

The Interplay between Medication Adherence and Health-Related Quality of Life in Hypertensive Elderly People in Rangpur Region of Bangladesh

Zannat T¹, Shaheen S², Noor IN³, Abrar AK⁴, Rashid HO⁵, *Nurunnabi M⁶

Abstract

Ageing brings physical changes and health risks, but older adults are a valuable societal asset. Understanding the challenges of ageing and promoting preventative measures is essential for successful ageing. A cross-sectional study was conducted between August 2020 and January 2021, at the Hypertension and Research Center, Rangpur, Bangladesh, to evaluate health-related quality of life (HRQoL) and its association with medication adherence among hypertensive elderly individuals. A total of 156 elderly hypertensive patients (of both genders) taking antihypertensive medication for at least one year were included in this study. Data was gathered via face-to-face interviews employing a pre-designed, semi-structured questionnaire. The medical record of each participant was also examined. The mean age of the participants was 66.2±6.6 years. More than one third of respondents (41%) reported about high adherence to medicine followed by low adherence (30.1%) and medium adherence (28.8%). Mean EQ-5D index value of HRQoL was found 0.63±0.263. After adjusting confounders, multivariate analysis found self-income, occupation, duration of blood pressure, controlled blood pressure, medication adherence, exercise and tobacco use influence the different domains of HRQoL. Moreover, high adherence improved the EQ-5D mean index by 0.201 ($p<0.05$). As medication adherence is significantly associated both in five aspects of health related quality of life and EQ-5D index value, mass awareness and counseling for being adherent to medicine should be improved.

CBMJ 2026 July: Vol. 15 No. 02 P:10-20

Keywords: Medication adherence, quality of life, hypertension, ageing, elderly people

Introduction

Concurrent epidemiological and demographic changes are taking place across the globe including Bangladesh resulting in a complicated interaction between changing disease patterns and population dynamics; the population of persons aged 60 and older will exceed that of children by 2047 worldwide.¹ Besides, the epidemiological transition is contributing to a rising burden of non-communicable diseases (NCDs) both regionally and globally. Among these NCDs, hypertension stands out as a prevalent. Hypertension is universally acknowledged as the leading cardiovascular risk factor and a significant contributor to global mortality. It is still one of the top causes of early death around the world, accounting for about 13.5% of all deaths.² Beyond its direct health consequences, hypertension significantly compromises the health-related quality of life (HRQoL) of affected individuals, particularly among the elderly. HRQoL reflects an individual's physical,

1. Dr. Taslima Zannat, Lecturer, Department of Community Medicine & Public Health, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh.
2. Dr. Shafia Shaheen, Associate Professor, Department of Epidemiology, National Institute of Preventive and Social Medicine, Dhaka, Bangladesh.
3. Dr. Irfan Nowroz Noor, Assistant Professor, Department of Epidemiology, Doctoral student, Mahidol University, OSD, DGHS, Dhaka, Bangladesh.
4. Dr. Ahmad K. Abrar, Assistant Scientist, Department of Epidemiology and Research, National Heart Foundation Hospital and Research Institute, Dhaka, Bangladesh.
5. Dr. Harun Or Rashid, Lecturer, Department of Pathology, Shaheed M. Monsur Ali Medical College, Sirajganj, Bangladesh.
6. *Dr. Mohammad Nurunnabi, Assistant Professor, Department of Community Medicine and Public Health, Sylhet Women's Medical College, Sylhet, Bangladesh.

Address of Correspondence:
Email: nur.somch@gmail.com

psychological, social, and emotional well-being and has become an essential outcome measure in modern healthcare. It captures not only the clinical burden of disease but also the wider psycho-social impact on patients' day-to-day functioning.³

Uncontrolled hypertension is still very common, even though there are good medications and care guidelines based on evidence. One of the most important factors in how well a treatment works is how well the patient sticks to their medicine, which is still a problem in real life. Low adherence to antihypertensive treatment is a significant factor contributing to the inability of clinical trial outcomes to be effectively integrated into ordinary therapy.⁴ Studies have shown that adherence varies with patient characteristics, including age, comorbidities, duration of treatment, education, and perceptions of illness and medications.^{5,6} Interventions aimed at improving adherence therefore need to address not only medical but also psychosocial and behavioural dimensions.

Medication adherence and HRQoL are closely related. According to research, people with hypertension have lower HRQoL than their peers with normotension, and poor treatment adherence is linked to lower well-being.⁷⁻⁹ For older adults, worsening emotional well-being is often associated with decreased adherence, while positive perceptions of illness and stronger beliefs in the necessity of treatment improve compliance.^{3,4} Global demographic shifts highlight the significance of HRQoL in managing hypertension. With an increased number of elderly people and a shift in demography,^{1,10} the health and quality of life of elderly population are becoming increasingly important public health priorities. In this context, it is essential to comprehend the relationship between HRQoL and medication

adherence in hypertensive elderly people in Bangladesh. These findings can guide more comprehensive and patient-centered strategies for hypertension management, ultimately leading to better health outcomes and an improved quality of life older people of the country.

Methods

This A cross-sectional study was conducted at the Hypertension and Research Center, Rangpur, Bangladesh, between August 2020 and January 2021. The study included men and women aged ≥ 60 years, diagnosed with hypertension, and on antihypertensive treatment for at least one year. Participants were recruited from the outpatient department during routine follow-up visits. A total of 156 elderly hypertensive patients were selected using a non-probability convenience sampling method. Data was collected through face-to-face interviews and supplemented by medical record reviews. A pre-designed, semi-structured questionnaire captured socio-demographics (age, gender, marital status, profession, income, family size, habits), hypertension details (duration, blood pressure, complications, comorbidities, family history), as well as health-related RQoL and medication adherence.

The validated Bangla version of 5Q-5D-3L questionnaire along with visual analogue scale (VAS) was used to gather data on the respondents' HRQoL. The five dimensions of the EQ-5D-3L descriptive system comprises of mobility, self-care, routine activities, pain/discomfort, and anxiety/depression. There are 3 levels for each dimension: no problems, some problems, and severe problems. By checking the box next to the statement that best describes their health, respondents choose their state of health. Each dimension is then assigned a one-digit number.

A 5-digit number that represents the patient's health status can be created by combining the digits for the five dimensions. The EQ VAS uses a 20 cm vertical visual analogue scale with endpoints labeled "best imaginable health state" and "worst imaginable health state" to record the patient's own-rated health. A quantitative indicator of health outcomes that takes into account the patient's subjective assessment is the VAS. By subtracting the appropriate weights from 1, the value for full health (i.e., state 11111), the index can be computed. A value set is the set of index values (weights) for every possible EQ-5D state.

Medication adherence among respondents was assessed using the 8-item structured, self-report Morisky Medication Adherence Scale (MMA-8) in Bangla. Better adherence is indicated by higher scores, whereas difficulties with non-adherence are suggested by lower scores. 0 to <6 (low), 6 to <8 (medium), and 8 (high) were the categories used to classify adherence levels.⁴

For continuous variables, mean $\pm$ SD (standard deviation) were reported, while categorical variables were summarized using frequencies and percentages. Associations were examined using Chi-square test, unpaired Student's t-test, and one-way ANOVA as appropriate. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to determine the strength of associations. Multivariate logistic regression was performed to identify determinants of HRQoL among hypertensive elderly, adjusting for potential confounders. Statistical analysis was conducted using IBM SPSS version 25 for Windows, with level of significance set at <0.05.

The study was approved by the Institutional Review Board (IRB) of National Institute of Preventive and Social Medicine (NIPSOM), Dhaka, Bangladesh (NIPSOM/IRB/2020/1225).

Results

The study respondents had a mean age of 66.2 ± 6.6 years (range: 60–90); nearly half were aged 60–64. Most were male (60.9%), majority were Muslim (92.9%), and married (75.6%). Education varied, with 28.2% up to secondary level. About one-third (34%) were employed, 33% homemakers, and 32% retired, mostly belongs to joint families. Among the female respondents in this study, majority (83.6%) was housewife. Mean family income was 27.75 ± 28.28 thousands BDT. About one third (31.4%) respondent had monthly family income 11-20 thousands BDT, 22.4% respondents had 3-10 thousands BDT monthly. Among the respondents, about one third people (28.2%) were ex-habituate of either smoke or smokeless tobacco (Table-I). 41.7% respondents had no experience of tobacco. About 18.59% respondents used to take tobacco in any form >30 years. In this study, more than half of respondents (57.7%) had no exercise habit ≥ 150 minutes weekly. Around half of respondents' (45.5%) duration of hypertension was 1-5 years. Besides, uncontrolled BP group comprised of two-third of respondents (66%) (Table-I). Female patients reported more health problems than males, including walking difficulties (60.7% vs. 55.8%), self-care issues (16.4% vs. 6.3%), limitations in usual activities (32.8% vs. 13.7%, $p < 0.05$), and pain/discomfort (50.8% vs. 21.1%, $p < 0.001$). Anxiety/depression was also more frequent among females (80.3%) than males (73.7%), though not statistically significant ($p > 0.05$) (Fig. 1). 41% of the patients reported high medicine adherence (more common in males, 46.3%, than females, 32.8%), while low adherence was more frequent among females, followed by 30.1% with low and 28.8% with medium adherence (Fig. 2). Significant differences in EQ-5D index values were observed across demographic and socioeconomic

Table-I: Sociodemographic characteristics, life style related behavior, hypertension related information (n= 156)

Characteristics	Categories	Frequency	Percentage
Age (in years)	60-65	90	57.7
	66-71	34	21.8
	72-77	21	13.5
	>77	11	7.1
	Mean age	66.24 ± 6.62 years	
Gender	Male	95	60.9
	Female	61	39.1
Religion	Muslim	145	92.9
	Hindu	11	7.1
Marital status	Married	118	75.6
	Not married at present	38	24.4
Education	Illiterate	28	17.9
	Up to primary	25	16.0
	Up to secondary	44	28.2
	Up to higher secondary	27	17.3
	Honors and above	32	20.5
Occupation	Employed	53	34
	House maker	51	32.7
	Retired	50	32.1
Type of family	Nuclear family	55	35.3
	Joint family	101	64.7
Monthly family income (BDT)	3000-10000	35	22.4
	11000-20000	49	31.4
	21000-30000	31	19.9
	31000-40000	20	12.8
	>40000	21	13.5
	Mean income	2775 ± 2828 BDT	
Life style behaviors			
Habit of tobacco	Ex consumer	44	28.2
	Current consumer	47	30.1
	Never consumer	65	41.7
Weekly exercise habit	<150 minutes	90	57.7
	≥150 minutes	66	42.3
Blood pressure related information			
Duration of hypertension	1-5 years	71	45.5
	6-10 years	47	30.1
	11-15 years	24	15.4
	>15 years	14	9
	Mean duration	7.54 ± 6.56 years	
Blood pressure status	Uncontrolled BP	103	66
	Controlled BP	53	34

factors. Mean EQ-5D index value of HRQoL was found 0.63±0.263 (not shown in table). Comparatively Younger respondents (60–69 years) showed higher mean scores than those aged 70+, males scored higher than females, and married individuals had better scores than unmarried ones (all $p<0.01$). Nuclear family respondents and those with higher secondary education also had significantly better

HRQoL. Employment status showed strong influence, with employed respondents scoring highest ($p<0.01$). Blood pressure control showed no significant effect, though uncontrolled respondents reported slightly better index values. EQ-5D index value was significantly lower among respondents with hypertension duration over 20 years compared to those with 1–10 years, while no significant difference

Fig. 1: Occurrence of problem in five domains of HRQoL among participants (n=156)

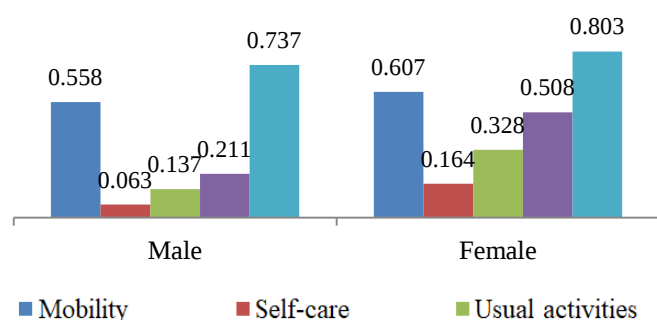
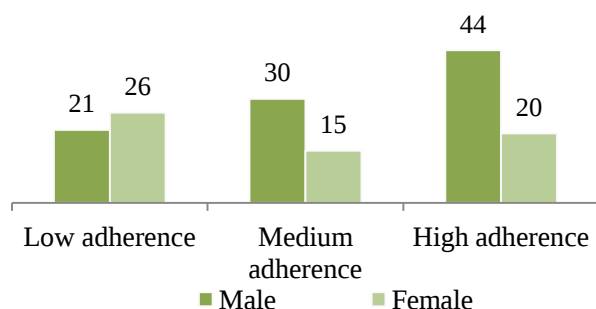


Fig. 2: Different level of medication adherence (n=156)



was observed between other groups ($p < 0.05$). The mean EQ-5D index value was significantly lower in respondents with low medication adherence (0.54 ± 0.34) compared to those with high adherence ($p < 0.05$) (Table-II). Multivariate logistic regression revealed that in the mobility domain, exercise, self-income, and blood pressure were associated. Having weekly moderate exercise habit, problem in mobility decreased by 0.883. For every unit change in self-income was 98% less prone to develop problem in mobility while controlled blood pressure are 50% less likely to have problem in mobility. Self-care was influenced by longer hypertension duration, lower medication adherence, and self-income. Each year increase in duration of hypertension was 1.1 times more frequent to have problem in self-care. Low medication was 8.2 times where medium medication

adherence was 2.4 times more prone to have problem in self-care. Usual activities were also affected by hypertension duration, blood pressure, medication adherence, and self-income, where low adherence and longer duration low heightened limitations. Besides, pain/unsoundness was linked to occupation, exercise, and tobacco use, with homemakers and retirees showing higher risk. Respondents having habit of exercise was less frequent to observe feeling of pain/unsound. House maker was 5.5 times more and retired person was 2.1 times more frequent to develop problem of pain/unsound. Ex-tobacco consumers were 66% less and never tobacco consumer were 70% less prone to observed feeling of pain/unsound. For anxiety/depression, only tobacco use emerged as a predictor. Ex-tobacco consumer were 16% less and never tobacco consumer were 2.5 times more frequent of having anxiety/depression than that of current tobacco consumer (Table-III). We also found significant associations between medication adherence and certain EQ-5D domains. Self-care problems (23.4%) and difficulties in usual activities (38.3%) were more frequent among respondents with low adherence compared to medium (6.7%, 17.8%) and high adherence (3.1%, 10.9%) ($p < 0.01$). Mobility issues and pain/discomfort showed no significant differences across adherence groups. Anxiety/depression was more common in low adherence (83%) than medium (75.6%) and high adherence (71.9%), though not statistically significant (Table-IV). A multiple linear regression model ($F = 4.472$, $p < 0.001$) with no autocollinearity, multicollinearity and outliers was applied which revealed same assumption regarding HRQoL. Moreover, it found younger age, male gender, absence of family history was also linked to better EQ-5D scores. Notably, high adherence improved the index by 0.201 ($p < 0.05$).

Table-II: EQ-5D index value and sociodemographic characteristics, blood pressure, medication adherence, life style related information (n=156)

Characteristics	Categories	EQ-5D Index (Mean±SD)	p-value
Age	60-69 years 70 years and above	0.67±0.22 0.52±0.32	<0.01*
Gender	Male Female	0.68±0.22 0.55±0.30	<0.01*
Marital status	Not married at present Married	0.53±0.32 0.66±0.23	<0.01*
Family type	Nuclear family Joint family	0.74±0.16 0.57±0.29	<0.001**
Educational status ^A	Illiterate Up to primary Up to secondary Up to higher secondary Honors and above	0.55±0.33 0.49±0.33 0.64±0.22 0.73±0.16 0.72±0.22	<0.01*
Occupation ^A	Employed House maker Retired	0.72±0.19 0.54±0.31 0.63±0.24	<0.01*
Blood pressure related information			
Blood pressure	Controlled BP Uncontrolled BP	0.59±0.28 0.64±0.25	>0.05
Duration of hypertension ^A	1-10 years 11-20 years >20 years	0.64±0.23 0.61±0.33 0.37±0.35	<0.05*
Medication adherence ^A	Low adherence Medium adherence High adherence	0.54±0.34 0.65±0.24 0.68±0.19	<0.05*
Lifestyle behavior			
Exercise (≤150 minutes weekly)	No Yes	0.58±0.27 0.69±0.24	<0.01*
Habit of tobacco ^A	Current consumer Ex consumer None	0.58±0.31 0.63±0.29 0.66±0.20	>0.05

Unpaired Student's t-test was applied, ^A=One way ANOVA was applied; *=Statistically significant, **=Highly significant.

Table-III: Multivariate analysis for status of association of independent variables with five domains health related quality of life (n=156)

Domain of HRQoL	Significantly associated variables	Wald χ^2 value	Coefficient B	p-value	OR (95% CI)
Mobility	Exercise	6.512	-0.883	0.024*	0.011 (0.412-0.210)
	Controlled BP	3.044	-0.671	0.081	0.511 (0.241-0.822)
	Self-income	5.096	.000	0.011*	0.024 (1.000-1.000)
Nagelkerke R ² .148; Overall classification 65.2%					
Self-care	Duration of Hypertension	4.1140	0.076	0.043*	1.078 (1.003-1.160)
	Self-income	5.532	.000	0.019*	1.000 (1.000-1.000)
	Low Medication adherence	6.361	2.101	0.012*	8.174 (1.597-41.826)
	Medium adherence	0.836	0.885	0.360	2.423 (0.364-16.150)
	High adherence	7.523	NA	0.023	Reference cat (1)
Nagelkerke R ² .315; Overall classification 90.3%					
Usual activities	Self-income	10.715	.000	0.001*	1.000 (1.000-1.000)
	Duration of Hypertension	6.465	0.084	0.011*	1.088 (1.019-1.161)
	Low adherence	7.850	1.554	0.005*	4.730 (1.595-14.027)
	Medium adherence	0.210	0.288	0.646	1.333 (0.390-4.557)
	High adherence	8.961	NA	0.011	Reference cat (1)
	Controlled BP	6.896	1.340	0.009*	3.818 (1.405-10.378)
Nagelkerke R ² .353; Overall classification 79.4%					
Pain/unsound	Exercise	3.257	-0.726	0.071	0.484 (0.220-1.064)
	Employed	12.132	NA	0.002	Reference cat (1)
	House maker	11.769	1.697	0.001*	5.45 (2.070-14.383)
	Retired	2.231	0.758	0.135	2.133 (0.789-5.765)
	Current tobacco consumer	7.561	NA	0.023	Reference cat (1)
	Ex consumer	5.994	-1.078	0.014*	0.340 (0.144-0.806)
	Never consumer	7.175	-1.208	0.007*	0.299 (0.124-0.723)
Nagelkerke R ² .224; Overall classification 72.9%					
Anxiety/depression	Current tobacco consumer	5.438	NA	0.066	Reference cat (1)
	Ex consumer	0.135	-0.169	0.713	0.844 (0.342-2.081)
	Never consumer	3.403	0.897	0.065	2.451 (0.946-6.354)
Nagelkerke R ² .057; Overall classification 76.8%					

*=Statistically significant.

Table-IV: Five aspects of health related quality of life and medication adherence (n=156)

Medication adherence	No problem Frequency (Percentage)	Problem Frequency (Percentage)	p-value
Mobility			
Low adherence	21 (44.7)	26 (55.3)	>0.05
Medium adherence	20 (44.4)	25 (55.6)	
High adherence	25 (39.1)	39 (60.9)	
Self-care			
Low adherence	36 (76.6)	11 (23.4)	<0.01*
Medium adherence	42 (93.3)	3 (6.7)	
High adherence [†]	62 (96.9)	2 (3.1)	
Usual activities			
Low adherence	29 (61.7)	18 (38.3)	<0.01*
Medium adherence	37 (82.2)	8 (17.8)	
High adherence [†]	57(89.1)	7 (10.9)	
Pain/unsound			
Low adherence	26(55.3)	21 (44.7)	>0.05
Medium adherence	31(68.9)	14 (31.1)	
High adherence	48 (75.0)	16 (25.0)	
Anxiety/depression			
Low adherence	8 (17.0)	39 (83.0)	>0.05
Medium adherence	11 (24.4)	34 (75.6)	
High adherence	18 (28.1)	46 (71.9)	

Chi-square test was applied; [†]=Reference category, *=Statistically significant.

Discussion

Both medication adherence and HRQoL are major issue in the current world. With an emphasis on medication adherence and sociodemographic factors, this study explored the factors that influence HRQoL in older adults with hypertension. The current study shows that comparatively younger age is linked to higher HRQoL scores, which is consistent with previous research. EQ-5D index values were higher among respondents aged 60–69 than among those aged 70 and older. According to similar age-related declines, hypertensive patients' HRQoL was considerably lowered as they grew older.^{3,11} This consistency emphasizes how aging contributes to psychosocial limitations, co-morbidities, and functional decline in addition to being a biological determinant. However, this study did not find higher adherence in advanced age groups, which suggests

that contextual and cultural differences may contour adherence behaviors differently than another study that found better adherence among older patients.

Disparities by gender also became evident. Males scored higher on HRQoL indices and reported fewer health problems compared to females, a finding echoed by several earlier studies where women experienced poorer physical and psychological well-being.³ Female respondents in present study reported more walking troubles, self-care problems, pain, and limitations in usual activities. Although some literature has noted better adherence among female patients,¹² our findings indicated lower adherence in women. This discrepancy might be attributable to socioeconomic roles, cultural expectations, and gendered health-seeking behaviors in the study setting, focus on the need for gender-sensitive interventions. Marital status was another significant

predictor, with married individuals exhibiting better HRQoL scores. This is consistent with a previous study,¹³ who reported higher HRQoL among married patients compared to their unmarried counterparts. Marriage may provide social support, shared responsibility in disease management, and emotional stability, all of which positively influence HRQoL.

This study found strong association between socioeconomic properties. Better HRQoL was associated with higher employment status and education, which was supported by other research,^{3,13} which showed that HRQoL was positively impacted by income, employment, and education. Increased health literacy, financial autonomy, and the ability to access health care resources are probably the main causes of the protective effects of education and work. Furthermore, it was discovered that nuclear families were advantageous, which is consistent with findings that better results are a result of stronger social and familial assistance networks.¹²

It was also clear how important lifestyle choices like smoking and physical activity were. Regular exercisers were less likely to report pain or discomfort and mobility issues, supporting other authors' findings that physical activity improves HRQoL.¹¹ When it came to pain and anxiety/depression, former and never-tobacco users fared better than current users. This is consistent with research that highlights the detrimental effects of tobacco use on mental and physical health.³

Medication adherence emerged as a leading determinant of HRQoL. This study exhibited low adherence was associated with significantly lower EQ-5D scores, particularly in self-care and usual activities, whereas high adherence improved the index by 0.201 points. These findings resonate strongly with other studies where the link between

adherence and HRQoL was emphasized^{4,8} as well as the role of patient perceptions of illness and medication in shaping adherence behaviours. While some studies reported higher adherence among older or unemployed patients,^{5,14} our results announced adherence to be higher in men and associated with better socioeconomic status, suggesting that adherence is context-specific and influenced by complex socioeconomic and cultural factors. Better communication between physicians and patients also ensures better medication adherence in elderly population.¹⁴

Interestingly, blood pressure control did not show significant effects on HRQoL in this study, a finding that diverges from previous research.^{6,13} One possible explanation is that respondents with uncontrolled blood pressure may have adapted psychologically or may not perceive their condition as impairing daily life in the absence of severe complications. Alternatively, this discrepancy may reflect measurement limitations or variations in self-reported health perceptions.

All things considered, this study supports the multifaceted effects of lifestyle, treatment-related, socioeconomic, and demographic factors on HRQoL. It supports existing literature in recognizing the roles of age, education, employment, marital status, physical activity, and adherence, while also revealing unique contextual patterns, particularly regarding gender differences, family structure, and perceptions of blood pressure control. Our study has some limitations. Its cross-sectional design and reliance on self-reported data may have introduced response and recall bias. Use of Sri Lanka's population weights for EQ-5D index calculation and the invalidated Bangla translation of the Morisky Medication Adherence Scale (MMA-8) are additional limitations, though the tool remains widely useful for assessing adherence.

Conclusion

Ageing, a continuous process, and hypertension, a significant non-communicable disease, both represent serious public health challenges. It can conclude that high medication adherence can enhance HRQoL when other factors are taken into account. Healthcare providers can apply appropriate, culturally sensitive strategies to help elderly people stick to their hypertension medications. Government also can take initiatives to privilege elderlies in every sector and make ageing healthier and dignified. Provision of physical activity might improve HRQoL. All hypertensive patients can be counseled for being physically more active when they come for follow-up visits.

Acknowledgement

We would like to express our gratitude the authority of Rangpur Hypertension and Research Center, Rangpur, Bangladesh, for their enormous support regarding data collection. We also acknowledge the altruistic and sincere participation of the elderly individuals in this study.

References

1. World Health Organization (WHO). *World report on ageing and health*. Geneva: WHO; 2015.
2. Khanam MA, Lindeboom W, Koehlmoos TLP, Alam DS, Niessen L, Milton AH. Hypertension: adherence to treatment in rural Bangladesh—findings from a population-based study. *Glob Health Action*. 2014;7(1):25028.
3. Holt EW, Muntner P, Joyce CJ, Webber L, Krousel-Wood MA. Health-related quality of life and antihypertensive medication adherence among older adults. *Age Ageing*. 2010;39(4):481-7.
4. Rajpura J, Nayak R. Medication adherence in a sample of elderly suffering from hypertension: evaluating the influence of illness perceptions, treatment beliefs, and illness burden. *J Manag Care Pharm*. 2014;20(1):58-65.
5. Lee JK, Grace KA, Taylor AJ. Effect of a pharmacy care program on medication adherence and persistence, blood pressure, and low-density lipoprotein cholesterol: a randomized controlled trial. *JAMA*. 2006;296(21):2563-71.
6. Mahmood S, Jalal Z, Hadi MA, Orooj H, Shah KU. Non-Adherence to prescribed antihypertensives in primary, secondary and tertiary healthcare settings in Islamabad, Pakistan: a cross-sectional study. *Patient Prefer Adherence*. 2020;14:73-81.
7. Saleem F, Hassali MA, Shafie AA. A cross-sectional assessment of health-related quality of life (HRQoL) among hypertensive patients in Pakistan. *Health Expect*. 2014;17(3):388-95.
8. Khayyat SM, Mohamed MM, Khayyat SMS, Hyat Alhazmi RS, Korani MF, Allugmani EB, et al. Association between medication adherence and quality of life of patients with diabetes and hypertension attending primary care clinics: a cross-sectional survey. *Qual Life Res*. 2019;28(4):1053-61.
9. Wong ELY, Xu RH, Cheung AWL. Health-related quality of life among patients with hypertension: population-based survey using EQ-5D-5L in Hong Kong SAR, China. *BMJ Open*. 2019;9(9):e032544
10. He W, Goodkind D, Kowal PR. *An aging world: 2015* [Internet]. Washington DC: U.S. Government Publishing Office; 2016.
11. Zhang Y, Zhou Z, Gao J, Wang D, Zhang Q, Zhou Z, et al. Health-related quality of life and its influencing factors for patients with hypertension: evidence from the urban and rural areas of Shaanxi Province, China. *BMC Health Serv Res*. 2016;16(1):277.
12. Olowookere AJ, Olowookere SA, Talabi AO, Etoneyaku AC, Adeleke OE, Akinboboye OO. Perceived family support and factors influencing medication adherence among hypertensive patients attending a Nigerian tertiary hospital. *Ann Trop Med Public Health*. 2015;8(6):241-5.

13. Ramli A, Ahmad NS, Paraidathathu T. Medication adherence among hypertensive patients of primary health clinics in Malaysia. *Patient Prefer Adherence*. 2012;6:613-22.
14. Lee W, Noh Y, Kang H, Hong SH. The mediatory role of medication adherence in improving patients' medication experience through patient-physician communication among older hypertensive patients. *Patient Prefer Adherence*. 2017;11:1119-26.