 2011;3(1):7-13.
21. Baghianimoghadam MH, Ardekani M, Baghianimoghadam B. Effect of education on improvement of quality of life by SF-20 in type 2 diabetic patients. *Acta Med Indones.* 2009;41(4):175-80.
22. Monjamed Z, Mehran A, Peimani T. The quality of life in diabetic patients with chronic complications. *J hayat.* 2006;12(1):55-66.
23. Sarani H, Ebrahimitabass E, Arbabisarjou A, Mehdipour S. The quality of life in the diabetic patients of Zahedan's Ali Asghar Hospital affiliated to Zahedan University of Medical Sciences, Iran (2011). *World Sci J.* 2011;1(6):54-64.
24. Vazirinejad R, Sajadi MA, Maghool N. A historical cohort study assessing the effect of diabetes on the quality of life of patients. *Pejouhesh Dar Pezeshki.* 2010;34(1): 12-9.
25. Solli O, Stavem K, Kristiansen IS. Health-related quality of life in diabetes: The associations of complications with EQ-5D scores. *Health Q life outcomes.* 2010;8(1):18-24.
26. Trikkalinou A, Papazafiropoulou AK, Melidonis A. Type 2 diabetes and quality of life. *World J Diabet.* 2017;8(4):120-9.

27. Joensen LE, Almdal TP, Willaing I. Associations between patient characteristics, social relations, diabetes management, quality of life, glycaemic control and emotional burden in type 1 diabetes. *Primary Care Diabet.* 2016;10(1):41-50.
28. Zysberg L, Bar Yoseph T, Goldman M. Emotional intelligence and glycemic management among type I diabetes patients. *Journal of health psychology.* 2017;22(2):158-63.
29. Abbasabad Arabi H, Bastani F, Navab E, Haghani H. Investigating quality of life and its relationship with emotional intelligence (EQ) in elderly with diabetes. *Iran J Psychiatry Clin Psychology.* 2015;21(3):215-24.
30. Downey LA, Johnston PJ, Hansen K, Schembri R, Stough C, Tuckwell V, et al. The relationship between emotional intelligence and depression in a clinical sample. *European J Psychiatry.* 2008;22(2):93-8.
31. Ciarrochi J DF, Anderson S. Emotional intelligence moderates the relationship between stress and mental health. *Personality and Individual Differences.* 2003.
32. Esmaeili M, Ahadi H, Delavar A, Shafi Abadi A. Effect of Learning the Emotional Intelligence Parameters on Mental Health. *Iran J Psychiatry Clin Psychol.* 2007;13(2):158-65.
33. Banegas JR, López-García E, Graciani A, Guallar-Castillón P, Gutierrez-Fisac JL, Alonso J, et al. Relationship between obesity, hypertension and diabetes, and health-related quality of life among the elderly. *European J Cardio Prev Rehabil.* 2007;14(3):456-62.
34. Parrish DR. The relevance of emotional intelligence for leadership in a higher education context. *Stud Higher Educ.* 2015;40(5):821-37.
35. Larin H, Benson G, Wessel J, Martin L, Ploeg J. Changes in emotional-social intelligence, caring, leadership and moral judgment during health science education programs. *J Scholar Teaching Learn.* 2014:26-41.
36. Thomopoulou I, Thomopoulou D, Koutsouki D. The differences at quality of life and loneliness between elderly people. *Bio Exer.* 2010;6(2): 37-42.
37. Bazr Afshan M, Hosseini M, Rahgozar M, Maddah B. Daily quality of life in elderly women who are members of Jahandidegan Shiraz 1386. *Iran J Ageing.* 2008;7:196-204.
38. Santini ZI, Koyanagi A, Tyrovolas S, Haro JM. The association of relationship quality and social networks with depression, anxiety, and suicidal ideation among older married adults: Findings from a cross-sectional analysis of the Irish Longitudinal Study on Ageing (TILDA). *J Affect Disor.* 2015;179:134-41.
39. Amini M, Heydari H. Effectiveness of relationships enrichment education on improvement of life quality and marital satisfaction in married female students. *J Educ Community Health.* 2016;3(2):23-31.
40. Delpasand M, Nasiripoor AA, Raiisi P, Shahabi M. The relationship between emotional intelligence and occupational burnout among nurses in critical care units. *Iran J Crit Care Nurs.* 2011;4(2):79-86.
41. Bacon AM, Burak H, Rann J. Sex differences in the relationship between sensation seeking, trait emotional intelligence and delinquent behaviour. *J Forensic Psychiatry Psychology.* 2014;25(6):673-

83.

42. Pardeller S, Frajo-Apor B, Kemmler G, Hofer A. Emotional Intelligence and cognitive abilities– associations and sex differences. *Psychology, Health* 2017;22(8):1001-10.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Methodsformula.docx](#)