Assessment of HRQoL and its Determinants for Kidney Stone Formers in urological settings of Pakistan

Zulnorain Ali
Quaid-I-Azam University
Ahmad Khan (akhan@qau.edu.pk)
Quaid-I-Azam University
Tahir Mehmood
National University of Science and technology
Obaidullah Malik
Drug Regulatory Authority of Pakistn
Jallat Khan
Khawaja Fareed University of Engineering and Information Technology, Rahim Yar Khan
zein el-emir
Benazir Bhutto Hospital

Article

Keywords: Urolithiasis, Kidney stones, Kidney stone formers, Health related quality of life, Wisconsin stone quality of life Questionnaire

Posted Date: July 20th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-46110/v3

Abstract

Background

Quality of life is the central health-improving goal. Urolithiasis is a complex disease related to disease-related morbidity and consequently effecting patient's health-related quality of life (HRQoL). The study aims to evaluate the HRQoL and markers of HRQoL of kidney stone formers using a disease-specific instrument.

Methods

HRQoL of kidney stone formers were compared with healthy individuals using Wisconsin stone quality of life (WISQoL) questionnaire. A prospective, cross-sectional, case-control study was conducted at different urological settings of Rawalpindi, Pakistan.

Result

Multivariate analysis of variance (MANOVA) analysis depicted that compared with healthy individuals stone formers reported statistically significant ($p < 0.001$) differences in HRQoL in overall health and all the four domains of WISQoL i.e., social, emotional, disease impact and impact on vitality. Regression analysis evaluated that demographic factors, clinical features of the disease and surgical procedure for active removal of stone are major determinants of QoL for stone formers ($p < 0.05$).

Conclusion

It was concluded that urolithiasis, its various disease related characteristics along with its management choices, is compromising patient's quality of life in all major domains of health. WISQoL questionnaire was proved to be a reliable disease-specific instrument for the assessment of HRQoL of kidney stone patients.

1 Introduction

Health-related quality of life (HRQoL) is a multidisciplinary approach and as a patient-reported outcome measure is considered a more reliable indicator of a patient's health status compared to physician objective assessment of the patient. (1)

Urolithiasis or kidney stone disease is a complex disease significantly related to disease-related morbidity (2). The complex nature of disease range for an acute stone event that may remain completely asymptomatic, to severely symptomatic (3). Further, the highly recurrent nature of the stone disease, with 50% chances of recurrence in the next 5 years (4), requires lifelong medication and dietary modification

that elucidates the chronic nature of the disease. With all this complexity urolithiasis is reported to compromising patients HRQoL.

Kidney stone disease is typically accompanied with renal colic. Although renal colic, the most common presentation of kidney stones is short-lived still the acute event is associated with frequent hospital evaluation, emergency department visits, hospitalization, and surgical intervention causing depression, stress, absence form workdays, or impaired work performance, financial burden and social dysfunction (3, 5, 6). Management of urolithiasis requires medical and surgical intervention. Although the advent of completely noninvasive and minimally invasive procedures like extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL) and ureterorenoscopy (URS) have improved surgical removal of stone as compared to historically used open surgical methods these interventions are still associated with side effects and complications (7). Consequently, the disease itself and various interventions for its management can compromise patient HRQoL (8).

Quality of life is the central health-improving goal. Assessment of HRQOL is therefore necessary for measuring progress toward achieving goals. Different generic and disease-specific instruments are used for the assessment of HRQoL in patients (9–11). Quality of life in kidney stone formers has long been assessed with generic instruments (8), Until 2013 a disease-specific quality of life instrument namely Wisconsin stone quality of life (WISQoL) questionnaire was developed, tested and validated in kidney stone population (9, 12, 13). The present study aims to evaluate the HRQoL of kidney stone formers in the local population and to determine various factors that are epitope of HRQoL in urolithic patients using WISQoL questionnaire.

2 Methodology

A prospective, cross-sectional, case-control study was conducted at the Department of Urology, Benazir Bhutto Hospital, and Holy Family Hospital Rawalpindi, Pakistan, for a period of 6 months (from April 2018 to October 2018). Ethical review board (ERB) approval for the study was obtained from the ERB committee of Quaid-I-Azam University, Islamabad, Pakistan. Informed consent was obtained from all individual participants included in the study. The sample size for the study was calculated through the G-power sample size calculator. For MANOVA analysis the minimum sample size calculated was 240 with effect size 0.085, $\alpha = 0.05$ and power of study 0.95 as input parameters while for linear multiple regression model minimum calculated sample size was 233 with effect size 0.087, $\alpha = 0.05$ and power of study 0.95 as input parameters. So the sample size for the current study was estimated around 240.

2.1 Study Population

The study population constitutes cases and controls. Cases constitute the individuals who were admitted to Hospitals for surgical removal of kidney stones. Case-mix includes stable interventional patients of urolithiasis. Control group include healthy individuals taken form general population whose stone-free

status was confirmed via ultrasound technique. Cases and controls were matched in terms of age and gender.

2.2 Inclusion and Exclusion Criteria

For Cases patients with stable stone disease admitted to urology departments for surgical removal of kidney stones were included in the study irrespective of their age. For Controls healthy individuals from the general population that were matched with cases in terms of age and gender were included in the study. Controls with a personal history of kidney stone disease or any renal disease were excluded from the study.

2.3 Data collection

Data was collected via patient's medical reports and direct interviews with the participants both cases and controls. Information was collected on the data collection form, about subject's demographics, associated comorbidity, past medical history, clinical features of kidney stone disease (including the size of kidney stone, type of kidney stone and location of stone within urinary tract) and procedure used for active removal of stone. Lastly, WISQoL, a 28-item disease-specific questionnaire, was self-administered to access HRQoL in kidney stone formers. The questionnaire was translated into the local language and validated as per WHO guidelines for ease of understanding of the study participants. The validated local language WISQoL had a Cronbach's alpha value of 0.78 ($\alpha = 0.78$).

2.4 Statistical analysis

Data were analyzed via SPSS v20. Data were expressed as counts and percentages for categorical variables while as mean and standard deviation for scale variable. Multivariate analysis of variance (MANOVA) was used to compare the mean score of WISQoL domains while linear regression analysis was used to derive any relation between demographic and clinical variables of disease with the WISQoL domains using 95% confidence interval and considering p-value less than 0.05 as statistically significant.

3 Results

A total of 246 individuals participated in the study, of which 219 were enrolled who were compliant with the inclusion criteria of the study. Within 219 enrolled participants 146 were cases and 73 were controls. The ratio of the case to control was 2:1. The demographic detail of cases and control is expressed in Table 1. The kidney stone formers belong to all the age groups with a range of 7 to 82 and mean age of 40.45 ± 16.7. The age group most affected by kidney stone disease was 31–50 years constituting 42.5% of the cases. The majority of stone formers 52.1% constitute male.

Table 1
Demographic data of cases and controls

Demographic Variables	Categories	Controls		Case	
		Count	Percentage %	Count	Percentage %
Gender	Male	38	52.1%	76	52.1%
	Female	35	47.9%	70	47.9%
Age Groups (in years)	under 16	5	6.8%	7	4.8%
	17–30	17	23.3%	40	27.4%
	31–50	28	38.4%	62	42.5%
	51–70	17	23.3%	30	20.5%
	> 71	6	8.2%	7	4.8%
Level of Education	uneducated	33	45.2%	76	52.1%
	educated	40	54.8%	70	47.9%
Occupation	unemployed	43	58.9%	88	60.3%
	employed	30	41.1%	58	39.7%

Table 2 shows the comparative analysis of WISQoL domains between cases and controls using MANOVA. The overall test statistics were statistically significant ($p < 0.001$) for the standard score of HRQoL and all the four domains of WISQoL i.e. social impact, emotional impact, disease impact, and impact on vitality.

Table 2
Comparison of WISQoL domain between stone formers and healthy controls.

WISQoL Domains	**Control**	**Cases**	**F-statistics**	**P-value**
Standard Score	75.616 ± 14.1926	52.629 ± 18.7511	1361.589	< 0.001
Social Impact	76.889 ± 17.4627	54.181 ± 22.2585	995.014	< 0.001
Emotional Impact	77.489 ± 16.7707	54.986 ± 24.7382	875.826	< 0.001
Disease Impact	75.816 ± 16.5288	50.834 ± 22.2451	945.740	< 0.001
Impact on Vitality	68.947 ± 24.3857	38.294 ± 23.2968	501.021	< 0.001
Note: Data of mean scores for WISQoL domains expressed as Mean ± SD. P-values obtained via MANOVA analysis.				

The impact of sociodemographic factors e.g. age, gender educational, and occupational status was assessed and is shown in Table 3. Age showed a significant association ($p < 0.05$) with all the domains

of WISQol while gender yielded a statistically significant relation with emotional domains (p = 0.042), disease impact (p = 0.009), and overall HRQoL (standard score p = 0.021).

Table 3
Association of WISQoL domains with Demographic Factors.

WISQoL domains		Univariate analysis			Multivariate analysis		
		Beta	SEM	p-value	Beta	SEM	p-value
Standard score	Gender	.630	5.202	< 0.001	.124	4.306	.021
	Age Groups	.876	1.097	< 0.001	.599	1.933	< 0.001
	Education	.693	4.826	< 0.001	.225	3.966	< 0.001
	Occupation	.623	5.757	< 0.001	.082	4.746	.130
Social impact	Gender	.605	5.590	< 0.001	.094	4.840	.101
	Age Groups	.862	1.209	< 0.001	.611	2.173	< 0.001
	Education	.683	5.130	< 0.001	.221	4.459	< 0.001
	Occupation	.617	6.072	< 0.001	.077	5.335	.181
Emotional impact	Gender	.613	5.713	< 0.001	.124	5.248	.042
	Age Groups	.843	1.320	< 0.001	.570	2.356	< 0.001
	Education	.683	5.279	< 0.001	.250	4.835	< 0.001
	Occupation	.589	6.418	< 0.001	.052	5.785	.394
Disease impact	Gender	.624	5.199	< 0.001	.154	4.689	.009
	Age Groups	.852	1.181	< 0.001	.544	2.105	< 0.001
	Education	.673	4.921	< 0.001	.207	4.320	< 0.001
	Occupation	.619	5.738	< 0.001	.117	5.169	.048
Impact on vitality	Gender	.537	4.529	< 0.001	.078	4.633	.281
	Age Groups	.788	1.123	< 0.001	.538	2.080	< 0.001
	Education	.626	4.189	< 0.001	.187	4.268	.005
	Occupation	.596	4.736	< 0.001	.127	5.107	.079

Note: Significant values obtained via linear regression analysis. If univariate regression analysis was significant multivariate regression analysis was performed. Results expressed as standardized coefficient of beta and Standard error of Mean (SEM).

The association of the patient's perception of stone status with HRQoL was also modeled via linear regression shown in Table 4. The model yielded statistically significant (p < 0.005) results in all the

domains of WISQoL. Patients who reported no stone within the body scored lower in all domains compared with those who reported they currently have a stone in the body at the time of filling the WISQoL.

Table 4
Patient's perception of stone presence.

WISQoL Domains	Beta	SEM	p-value
Standard score	.858	2.707	< 0.001
Social impact	.838	3.017	< 0.001
Emotional impact	.848	3.014	< 0.001
Disease impact	.844	2.807	< 0.001
Impact on vitality	.746	2.815	< 0.001
Note: Significant values obtained via linear regression analysis. Results expressed as standardized coefficient of beta and Standard error of Mean (SEM).			

Table 5 shows the linear regression model for the association of disease characteristics on patients HRQoL. Type of stone (staghorn stone and non-staghorn stone) and stone location within urinary tract (either Kidney/ureter/bladder or stone localized at more than one place within the urinary tract) showed significant ($p < 0.05$) result with all the domains of WISQoL while the procedure for active removal of stone [non-invasive (ESWL), partially/minimally invasive(PCNL or URS) or invasive(laparoscopy)] showed statistically significant result with social impact ($p = 0.008$), emotional impact ($p = 0.009$) and disease impact ($p = 0.021$) however impact on vitality indicated statistically insignificant result ($p = 0.163$). Stone size (less than 30mm or 30mm and greater) yielded insignificant results with all domains of WISQoL.

Table 5
Association of WISQoL domains with disease characteristics.

WISQoL Domains		Univariate analysis			Multivariate analysis		
		Beta	SEM	p-value	Beta	SEM	p-value
Standard score	Type of stone	.352	12.149	< 0.001	.244	12.357	.005
	Size of stone	.199	20.756	.015	.049	23.862	.559
	Stone Location	.276	14.395	.001	.191	14.658	.023
	Procedure for stone Removal	.301	10.687	< 0.001	.223	10.625	.009
Social impact	Type of stone	.348	12.701	< 0.001	.239	12.918	.006
	Size of stone	.205	21.731	.013	.062	24.946	.463
	Stone Location	.268	15.126	.001	.179	15.323	.033
	Procedure for stone Removal	.304	11.194	< 0.001	.228	11.107	.008
Emotional impact	Type of stone	.333	13.310	< 0.001	.222	13.498	.010
	Size of stone	.180	22.482	.029	.041	26.066	.631
	Stone Location	.267	15.572	.001	.183	16.012	.031
	Procedure for stone Removal	.319	11.462	< 0.001	.247	11.606	.004
Disease impact	Type of stone	.327	12.237	< 0.001	.228	12.556	.009
	Size of stone	.185	20.670	.025	.038	24.246	.661
	Stone Location	.270	14.318	.001	.192	14.894	.025
	Procedure for stone Removal	.274	10.703	.001	.199	10.795	.021
Impact on vitality	Type of stone	.358	9.590	.000	.275	9.970	.002
	Size of stone	.221	16.564	.007	.079	19.252	.361
	Stone Location	.251	11.625	.002	.177	11.826	.039
	Procedure for stone Removal	.213	8.782	.010	.120	8.572	.163

WISQoL Domains	Univariate analysis			Multivariate analysis		
	Beta	SEM	p-value	Beta	SEM	p-value

Note: Significant values obtained via linear regression analysis. If univariate regression analysis was significant multivariate regression analysis was performed. Results expressed as standardized coefficient of beta and Standard error of Mean (SEM).

Figure 1 shows an assocaiation of age with WISQoL domains. A decline in the HRQoL of the kidney stone formers was observed with the increasing age in all the WISQoL domains.

4 Discussion

The trends in the prevalence of urolithiasis in Asian subcontinent show a variable response with overall prevalence of 1–5% while some Asian countries like Saudi Arabia have also reported prevalence up to 20.1% (14). Pakistan being situated in the middle of Afro-Asian stone forming belt show a high incidence of kidney stone formation with study reporting urolithiasis workload of 40–50% in the urological settings of Pakistan (15). Quality of life of kidney stone formers has been a concern in this regard. HRQoL in kidney stone patients have been assessed in different urologic setting in different regions of the world but to the best of our knowledge this is first attempt to assess the HRQoL of stone formers using disease specific instrument in native community with such vast ethnic inclusiveness.

Study reveals that quality of life of stone formers is affected as kidney stone formers scored lower than healthy study participants in all the major domains of HRQoL i.e. social, emotional, disease impact and vitality. These results are consistent with Bryant and Micheal (2) who also reported same finding using SF 36 questionnaire.

Results indicated an age related decline in the HRQoL of kidney stone formers as shown in Fig. 1, similar findings were reported by Arafa and Mostafa (5). That is particularly true for age, this decline in QoL of stone formers with advancing age can be attributed to the compromised ability of coping with the emotional and physical trauma associated with kidney stone disease. On contrary the pediatric stone formers scored very high in all the domains of WISQoL as depicted in Fig. 1, More evidences are needed to support the argument that either urolithiasis does not compromise the HRQoL of pediatric stone formers to the extent the QoL of other age groups is affected or the appropriateness of WISQoL for this particular age group need to be addressed as WISQoL was originally validated for adult stone formers.

A gender related difference was observed in the HRQoL of stone formers, female stone formers scored lower than male stone formers in all the WISQoL domains i.e. standard score (54.3 vs 50.8), social impact (57.0 vs 51.2), emotional impact (56.5 vs 53.3), disease impact (51.6 vs 50.0) and impact on vitality (41.6 vs 34.8), similar results were reported by Penniston and Nakada (7) who evaluated the difference between the HRQoL of male and female stone former using a generic instrument.

Clinical features of kidney stone disease were also observed as markers of HRQoL. Among diseases feature patients having stone localized at more than one site in the body (for example, patients having a stone in kidney and ureter at the same time) scored lowered in WISQoL domains than those with stone localized at a single site (either kidney, ureter or bladder). Moreover, stone type (either staghorn stone or non-staghorn stone) also yielded a statistically significant association with the HRQoL. Arafa and Mostafa (5) in their study also reported a significant relation of stone location and stone size with the HRQoL of urolith formers, However, in our study, a statistically insignificant association was found with the kidney stone size. Although stone formers having larger stone within their body scored lower in major domains of WISQoL (52.7 vs 50.9 for the standard score, 55.3 vs 49.5 for emotional impact and 51.0 vs 46.9 for disease impact) while almost similar and converse results were observed in social impact (54.1 vs 54.9) and impact on vitality (37.9 vs 45.2) respectively. This difference may be due to the accommodation process involving response shift that results in a change in internal standard and values (16).

Interestingly the patient's perception of current stone status showed contradictory results, as patients who reported that they do not currently have stone within their body scored lower in WISQoL domains (standard score; 54.5 vs 46.3, Social impact; 55.8 vs 48.8, emotional impact; 58.1 vs 44.4, disease impact; 53.2 vs 42.7, impact on vitality; 38.0 vs 39.4) compared with those who reported the presence of stone within their body. These contradictory results can be accredited to the fact that patients who responded were asked about their perception for the stone presence within their body a couple of days after surgery, so the hospital stay, post-surgical impairment and stent placement (17) maybe associated with the current finding. Further the fact the complete stone free status is achieved by patients a couple of weeks after surgical intervention also supports the current finding. Notably procedure for active removal of stone was critical for determining the patient's HRQoL. Depending on clinical features of disease different surgical techniques including PCNL, URS, Pyelolithotomy, cystolithotomy, and open surgery were used for active stone removal, findings report a statistically significant relation of surgical procedure with WISQoL domains. Patients receiving different minimally/partially invasive procedures (e.g. PCNL and URS) for active stone removal scored better than patients who were subjected to invasive or completely invasive surgical procedures like pyelolithotomy, cystolithotomy or laparoscopic procedures respectively.

Conclusion

The overall advancement in the treatment modalities for urolithiasis has improved the clinical practices in this domain but HRQoL remains a major concern. It was concluded that urolithiasis, its various disease related characteristics along with its management choices, is compromising patient's quality of life in all major domains of health effecting not only patient's vitality but also effecting patients life socially and psychologically. WISQoL was proved to be a reliable disease-specific instrument in assessing the HRQoL of adult kidney stone formers. We recommend more investigation for the generalizability of the instrument for all age groups particularly for pediatric stone formers and more such types of studies in multiple settings with longitudinally evaluating the disease impact to overcome the potential limitation of this study.

Declarations

Ethical Approval.

The study has been approved by the Quaid-I-Azam University ethics committee and have been performed in accordance with the ethical standards as laid down in 1964 Declaration of Helsinki and its later amendments or comparable ethical standard.

Consent for Publication

Not Applicable

Availability of Data and Material

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request

Competing Interest

The Authors declares they have no competing interest

Funding Source

None

Acknowledgement

We are grateful to our collaborators Dr. Sharjil Wahid and Dr. Ali Shaiman for data assistance.

Authors Contribution

Zulnorain Ali: Protocol development, data collection, data analysis and manuscript writing.

Ahmad Khan: Protocol development.

Tahir Mehmood: Data management and data analysis.

Obaidullah Malik: Data analysis, manuscript revision.

Jallat Khan: Manuscript editing and revisions

Zein-el-Emir: Data collection.

Conflict of Interest

The authors declare that they have no conflict of interest.

Acknowledgement

We are grateful to our collaborators Dr. Sharjil Wahid and Dr. Ali Shaiman for data assistance.

References

1. Penniston KL, Sninsky BC, Nakada SY. Preliminary evidence of decreased disease-specific health-related quality of life in asymptomatic stone patients. Journal of endourology. 2016;30(S1):S-42-S-5.
2. Bryant M, Angell J, Tu H, Goodman M, Pattaras J, Ogan K. Health related quality of life for stone formers. The Journal of urology. 2012;188(2):436–40.
3. Bensalah K, Tuncel A, Gupta A, Raman JD, Pearle MS, Lotan Y. Determinants of quality of life for patients with kidney stones. The Journal of urology. 2008;179(6):2238–43.
4. Sohgaura A, Bigoniya P. A review on epidemiology and etiology of renal stone. Am J Drug Discov Dev. 2017;7(2):54–62.
5. Arafa MA, Rabah DM. Study of quality of life and its determinants in patients after urinary stone fragmentation. Health and quality of life outcomes. 2010;8(1):119.
6. Diniz DH, Blay SL, Schor N. Quality of life of patients with nephrolithiasis and recurrent painful renal colic. Nephron Clinical Practice. 2007;106(3):c91-c7.
7. Penniston KL, Nakada SY. Health related quality of life differs between male and female stone formers. The Journal of urology. 2007;178(6):2435–40.
8. New F, Somani BK. A complete world literature review of quality of life (QOL) in patients with kidney stone disease (KSD). Current urology reports. 2016;17(12):88.
9. Penniston KL, Antonelli JA, Viprakasit DP, Averch TD, Sivalingam S, Sur RL, et al. Validation and reliability of the Wisconsin stone quality of life questionnaire. The Journal of urology. 2017;197(5):1280–8.
10. Streeper NM, Wertheim ML, Nakada SY, Penniston KL. Cystine stone formers have impaired health-related quality of life compared with noncystine stone formers: a case-referent study piloting the Wisconsin Stone Quality of Life Questionnaire among patients with cystine stones. Journal of endourology. 2017;31(S1):S-48-S-53.
11. Donnally CJ, Gupta A, Bensalah K, Tuncel A, Raman J, Pearle MS, et al. Longitudinal evaluation of the SF-36 quality of life questionnaire in patients with kidney stones. Urological research. 2011;39(2):141–6.
12. Penniston KL, Nakada SY. Development of an instrument to assess the health related quality of life of kidney stone formers. The Journal of urology. 2013;189(3):921–30.
13. Penniston KL, Nakada SY. Use of the WISQOL Questionnaire. Journal of endourology. 2017;31(4):420-.
14. López M, Hoppe B. History, epidemiology and regional diversities of urolithiasis. Pediatric nephrology. 2010;25(1):49.

15. Ahmad S, Ansari TM, Shad MA. PREVALENCE OF RENAL CALCULI; TYPE, AGE AND GENDER SPECIFIC IN SOUTHERN PUNJAB, PAKISTAN. Professional Medical Journal. 2016;23(4).
16. Sprangers MA, Schwartz CE. Integrating response shift into health-related quality of life research: a theoretical model. Social science & medicine. 1999;48(11):1507–15.
17. Zhao PT, Hoenig DM, Smith AD, Okeke Z. A randomized controlled comparison of nephrostomy drainage vs ureteral stent following percutaneous nephrolithotomy using the Wisconsin StoneQOL. Journal of endourology. 2016;30(12):1275–84.

Figures

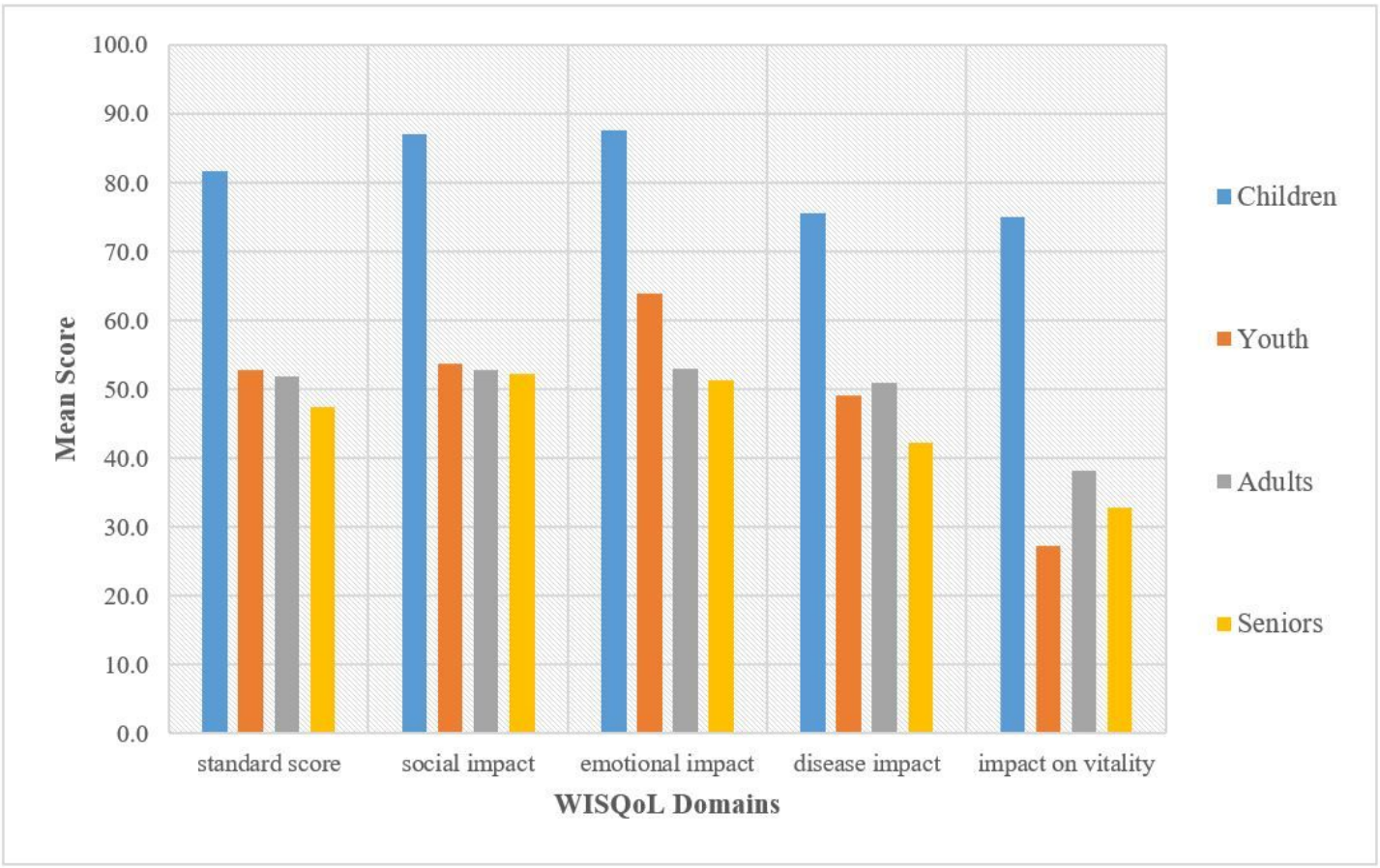

Figure 1

Graphical representation of Association of Age with WISQoL domains