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Title

Health-related Quality of Life Variations by Socio-demographic Factors and Chronic Conditions in Urban South Asia: The CARRS Study

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ABSTRACT [251 words]

Objectives: Health-related quality of life (HRQOL) is a key indicator of health. However, HRQOL data from representative populations in South Asia are lacking. This study aims to describe HRQOL overall, by age, gender, and socio-economic status (SES), and examine the associations between selected chronic conditions and HRQOL in adults from three urban cities in South Asia.

Methods: We used data from 16287 adults aged ≥20 years from the baseline survey of the Centre for Cardiometabolic Risk Reduction in South Asia (CARRS) cohort (2010-11). HRQOL was measured using the European Quality of Life 5 dimension - Visual Analogue Scale (EQ5D-VAS), which measures health status on a scale of 0 (worst health status) – 100 (best possible health status).

Results: 16,284 participants completed EQ5D-VAS. Mean age was 42.4(+/-13.3) years and 52.4% were women. 14% of the respondents reported problems in mobility, and pain/discomfort domains. Mean VAS score was 74 (95% confidence interval [CI]: 73.7, 74.2). Significantly lower health status was found in elderly (64.1), women (71.6), unemployed (68.4), less educated (71.2) and low-income group (73.4). Individuals with chronic conditions reported worse health status than those without (67.4 vs. 76.2): Odds Ratio: 1.8 [95%CI: 1.61, 2.04].

Conclusions: The mean VAS (74.5) reported in our study is much lower than developed countries (82.5). Our data demonstrate significantly lower HRQOL in key demographic groups and those with chronic conditions, which are consistent with previous studies. These data provide insights on inequalities in population health status, and potentially reveal unmet needs in the community to guide health policies.

Key words (5)

Health related Quality of Life (HRQOL), EQ5D, Chronic conditions, South Asia, Visual Analogue Scale

Strengths and limitations of this study

- This is the first population level health related quality of life (HRQOL) data from South Asia using EQ5D-VAS including three large metropolitan cities in India and Pakistan with a large sample size (16,284 adults aged ≥20 years).
- Our data provide the first baseline values to be used for monitoring population health status and analysed the relationships between selected chronic conditions and HRQOL.
- HRQOL data presented in this article could be used to complement national targets by providing a measure of chronic disease burden based on perceived health status rather than solely on mortality and disease prevalence.
- Due to the cross-sectional nature of the data, the causal relationship between socio-economic parameters/chronic conditions and HRQOL cannot be determined.
- Many chronic conditions (respiratory, locomotor, cancer, etc.) were not included in the survey. Therefore, the ranking of most severe health conditions and associated HRQOL is not complete.

Main article [3568 words]

Introduction

Health-related Quality of Life (HRQOL) is a multidimensional concept that provides a broader perspective of health through conveying an individual's ability to function in physical, mental, and social domains of life (1). HRQOL is thus an essential patient-centred outcome measure, which is useful to guide health policies (2, 3). HRQOL is preferred over other health indicators (life expectancy, mortality, morbidity) for measuring chronic disease burden as it incorporates both length and quality of life (4). In South Asia, chronic conditions (diabetes, hypertension and heart diseases) occur at an early age (5) with detrimental effects on length and quality of life (6, 7). In addition, episodes and fear of hypoglycaemia, recurrent heart attacks, stroke and other long-term complications (kidney diseases, diabetic retinopathy) are not always measured as such, though they have a substantial adverse impact on an individual's overall health status (8). Therefore, it is important to quantify the effect of chronic conditions on individuals HRQOL.

There are several disease-specific (Chronic respiratory distress questionnaire, Arthritis Impact Measurement Scale) and generic instruments (Short Form 36, World Health Organization (WHO) – Quality of Life questionnaire, and European Quality of Life Five Dimensions – Visual Analogue Scale (EQ5D-VAS)) available to measure population HRQOL (4, 9-18). However, the EQ5D-VAS is favoured because it is generic, not specific to a particular disease, and it not only includes multidimensional measures of health profile in five dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression), but also includes the single-dimensional measure VAS, to summarize overall health status (1). Also, EQ5D-VAS has been applied and validated for

its use in many population surveys across the world, therefore, it makes the comparison of health status across populations easier.

Data on population HRQOL across socioeconomic status (SES) from South Asia are scarce, and little is known about the relative associations between different chronic conditions and individual HRQOL. The Centre for Cardio-metabolic Risk Reduction in South Asia (CARRS) study (19) had collected data on both EQ5D-VAS and selected chronic conditions from a large representative population of adults in urban South Asia. We used this opportunity to examine population HRQOL in this region. In this paper, we describe the variations in HRQOL by age, gender, and SES, and explore the relationships between selected chronic conditions and HRQOL in a representative sample of adults aged ≥20 years from three metropolitan cities in India and Pakistan. We also analysed the relationship between multidimensional EQ5D measures and single dimensional VAS across major subgroups.

Methods

Study design and setting

We obtained data from the baseline cross-sectional survey of the CARRS cohort (2010-11), which recruited a representative sample of non-pregnant adults aged ≥20 years from three urban cities: Chennai, Delhi, and Karachi. These metropolitan cities with large and heterogeneous populations in terms of demographic profile and economic transitions offer unique opportunities to assess variations in health status across different socio-economic groups. The detailed CARRS study design has been published elsewhere (19). Briefly, a multi-stage cluster random sampling strategy was used with wards (in Delhi and Chennai) or clusters (in Karachi) as the primary sampling units. Using the WHO STEPS survey "Kish method", two participants, one male and one female,

aged ≥20 years (non-pregnant) and meeting the study eligibility criteria, were selected from each randomly selected household (19).

Study measures

Comprehensive and uniform data collection instruments were used to capture measurements in all three sites. A summary of all surveillance measures, methods, and instruments used in the study has been published in detail (19). Briefly, a questionnaire was administered to collect information regarding demographic, socio-economic, behavioural, and past and present health status of the participant.

Trained study staff measured anthropometric parameters (height, weight) using standardized techniques and blood pressure (BP) twice at each participant's home or at a medical camp organized in the community, after five minutes in a seated position using an electronic BP measuring device (Omron Dailan Co., China). If the difference between the first two systolic or diastolic BP readings was more than 10 mmHg or 5 mmHg, respectively, a third reading was taken. Average BP readings of the two/three readings were recorded in the study database. Additionally, fasting blood glucose and glycated haemoglobin (HbA1c) were measured. The overall response rates were 94.7% for questionnaire completion and 84.3% for blood tests.

Population health status was measured using the EQ5D-VAS questionnaire, which consisted of two components; health state description and self-rated health status on VAS. Health state description (profile) includes five dimensions (5D); mobility (walking ability), self-care (ability to wash or dress by oneself), usual activities (ability to work, study, housework), pain/discomfort, and anxiety/depression. The respondents self-rate their level of severity for each dimension using three levels (EQ5D-3L): having no problems, having some or moderate problems, or being unable to do/having extreme problems. The respondents were asked to choose one of the statements which best described their health status on the surveyed day. For example, three levels of 'mobility'

dimension were phrased as "I have no problems in walking," "I have some problems in walking," and "I am confined to bed". Given the possible permutations of different domains and response types, there are potentially 243 (=3^5) different health profiles.

For overall health status, the respondents evaluated their health status using the VAS. The VAS asks respondents to mark health status on the day of the interview on a scale of 0 (worst health status) – 100 (best imaginable health status).

Covariates: Self-reported age at baseline in completed years was used and categorized into 20-24, 25-34, 35-44, 45-54, 55-64, 65-74 and ≥75. Based on participant responses, we categorized employment status into employed, student, housewife, retired, and unemployed. Income class was grouped into three categories based on household monthly income: low-income (<10,000 INR), middle-income (10,000-20,000 INR) and high-income strata (>20,000 INR). We categorized highest education level attained into three categories - up to primary, secondary schooling, and graduates. The marital status was classified as: single, married, widowed, and divorced. Body mass index (Kg/m^2) of ≤18 was used to define the underweight, and >18-25: normal weight, >25-30: overweight and ≥30: obese. Lifestyle habits like tobacco use was classified based on self-reports as never, former and current user. Data on chronic conditions consisted of self-reported hypertension, diabetes, heart disease, stroke, and kidney disease. In addition, diabetes was categorized into self-reported, newly diagnosed (defined by no self-reported diabetes and fasting blood glucose (FBG) of ≥126 mg/dl, or HbA1c ≥6.5%), pre-diabetes (no self-reported diabetes and FBG ≥100-125 mg/dl or HbA1c ≥5.7-6.4%) and normoglycemia (no self-reported diabetes and FBG<100 mg/dl and HbA1c<5.7%). Similarly, we classified hypertension as: self-reported, newly diagnosed (no self-reported hypertension and BP ≥140/90mmHg), prehypertension (no self-reported hypertension and BP: 120-139 / 80-89 mmHg) and normotensive (no history of hypertension and BP <120/80 mmHg).

Ethical considerations

The CARRS study has obtained institutional ethics approval from each of the participating institutions: Public Health Foundation of India, All India Institute of Medical Sciences, New Delhi, Madras Diabetes Research Foundation, Chennai, Aga Khan University, Karachi and Rollins School of Public Health, Emory University, USA. Study participants provided written informed consent, before participation in the study.

Analysis

We used Stata (version 14.0 SE; StataCorp, TX, USA) for data analysis. We used the 'svy' command for all analysis to account for the complex survey design (20). Before any of the survey estimation commands were used, the svyset command was used to specify the variables that described the stratification, sampling weight, and primary sampling unit variables. This analysis included data obtained from 16,284 study participants. All the responses coded as refused, unknown, or missing were treated as missing data. The frequency (percentages) and mean were reported to display the level of population health status and the sample characteristics. Percentages of those reporting any problems in EQ5D domains and mean VAS were stratified by respondent's demographic characteristics - age, gender, marital status, and SES - education, income, and employment status; and health-related indicators - presence of chronic conditions, were reported. Additionally, odds-ratios of moderate or severe health problems in people with and without chronic conditions was analysed using logistic regression. The model was adjusted for socio-demographic covariates (age, gender, marital status, education level, and household income). Linear regression was performed to explore the relationship between the VAS and the EQ5D measures across major subgroups. In the regression model, VAS was used as a dependent variable, and EQ5D measures were treated as independent variables.

Study Results

Characteristics of the study population

A total of 17,274 individuals in 10,002 households were approached in the three study sites (7,596 participants in Chennai, 5,420 in Delhi, 4,258 in Karachi). From these, a total of 16,287 participants were recruited (the overall response rate was 94.3% at the participant level; 6,906 Chennai [90.9%], 5,364 Delhi [98.9%], and 4,017 Karachi [94.3%]). Detailed baseline characteristics of the CARRS cohort is published elsewhere (21-24). Briefly, mean age was 42.4 (+/- 13.3), 52.4% were females, 61% completed secondary schooling, and the majority of respondents (72.5%) reported household income level <INR. 10,000 (US$200). A third (66%) of the study population had BMI ≥25, and one-fifth (20%) of the respondents reported current tobacco use and 37.5% had self-reported chronic conditions (hypertension, diabetes, heart disease, stroke or chronic kidney disease).

Overall HRQOL by age and gender

A total of 16,284 study participants completed the EQ5D-VAS [99.9%]. Overall, the percentage of respondents reporting any problems in mobility and pain/discomfort (14% each) were higher than for other domains. Greater health problems were observed with higher age for both men and women (p-value <0.001). [Table 1]. Problems with mobility were higher with advancing age. However, problems with anxiety/depression did not show such trend. Average health status (VAS) reported by the CARRS cohort was 74.5 (95% CI 73.7 – 74.2). [Figure 1]. Women reported lower health status than men (71.6 vs.79.0).

74% of the respondents rated a perfect health profile with no difficulties in any EQ-5D domain, and 0.06% rated the worst health profile whereby they had difficulties with every EQ-5D domain. The distribution of the VAS scores was skewed in the direction of

best-imagined health state. Only 0.5% respondents rated their health status on VAS under 10, and 10% rated it under 50 [Appendix 1].

HRQOL and socio-economic status

Table 2 and Figure 2 depicts the mean VAS, percentage, and odds of respondents reporting any problems in the five dimensions, across various sub-groups, respectively. Employed adults and students reported better health status than homemakers, retired, or unemployed participants. We observed almost equal health status in homemakers and retired people. Health status was also similar in the middle- and high-income groups, while it was significantly lower in the low-income group. Individuals with higher education (graduate and above) and high income had higher HRQOL than those with secondary or primary schooling and low-income class. Also, individuals with BMI ≥18-24 Kg/m^2 reported better health status, than those with BMI ≥25 Kg/m^2. Current tobacco users reported better health status than former tobacco users or non-users. However, in a stratified analysis of HRQOL in tobacco users by presence or absence of chronic conditions, tobacco users with chronic conditions reported worse health status than non-users.

HRQOL and chronic conditions

Overall, individuals with chronic conditions reported lower health status than those without chronic conditions. About half of the respondents with self-reported diabetes, hypertension, stroke, heart disease, or chronic kidney disease reported moderate or severe problems in all five domains (Table 2).

Table 3 presents the adjusted odds ratio of any problems (moderate or severe) comparing people with versus without chronic conditions, stratified by sex and cities. Individuals with chronic conditions reported two times greater problems in mobility, usual activities domains, pain/discomfort, and anxiety/depression, than in individuals without chronic conditions.

Further, a small proportion of individuals with chronic conditions, mostly those with hypertension (10.5%) or diabetes (8.3%) reported having a perfect health state.

Relationship between VAS and EQ5D measures across major sub-groups

We expected that each EQ5D dimension would have an independent relationship with VAS since each of them represents a different aspect of HRQOL. Appendix 2 provides the beta coefficients of the weighted regression models (i.e., with the application of the population sampling weights). In the overall population, having any problems in mobility, self-care, pain/discomfort, and anxiety/depression were associated with VAS scores that were 10-12 points lower. This inverse relationship of lower VAS with higher domain difficulties was larger in men, elderly (>60 years), low-income, less educated, divorced, and high BMI individuals, compared to their respective counterparts. Tobacco users who reported difficulties in all domains of EQ5D had lower VAS scores (indicating lower quality of life). Kidney disease and stroke were the most disabling conditions on all measures.

Discussion

Comparative assessments of HRQOL variations by socio-demographic factors and chronic conditions aid in prioritizing public health targets for intervention. Results from this study indicate that less than 10% of the respondents rated their health status as 100 (i.e. best imagined health state) on VAS. Mobility, pain/discomfort, and anxiety /depression were the most commonly reported problems, with the extent of these problems differing across population subgroup. Elderly (>60 years) and women reported significantly greater problems in the mobility, pain/discomfort and anxiety/depression domains.

The mean VAS in our study was 74.5, which is lower than reported by most western countries (82.5), but comparable to the results from other low- and middle-income countries (LMICs) (71.1 - 77.8) [Appendix 3] (25-28). Lower health status reported by urban South Asians can be interpreted in a number of ways. The lower scores may be related to generally lower reporting of HRQOL among this group. Alternatively, these scores may reflect morbidity and sub-optimal access to healthcare facilities to address health concerns. South Asians experience chronic conditions at relatively younger ages than other race/ethnic groups and the associated reductions in productivity and income levels may be manifested in these self-reported EQ5D-VAS scores.

Mobility is the dimension that has the highest rate of having problems (14-17%) in South Asia, which is comparable to results from other LMICs (29). However, problems in anxiety/depression are pretty low in South Asia when compared to the rest of the world; this could be due to under diagnoses of depression related problems or stigma attached to these health conditions. These patterns could also reflect differences in how adults in different parts of the world self-rate their health.

Worse health status in retired or homemakers, compared to employed persons may be related to being homebound or reflect underlying illnesses that may be the factor driving these participants to be homebound and not employed.

In terms of modifiable risk factors, maintaining a healthy BMI cut-off (18-25 Kg/m^2) is favoured because, individuals with BMI <18 Kg/m^2 and ≥25 Kg/m^2, reported greater problems in all five domains. Although, previous studies have shown that lower levels (intensity) of tobacco use are linked with higher HRQOL and regular tobacco users with worse health status (30, 31), in our study, former tobacco users reported lower HRQOL than current users. This finding may indicate reverse causality, i.e. former tobacco users after experiencing an illness would have quit smoking/tobacco. Further, supported by

the fact that tobacco users with chronic conditions or greater difficulties in EQ5D domains had lower VAS scores is suggestive that morbidity and not the habit of tobacco use per se are more closely related to participants' perception of health. However, a causal link between tobacco use and HRQOL cannot be confirmed in this cross-sectional study. Longitudinal analyses of the independent associations between the smoking/tobacco with HRQOL may provide a better understanding of this relationship.

The lower health status reported by females, less educated, unemployed, and low-income groups may indicate higher levels of stress in these groups (17). Other potential contributing factors that are known to influence health status are living conditions, Gross domestic product (GDP) per capita, inequities in income distributions, and access to healthcare (32-37). Therefore, public health initiatives should focus on inter-sectoral approaches to address issues of education, generating more avenues for employment, and improving the quality of primary healthcare.

Notably, one in five individuals living with known hypertension or diabetes (average disease duration four years) still reported a perfect health state, indicating that these individuals may feel asymptomatic until they experience a clinical event. Also, very small proportions of patients with heart disease and stroke (with longer duration of illness; average nine years), reported perfect health states, suggesting that these individuals may have adapted to their conditions over time and maybe benefiting from treatment and self-care that improves their self-rated quality of life. However, we did not investigate whether these other factors like adherence influence quality life in those living with chronic conditions.

Due to the differences in statistical analyses, HRQOL measures, socio-demographic characteristics of the sample, and medical conditions selected, the results of this study may not be directly comparable to reports from other countries (38). Nevertheless, a

few differences and common findings are noteworthy. Individuals with stroke or chronic kidney disease rated the lowest health status, which is consistent with results reported from other studies done in China, Thailand, and Western populations (28, 39-42). Since the respondent's health status could be affected by how well the condition was managed, caution is needed in interpreting study results regarding the relative effect of chronic conditions on HRQOL (43-47). A more recent Canadian study conducted by Mo *et al*. indicated a strong relationship between low health utility index (HUI) scores and certain chronic conditions (48). The authors found that arthritis/ rheumatism, heart disease, hypertension, cataracts, and diabetes had a negative impact on HRQOL. In the US, Medical Expenditure Panel Survey data based study reported that, after adjusting for socio-demographic variables, all of the selected chronic conditions were associated with lower EQ5D scores, with effects greatest for emphysema, followed by heart disease, stroke, high BP, diabetes, and asthma(49, 50).

Lastly, the issues of 'clinical' or 'policy' relevance of the difference in EQ5D measures needs much discourse. For example, if the VAS in two groups of the population is 5 or 10 points different from each other, we will not be able to make a clinical judgment on how much these two groups would differ in their actual health status. These issues relate to determining a minimally significant difference/change in HRQOL needs investigation in future studies. Also, the findings of this study may not be replicable if researchers use a different HRQOL instrument (51-56), which can be tested in a future study.

To our knowledge, this is the first population level HRQOL data from South Asia using EQ5D-VAS including three large metropolitan cities in India and Pakistan with a large sample size that has used multistage cluster random sampling strategy and standardized protocols and measurement tools across sites. Our data provide the first baseline values to be used for monitoring population health status and analysed the

relationships between selected chronic conditions and HRQOL. This information could be used to complement national targets by providing a measure of chronic disease burden based on perceived health status rather than solely on mortality and disease prevalence. In our secondary data analysis, EQ5D and VAS measures correlated well, which confirms the convergent and discriminate validity of the EQ5D instrument.

There are several limitations to this study. First, due to the cross-sectional nature of the data, the causal relationship between socio-economic parameters/chronic conditions and HRQOL cannot be determined and is not implied. Second, many chronic conditions (respiratory, locomotor, cancer, etc.) were not included in the survey. Therefore, the ranking of most severe health conditions and associated HRQOL is not complete. Third, the selected chronic conditions were self-reported, and the study investigators did not examine the accuracy of information. However, this poses less of a threat to validity because self-reporting of heart diseases, stroke, and kidney diseases are pretty accurate in community surveys (57-60). Further, hypertension and diabetes were measured in this study using standardized methods. Lastly, EQ5D data were self-reported and the variation in how individuals perceive disability varies widely. However, this should be less of a problem given the large sample size in this study.

Conclusion

HRQOL appears to be lower with higher age and among women in South Asia. Our data demonstrates significantly lower HRQOL in key demographic groups and those with chronic conditions, which are consistent with previous studies. These data provide insights on inequalities in population health status, and potentially reveal unmet needs in the community to guide health policies.

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Conflict of Interest: All authors [KS, DK, RS, MKA, RP, VSA, VM, MMK, MDS, NT KMVN, and DP) declare that they have no conflict of interest to report.

Author's contribution: KS, DP, MKA, RS, NT and KMVN conceptualized and designed the study. KS wrote the first draft of the manuscript. KS and DK performed statistical analysis. RS, VSA, MKA, RP, VM, MMK, MDS, NT, KMVN, and DP contributed significantly in the revision of the manuscript. All authors have approved the submission of this version of the manuscript.

Data sharing statement: KS, DK, and DP have access to study dataset and statistical code. Any request for data sharing should be addressed to the corresponding author (DP).

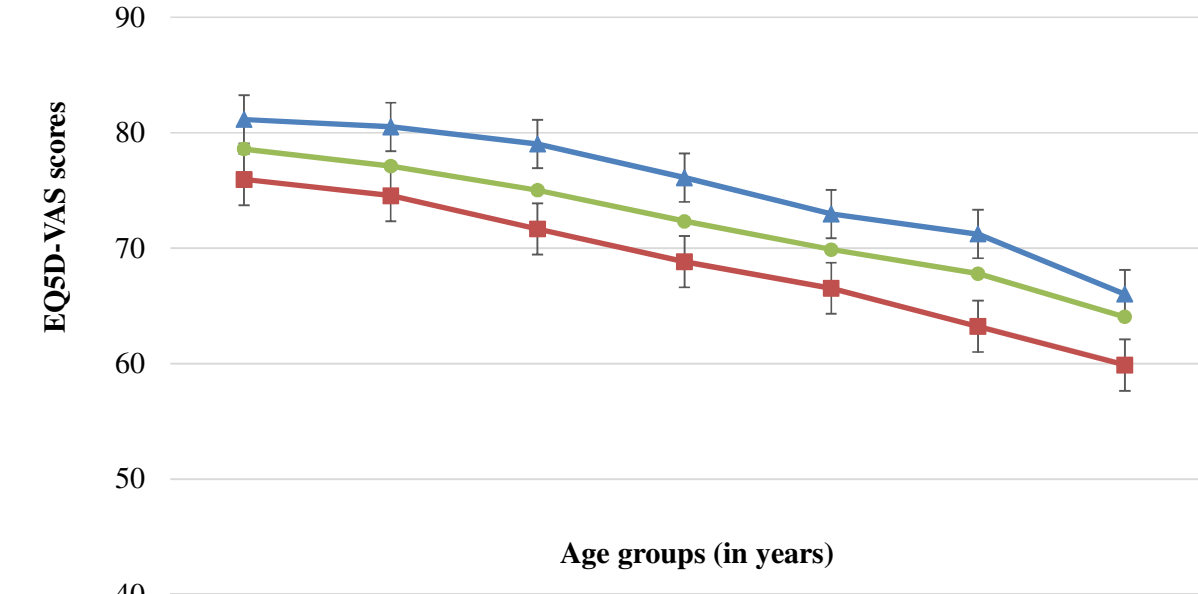
Tables

Table 1 - Percentage of respondents reporting moderate or severe problems in EQ5D domains, stratified by age and gender

EQ5D Dimensions	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	≥75 years	Overall
Overall (N)	1179	3752	4672	3539	2005	878	262	16287
Males (N)	591	1614	2128	1723	1026	500	178	7760
Females (N)	588	2138	2544	1816	979	378	84	8527
Mobility								
All respondents (%)	5.3	8.3	13.6	18.1	23.5	31.2	39	14.6
95% CI	[4.0,7.0]	[6.8,10.0]	[11.7,15.9]	[16.1,20.3]	[20.8,26.4]	[27.5,35.2]	[32.7,45.6]	[13.3,15.9]
Male (%)	2.9	3.6	6	8.7	17	20.5	34.7	8.2
95% CI	[1.5,5.6]	[2.6,5.0]	[4.8,7.3]	[7.2,10.4]	[14.1,20.4]	[16.7,24.9]	[27.5,42.7]	[7.3,9.2]
Female (%)	7.8	11.8	20.1	26.9	30.6	45.6	48	20.3
95% CI	[5.9,10.2]	[9.7,14.4]	[17.1,23.4]	[24.0,29.9]	[26.5,35.1]	[40.8,50.6]	[36.2,60.1]	[18.5,22.3]
Self-care								
All respondents (%)	1.6	2.6	3.8	4.7	6.9	9	14.6	4.2
95% CI	[1.0,2.8]	[2.0,3.5]	[2.9,5.0]	[3.8,5.7]	[5.4,8.8]	[6.9,11.8]	[10.3,20.2]	[3.6,4.9]
Male (%)	1.2	1.5	1.7	2.7	5.1	5.2	14	2.6
95% CI	[0.4,3.6]	[0.8,2.5]	[1.0,2.9]	[1.8,3.9]	[3.1,8.2]	[3.3,8.0]	[8.9,21.5]	[2.0,3.3]
Female (%)	2.1	3.5	5.5	6.5	8.9	14.2	15.6	5.6
95% CI	[1.2,3.5]	[2.5,5.0]	[4.1,7.5]	[5.2,8.2]	[6.7,11.6]	[10.6,18.7]	[9.4,24.9]	[4.6,6.8]
Usual activities								
All respondents (%)	2	3.5	4.8	7.1	10.7	16.6	23.1	6.0
95% CI	[1.2,3.2]	[2.8,4.4]	[3.8,5.9]	[6.0,8.4]	[8.9,12.8]	[13.9,19.7]	[17.8,29.4]	[5.4,6.8]
Male (%)	1.3	1.4	1.8	3.2	6.4	11	19.7	3.2
95% CI	[0.5,3.7]	[0.9,2.1]	[1.2,2.7]	[2.3,4.3]	[4.8,8.6]	[7.9,15.2]	[13.8,27.2]	[2.7,3.9]
Female (%)	2.6	5.1	7.2	10.7	15.4	24.1	30.3	8.5
95% CI	[1.6,4.3]	[4.0,6.6]	[5.6,9.2]	[8.8,12.9]	[12.3,19.1]	[20.4,28.1]	[20.7,42.0]	[7.4,9.7]
Pain/Discomfort								
All respondents (%)	6	9.2	13.4	18.6	20.4	27.1	30.3	14.3
95% CI	[4.4,8.1]	[7.7,10.9]	[11.5,15.5]	[16.6,20.7]	[17.9,23.1]	[23.3,31.2]	[24.1,37.2]	[13.0,15.6]
Male (%)	3.6	5.5	7.6	10.6	14.1	16.5	28	8.9
95% CI	[2.3,5.7]	[4.0,7.3]	[6.0,9.6]	[9.1,12.4]	[11.4,17.4]	[13.1,20.7]	[20.7,36.7]	[8.0,9.9]
Female (%)	8.5	11.9	18.2	25.9	27.2	41.2	35.1	19.1
95% CI	[5.7,12.3]	[9.8,14.5]	[15.5,21.3]	[23.0,29.1]	[23.5,31.1]	[35.6,47.0]	[25.0,46.7]	[17.1,21.2]
Anxiety/Depression								
All respondents (%)	4.9	5.8	7.6	9.9	10.9	13.7	18	8.1
95% CI	[3.7,6.6]	[4.8,7.0]	[6.5,8.9]	[8.7,11.4]	[9.4,12.7]	[11.2,16.7]	[13.3,23.7]	[7.4,8.9]
Male (%)	3.7	4.1	5.4	6.7	8.7	7.6	15.7	5.9
95% CI	[2.2,6.0]	[3.1,5.5]	[4.3,6.8]	[5.2,8.5]	[6.8,11.0]	[5.4,10.7]	[10.7,22.6]	[5.2,6.7]
Female (%)	6.2	7.0	9.5	13	13.4	21.9	22.7	10.1
95% CI	[4.4,8.6]	[5.6,8.8]	[7.9,11.4]	[11.0,15.2]	[11.1,16.1]	[18.0,26.5]	[14.0,34.6]	[9.1,11.3]

Abbreviations: CI – confidence interval, EQ5D – European Quality of Life 5 dimension, N – number of participants

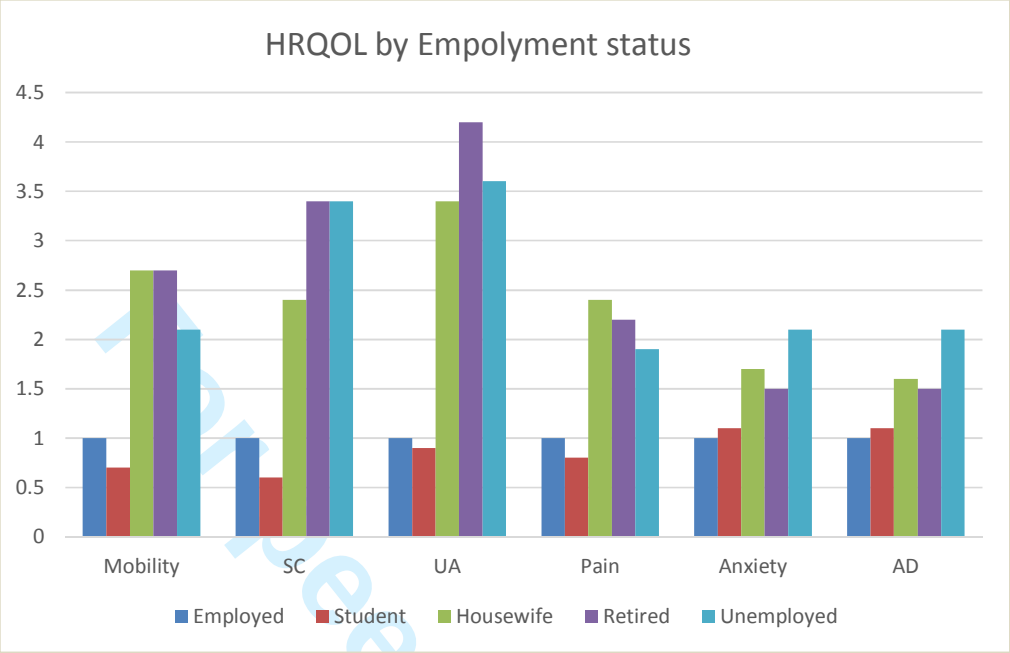
Figure 1 - Mean self-rated health status using EQ5D-VAS of respondents by age groups and gender



	20-24	25-34	35-44	45-54	55-64	65-74	>75
Males	81.15	80.51	79.02	76.11	72.95	71.22	66.02
Females	75.95	74.55	71.66	68.83	66.53	63.23	59.88
Total	78.6	77.11	75.03	72.33	69.88	67.8	64.06

Figure Legend: This figure presents the mean self-rated health status for overall study population by age-groups and gender. European Quality of Life 5 Dimension - Visual Analogue Scale (EQ5D-VAS) measures health status on a scale of 0 (worst health status) – 100 (best imaginable health status)

Figure 2 - Odds of moderate or severe health problems by socio-demographic factors and chronic conditions



SC – Self-Care, UA – Usual Activities, AD – Any Dimension

Figure 2.a. shows the odds of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by employment status. With reference to those who were employed (OR=1), housewife, retired, and unemployed reported greater problems in all five domains. Whereas, students only reported higher anxiety problems compared to employed.

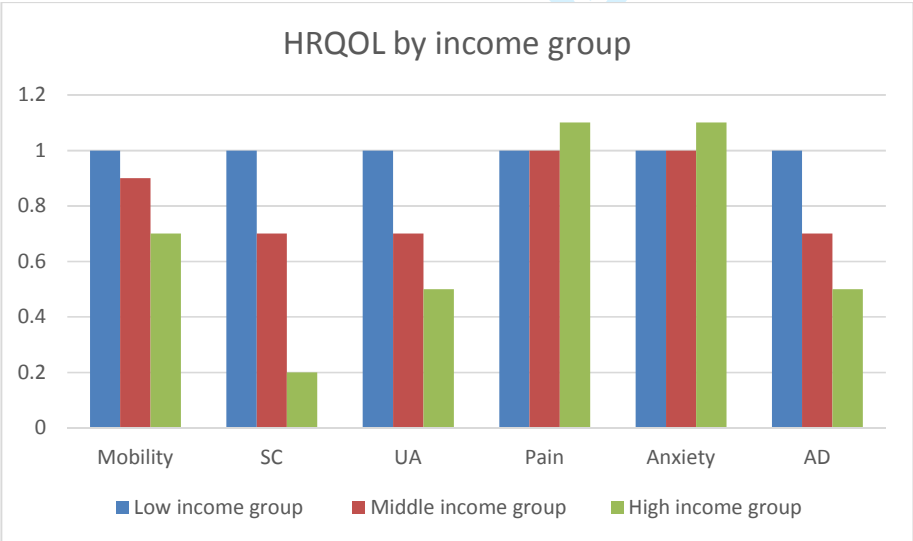


Figure 2.b. shows the odds of moderate or severe difficulties in EQ5D domains by income-group. With reference to low-income group (OR=1), those in middle- or high- income groups had less problems in all five domains.

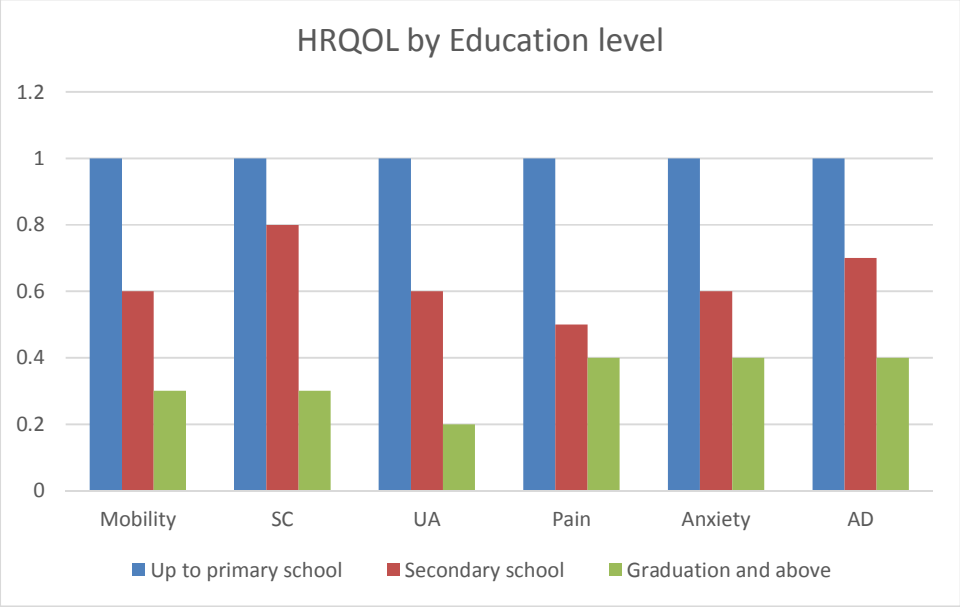


Figure 2.c. shows the odds of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by education level. With reference to those primary school education (OR=1), individuals with secondary school or graduates reported significantly lower problems in all five domains.

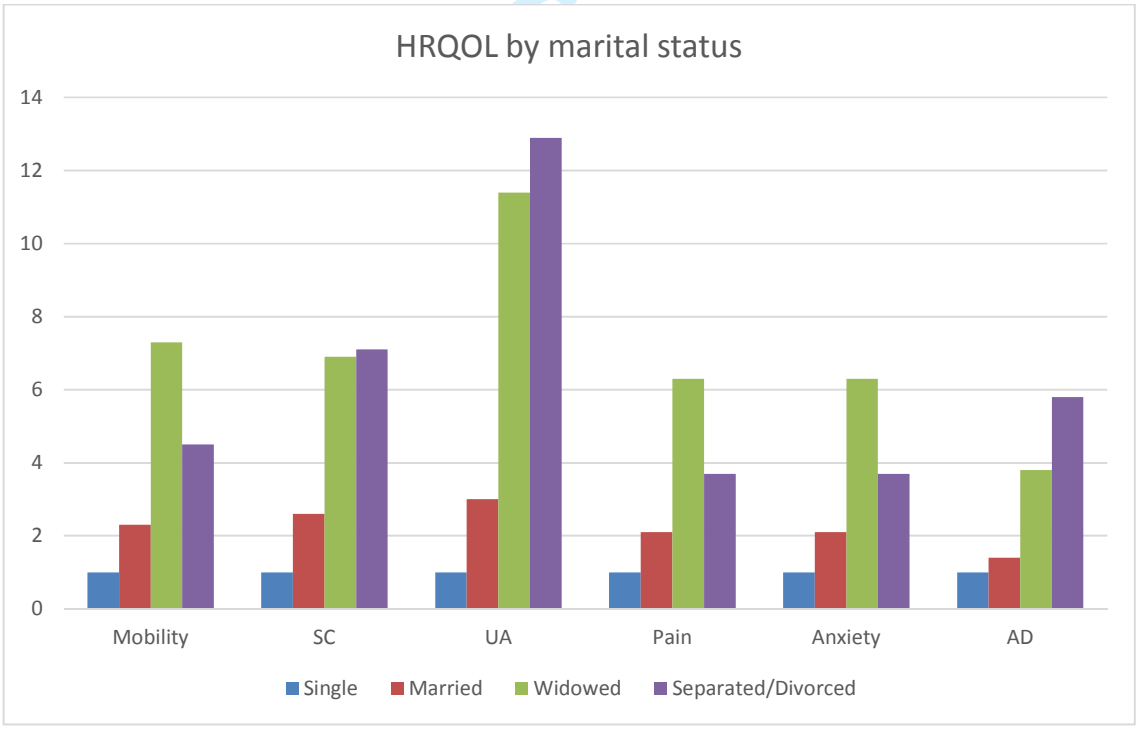


Figure 2.d. shows the odds of moderate or severe difficulties in EQ5D domains by marital status. With reference to single (OR=1), those who were married, widower, or divorcee had greater problems in all five domains.

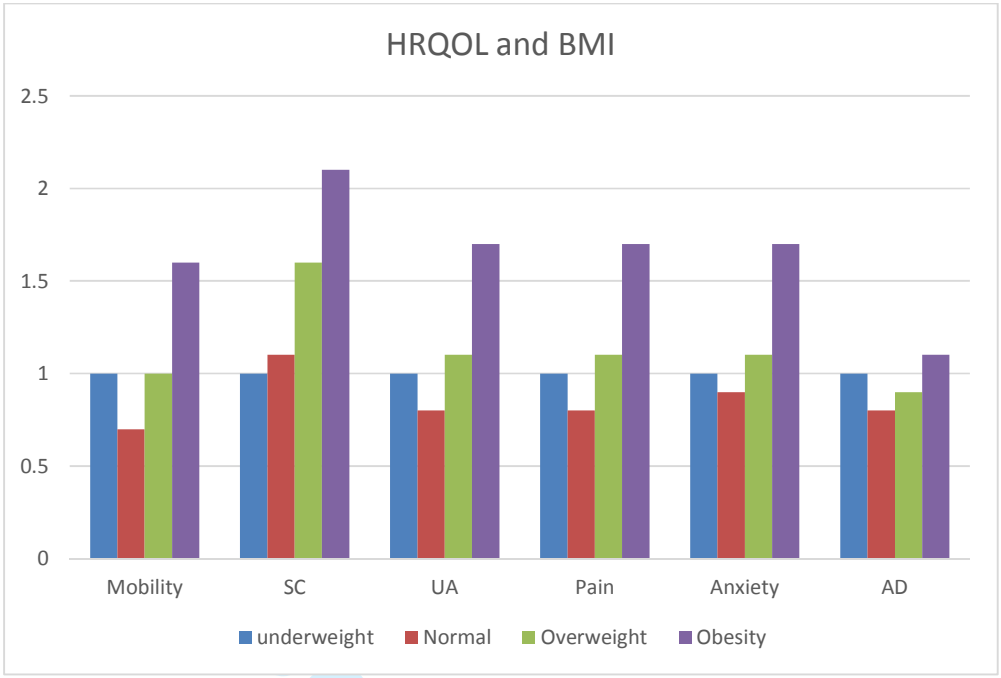


Figure 2.e. shows the odds of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by body mass index (BMI). With reference to underweight i.e. BMI <18Kg/m^2 (OR=1), individuals with overweight (BMI>25Kg/m^2) or obesity (BMI>30Kg/m^2) reported significantly greater problems in all five domains.

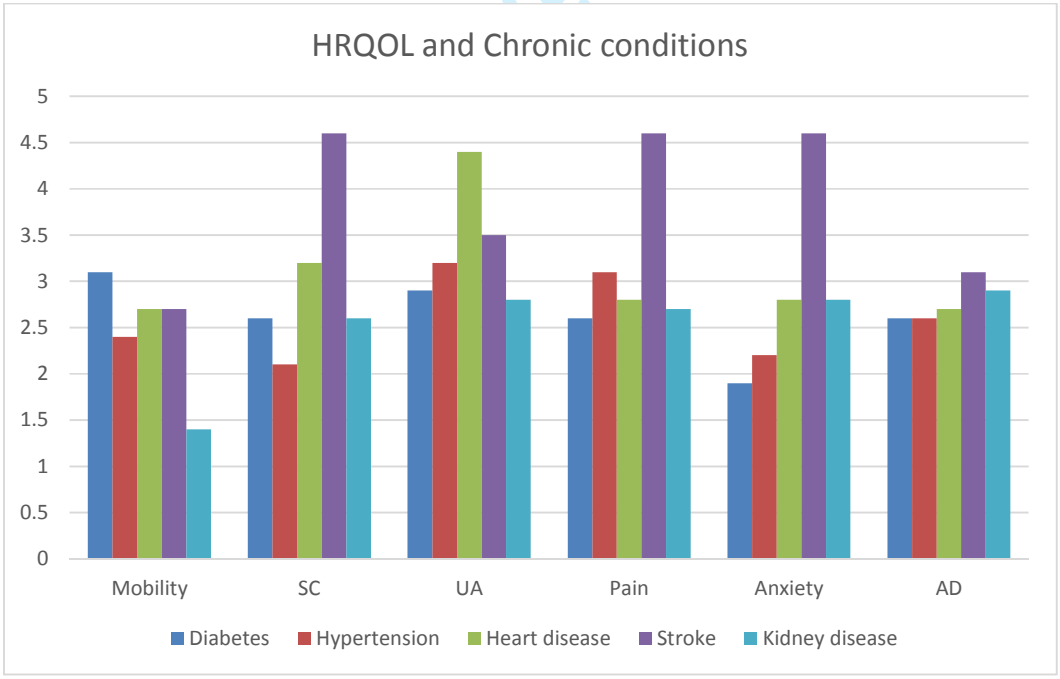


Figure 2.f. shows the odds of moderate or severe difficulties in EQ5D domains by chronic conditions. Compared to those without chronic conditions, individuals with self-reported diabetes, hypertension, heart disease, stroke and kidney disease had twice greater problems in all five domains.

Abbreviations: AD – Any Dimension, HRQOL – Health-related quality of life, SC – Self-Care, UA – Usual Activities,

Table 2 - Mean EQ-VAS and percentages of respondents reporting moderate or severe problems by various subgroups

	No. of respondents	EQ-VAS		Mobility		Self-care		Usual activities		Pain/discomfort		Anxiety/ depression	
		Mean	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI
Cities													
Chennai	6906	70.79	[70.10,71.49]	17.3	[15.4,19.4]	7.8	[6.5,9.2]	7.7	[6.6,9.0]	10.3	[9.1,11.7]	11.4	[9.8,13.1]
Delhi	5364	78.88	[77.89,79.88]	14.1	[11.9,16.7]	1.6	[1.2,2.1]	4.4	[3.4,5.7]	19.4	[16.9,22.2]	5.2	[4.0,6.6]
Karachi	4017	73.23	[72.63,73.82]	10.4	[9.4,11.5]	1.9	[1.5,2.4]	5.6	[4.9,6.4]	12.9	[11.8,14.2]	7.2	[6.3,8.1]
Employment status													
Employed	7635	77.29	[76.45,78.14]	8.7	[7.7,9.9]	2.4	[1.8,3.1]	2.8	[2.3,3.4]	9.3	[8.3,10.4]	6.2	[5.4,7.1]
Student	361	77.5	[75.26,79.73]	6.5	[4.1,10.0]	1.5	[0.7,3.4]	2.6	[1.3,4.9]	8.3	[5.4,12.7]	7.0	[4.4,10.8]
Homemakers	6781	71.62	[70.75,72.49]	20.9	[18.9,22.9]	5.7	[4.8,6.8]	9.0	[7.8,10.4]	19.7	[17.6,22.0]	9.9	[8.9,11.0]
Retired	765	71.66	[69.98,73.34]	21.0	[17.7,24.6]	7.7	[5.7,10.3]	11.0	[8.5,14.0]	18.1	[15.0,21.8]	9.0	[7.0,11.5]
Unemployed	743	68.38	[66.87,69.90]	17.1	[13.6,21.2]	7.7	[5.7,10.5]	9.5	[7.3,12.4]	16.1	[13.2,19.6]	12.3	[9.8,15.2]
Income class													
Low income group (INR <10000 or US$ 155)	11537	73.44	[72.73,74.14]	15.2	[13.9,16.7]	4.8	[4.1,5.7]	6.8	[6.0,7.6]	14	[12.7,15.4]	9.2	[8.3,10.1]
Middle income group (INR 10000-20000 or US$ 155-310)	2667	75.87	[74.81,76.94]	14.6	[12.6,16.8]	3.5	[2.6,4.7]	4.9	[3.9,6.1]	14.5	[12.4,17.0]	6.4	[5.3,7.6]
High income group (INR >20000 or US$>310)	1975	77.17	[75.95,78.39]	11.0	[8.8,13.8]	1.5	[1.0,2.2]	3.4	[2.3,4.9]	15.5	[12.8,18.6]	5.0	[3.9,6.4]
Education status													
Up to primary school	3604	71.18	[70.11,72.24]	21.6	[19.5,24.0]	5.6	[4.7,6.7]	9.8	[8.5,11.2]	20.8	[18.5,23.3]	10.9	[9.6,12.4]
Secondary school	9924	74.34	[73.56,75.13]	14.0	[12.6,15.5]	4.5	[3.7,5.3]	5.8	[5.1,6.7]	13.0	[11.8,14.4]	8.1	[7.3,9.0]
Graduation and above	2759	77.94	[76.99,78.88]	8.3	[6.7,10.2]	1.6	[1.1,2.2]	2.3	[1.7,3.1]	10.8	[9.0,12.8]	5.0	[4.1,6.0]
Marital Status													
Single	1177	78.27	[76.94,79.60]	6.7	[5.2,8.7]	1.6	[0.9,2.9]	2.0	[1.2,3.2]	7.1	[5.5,9.2]	5.4	[3.9,7.5]
Married	14217	74.36	[73.67,75.05]	14.2	[13.0,15.6]	4.1	[3.5,4.8]	5.7	[5.0,6.5]	14	[12.6,15.4]	7.8	[7.1,8.6]

Widowed	838	67.47	[66.15,68.79]	34.5	[30.5,38.8]	10.2	[8.0,12.9]	18.7	[15.8,22.1]	32.7	[29.3,36.2]	18.2	[15.4,21.3]
Separated/Divorced	55	65.33	[57.91,72.75]	24.6	[11.8,44.3]	10.2	[4.6,21.3]	20.6	[8.8,41.0]	22.3	[12.2,37.2]	25.1	[14.9,39.2]
BMI (Kg/m^2)													
underweight (<18)	756	74.03	[72.30,75.77]	14.9	[11.7,18.8]	3.0	[1.7,5.3]	5.4	[3.7,7.9]	12.9	[10.1,16.5]	9.0	[6.3,12.7]
Normal (18-25)	5278	75.15	[74.35,75.94]	11.8	[10.4,13.3]	3.5	[2.8,4.2]	4.8	[4.0,5.7]	11.5	[10.2,13.0]	7.5	[6.6,8.7]
Overweight (25-30)	4190	73.62	[72.72,74.52]	15.2	[13.4,17.2]	4.8	[3.8,6.0]	6.2	[5.2,7.3]	14.4	[12.6,16.4]	8.2	[7.2,9.4]
Obesity (>30)	2249	70.4	[69.57,71.22]	22.3	[19.9,24.9]	6.4	[5.1,8.0]	9.1	[7.6,10.9]	20.7	[18.2,23.6]	10	[8.5,11.8]
Tobacco use (Smoke/Chew/other forms)													
Never user	12215	74.12	[73.44,74.80]	15.4	[14.0,16.8]	4.5	[3.8,5.3]	6.4	[5.6,7.2]	14.6	[13.1,16.2]	8.1	[7.3,9.0]
Current user	3758	75.33	[74.33,76.32]	11.8	[10.4,13.4]	3.1	[2.4,4.1]	4.6	[3.8,5.6]	12.9	[11.6,14.5]	7.9	[6.7,9.2]
Former user	314	70.15	[67.00,73.29]	17.6	[13.4,22.8]	4.7	[2.7,8.1]	8.3	[5.6,12.3]	18.1	[13.6,23.7]	12.4	[8.8,17.2]
Chronic conditions (self-reported)													
No	12498	76.21	[75.49,76.93]	11.9	[10.7,13.1]	3.5	[2.8,4.2]	4.5	[3.9,5.2]	11.2	[10.1,12.5]	6.8	[6.0,7.6]
Yes	4699	67.36	[66.62,68.09]	24.6	[22.4,27.0]	6.9	[5.9,7.9]	11.8	[10.5,13.2]	25.5	[23.3,27.9]	13.2	[12.0,14.5]
Diabetes													
No diabetes	4610	75.17	[74.41,75.92]	10.1	[8.9,11.4]	3.3	[2.6,4.1]	4.2	[3.5,5.0]	10.3	[8.8,12.0]	7.5	[6.5,8.6]
Pre-diabetes	5449	74.48	[73.59,75.37]	15.5	[13.6,17.5]	4.2	[3.3,5.2]	6.0	[5.0,7.2]	14.6	[12.9,16.4]	8.0	[7.0,9.1]
Newly diagnosed	2015	74.35	[73.39,75.30]	17.2	[14.7,20.1]	5.0	[3.8,6.5]	8.1	[6.5,10.0]	17.2	[15.0,19.6]	8.5	[7.1,10.1]
Self-reported Diabetes	1661	65.99	[64.86,67.12]	20.9	[18.9,23.1]	6.3	[5.2,7.5]	9.5	[8.3,11.0]	19.8	[18.1,21.7]	10.5	[9.3,11.8]
Hypertension													
Normotension	5695	74.82	[74.06,75.57]	12.8	[11.4,14.3]	3.8	[3.0,4.9]	4.7	[3.9,5.6]	11.6	[9.9,13.6]	6.9	[6.0,8.0]
Prehypertension	4717	76.02	[75.09,76.95]	12.7	[11.2,14.4]	3.7	[2.9,4.6]	5.1	[4.3,6.0]	12.3	[11.0,13.8]	6.5	[5.6,7.5]
Newly diagnosed	2780	75.85	[74.83,76.87]	12.9	[11.0,15.1]	3.0	[2.4,3.8]	5.1	[4.2,6.3]	12.6	[11.0,14.3]	8.4	[7.2,9.9]
Self-reported	2397	66.79	[65.88,67.71]	18.8	[16.8,21.0]	4.9	[4.2,5.7]	8.7	[7.6,9.9]	19.6	[17.8,21.4]	10.8	[9.7,12.0]
Heart Disease													
No	15842	74.61	[73.92,75.29]	14.2	[12.9,15.5]	4.0	[3.4,4.7]	5.6	[5.0,6.4]	13.8	[12.6,15.2]	7.9	[7.2,8.6]
Yes	445	63.33	[61.36,65.29]	31.2	[25.7,37.3]	11.7	[8.3,16.2]	20.8	[16.7,25.7]	31.4	[26.5,36.7]	19.0	[15.0,23.8]
Stroke													
No	16203	74.38	[73.69,75.07]	14.5	[13.3,15.8]	4.1	[3.5,4.8]	6.0	[5.3,6.7]	14.1	[12.9,15.5]	8.1	[7.4,8.8]
Yes	84	62.41	[58.58,66.25]	31.9	[22.0,43.7]	16.8	[10.0,26.7]	18.1	[11.1,28.1]	43.3	[32.3,55.1]	21.2	[13.2,32.2]

Kidney disease														
	No	16175	74.41	[73.72,75.09]	14.6	[13.3,15.9]	4.1	[3.6,4.8]	6.0	[5.3,6.7]	14.1	[12.9,15.5]	8.1	[7.3,8.8]
	Yes	112	62.57	[59.41,65.74]	19.2	[13.1,27.2]	10	[5.7,17.0]	15.1	[9.9,22.3]	31.4	[23.5,40.6]	20.7	[14.1,29.3]

NOTES: Tobacco use, Heart disease, Kidney disease were based on self-reports, newly diagnosed diabetes - defined as no self-reported diabetes and fasting blood glucose (FBG) of ≥126 mg/dl, or HbA1c ≥6.5%), pre-diabetes – no self-reported diabetes and FBG ≥100-125 mg/dl or HbA1c ≥5.7-6.4%), normoglycemia –no self-reported diabetes and FBG<100 mg/dl and HbA1c<5.7%, Newly diagnosed hypertension – defined as no self-reported hypertension and BP ≥140/90mmHg, prehypertension - no self-reported hypertension and BP: 120-139 / 80-89 mmHg and normotensive - no history of hypertension and BP <120/80 mmHg.

Abbreviations: INR: Indian rupees, mmHg – millimetre of mercury, mg/dl - Milligram/decilitre; US$ - United States Dollar

Table 3: Adjusted Odds ratio of reporting any problems in individuals with chronic conditions versus those without chronic conditions, by cities and gender

	Mobility		Self-care		Usual activities		Pain/discomfort		Anxiety/depression	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Overall	1.6	[1.38,1.85]	1.4	[1.11,1.78]	1.8	[1.55,2.22]	2.1	[1.82,2.33]	1.7	[1.47,2.02]
Males	2.1	[1.56,2.56]	1.6	[1.11,2.48]	2.1	[1.45,3.14]	2.1	[1.74,2.55]	2.2	[1.63,2.94]
Females	1.4	[1.23,1.76]	1.3	[1.00,1.79]	1.8	[1.48,2.21]	2.1	[1.78,2.47]	1.5	[1.28,1.84]
Chennai	1.3	[1.07,1.72]	1.1	[0.82,1.48]	1.3	[1.09,1.74]	2.6	[1.79,3.96]	1.7	[1.38,2.08]
Males	1.6	[1.08,2.33]	1.1	[0.69,1.85]	1.2	[0.78,2.01]	1.9	[1.38,2.51]	1.9	[1.40,2.59]
Females	1.3	[0.95,1.72]	1.1	[0.75,1.58]	1.5	[1.13,1.93]	1.9	[1.49,2.56]	1.6	[1.20,2.09]
Delhi	2.1	[1.60,2.50]	1.9	[1.4, 2.5]	2.6	[1.79,3.96]	2.3	[1.68,3.09]	1.9	[1.32,2.89]
Males	2.5	[1.69,3.77]	5.4	[1.99,14.82]	4.1	[1.75,9.64]	2.2	[1.63,3.01]	3.6	[1.36,9.78]
Females	1.9	[1.44,2.46]	2.3	[1.29,4.16]	2.4	[1.54,3.62]	2.5	[1.84,3.35]	1.6	[1.13,2.39]
Karachi	1.5	[1.20,1.95]	1.8	[1.05,3.10]	2.3	[1.68,3.09]	1.9	[1.56,2.34]	1.7	[1.24,2.29]
Males	2.7	[1.56,4.86]	1.8	[0.74,4.36]	3.1	[1.66,5.97]	2.6	[1.60,4.14]	2.2	[1.30,3.73]
Females	1.3	[1.01,1.69]	2.2	[1.11,4.24]	2.1	[1.51,2.98]	1.7	[1.32,2.15]	1.4	[0.93,2.02]

NOTES: *Logistic regression model was adjusted for age, sex, income, education, marital status

Abbreviations: CI – confidence interval, OR – odds ratio

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Web-appendix (supplementary file)

Appendix 1: The distribution of the respondents EQ-VAS values

EQ-VAS score	Number	Percentage (%)	Cum. Percentage (%)
10-	29	0.18	0.18
20-	72	0.44	0.62
30-	88	0.54	1.16
40-	365	2.24	3.4
50-	2,056	12.62	16.03
60-	1,979	12.15	28.18
70-	3,728	22.89	51.07
80-	4,026	24.72	75.78
90-	2,594	15.93	91.71
100-	1,350	8.29	100

Notes: EQ-VAS: European Quality of Life – Visual Analogue Scale, Cum. Percentage – Cumulative percentage

Appendix 2: Relationship between EQ-VAS and EQ5D across major sub-groups

Dependent variable	Mobility	Self-care	Usual care	Pain / discomfort	Anxiety / Depression	Observation
Overall	-10.5 (0.6)	-9.9 (0.9)	-12.4 (0.7)	-10.9 (0.6)	-8.9 (0.8)	16287
Gender						
Male	-12.0 (0.6)	-11.4 (1.1)	-14.6 (0.9)	-11.9 (0.6)	-12.1 (0.7)	7760
Female	-8.1 (0.4)	-7.9 (0.7)	-9.9 (0.6)	-7.7 (0.4)	-9.1 (0.5)	8527
Age groups						
Young (20-44 yrs)	-9.9 (0.5)	-11.0 (0.9)	-12.0 (0.8)	-8.8 (0.5)	-9.3 (0.6)	9603
Middle (45-60 yrs)	-9.0 (0.5)	-10.8 (0.9)	-11.3 (0.8)	-9.0 (0.5)	-10.7 (0.6)	5544
Elderly (>60 yrs)	-11.1 (1.0)	-11.7 (1.6)	-13.1 (1.3)	-11.0 (1.1)	-13.2 (1.4)	1140
Income						
Low income group (INR <10000 or US$ 155)	-10.6 (0.4)	-12.1 (0.7)	-13.2 (0.6)	-10.2 (0.4)	-10.7 (0.5)	11537
Middle income group (INR 10000-20000 or US$ 155-310)	-10.2 (0.8)	-8.9 (1.6)	-10.7 (1.3)	-9.2 (0.8)	-11.8 (1.1)	2667
High income group (INR >20000 or US$>310)	-12 (1.0)	-14.4(2.5)	-15.6 (1.7)	-10.5 (0.9)	-8.2 (1.6)	1975
Level of education						
Up to primary school	-10.8 (0.6)	-12.8 (1.1)	-12.6 (0.8)	-9.9 (0.6)	-11.6 (0.8)	3604
Secondary school	-9.9 (0.4)	-11.1 (0.8)	-12.2 (0.7)	-9.3 (0.4)	-10.2 (0.5)	9924
Graduation and above	-8.9 (1.0)	-8.3 (2.1)	-11.4 (1.8)	-9.8 (0.9)	-8.3 (1.3)	2759
Marital status						
Single	-8.4 (1.9)	-9.4 (3.8)	-15.2 (3.3)	-9.0 (1.8)	-10.8 (2.0)	1177
Married	-10.3 (0.4)	-11.5 (0.6)	-12.3 (0.5)	-9.5 (0.4)	-10.3 (0.5)	14217
Widowed	-9.9 (1.2)	-11.1 (1.8)	-12.9 (1.4)	-10.1 (1.2)	-11.8 (1.5)	838
Divorce	-18.6 (5.8)	-14.1 (7.0)	-24.2 (6.0)	-15.1 (5.6)	-15.6 (5.1)	55
Tobacco use						
No	-10.1 (0.4)	-11.4 (0.6)	-12.4 (0.5)	-9.8 (0.4)	-10.5 (0.5)	12529
Yes	-13.4 (0.8)	-15.5 (1.5)	-16.5 (1.2)	-11.1 (0.7)	-12.6 (0.9)	3758
Alcohol use						
No	-10.6 (0.4)	-12.1 (0.6)	-13.1 (0.5)	-10.2 (0.4)	-11.0 (0.5)	13911
Yes	-10.6 (1.1)	-10.7 (2.0)	-11.4 (1.9)	-8.2 (1.0)	-10.6 (1.2)	2376
BMI						
Underweight	-10.6 (2.4)	-15.6 (5.1)	-15.4 (3.9)	-10.5 (2.9)	-7.8 (4.8)	756
Normal weight	-10.6 (0.9)	-11.6(1.5)	-13.6 (1.2)	-9.2 (0.9)	-9.7 (1.2)	5278
Overweight	-10.3 (1.1)	-12.1 (1.2)	-11.6 (1.3)	-7.7 (0.9))	-8.9 (1.2)	4190
Obesity	-7.4 (0.9)	-9.9 (1.7)	-11.4 (1.3)	-8.0 (0.9)	-8.6 (1.4)	2249
Diabetes						
Diabetes (diagnosed or self-reported)	-10.0 (0.6)	-11.6 (1.1)	-11.6 (0.9)	-9.7 (0.6)	-11.4 (0.8)	3676
Pre diabetes	-10.2 (0.6)	-13.5 (1.0)	-14.1 (0.8)	-9.4 (0.6)	-10.6 (0.7)	5449
No diabetes	-10.9 (0.7)	-11.0 (1.2)	-12.6 (1.1)	-9.9 (0.7)	-10.0 (0.8)	4610
Hypertension						

Diagnosed or Self-reported hypertension	-11.2 (0.6)	-14.7 (1.0)	-14.1 (0.8)	-10.8 (0.6)	-10.8 (0.7)	5074
Pre hypertension	-10.9 (0.7)	-12.4 (1.2)	-14.1 (1.0)	-9.7 (0.7)	-11.2 (0.9)	4717
No hypertension	-9.3 (0.6)	-9.6 (1.0)	-10.4 (0.9)	-8.4 (0.6)	-10.0 (0.7)	5695
Heart disease						
No	-10.5 (0.3)	-11.9 (0.6)	-13.0 (0.5)	-9.9 (0.3)	-10.7 (0.4)	15842
Yes	-9.0 (1.6)	-9.0 (2.5)	-9.5 (1.9)	-7.4 (1.7)	-11.8 (2.0)	445
Stroke						
No	-10.7 (0.3)	-11.9 (0.6)	-13.1 (0.5)	-10.0 (0.3)	-10.8 (0.4)	16203
Yes	-13.7 (3.6)	-18.4 (4.4)	-19.2 (4.1)	-12.2 (3.5)	-16.3 (4.1)	84
Kidney disease						
No	-10.7 (0.3)	-11.9 (0.6)	-13.1 (0.5)	-9.9 (0.3)	-10.8 (0.4)	16175
Yes	-11.6 (3.7)	-21.2 (4.8)	-14.3 (4.2)	-16.4 (3.2)	-16.3 (3.7)	112

NOTES: Tobacco use, Heart disease, Kidney disease were based on self-reports, newly diagnosed diabetes - defined as no self-reported diabetes and fasting blood glucose (FBG) of ≥126 mg/dl, or HbA1c ≥6.5%), pre-diabetes – no self-reported diabetes and FBG ≥100-125 mg/dl or HbA1c ≥5.7-6.4%), normoglycemia – no self-reported diabetes and FBG<100 mg/dl and HbA1c<5.7%, Newly diagnosed hypertension – defined as no self-reported hypertension and BP ≥140/90mmHg, prehypertension - no self-reported hypertension and BP: 120-139 / 80-89 mmHg and normotensive - no history of hypertension and BP <120/80 mmHg. INR: Indian rupees, mmHg – millimeter of mercury, mg/dl - Milligram/deciliter; yrs – years; US$ - United States Dollar

Appendix 3 - The comparison of HRQOL as measured by EQ5D-VAS among different countries

Countries, year of study	N	EQ-VAS	Percentages with any difficulties in EQ5D domain					
		Mean	Mobility	Self-care	Usual activities	Pain / Discomfort	Anxiety / Depression	Any dimension
India, **Delhi (age≥20), 2011**	5,365	78.9	14.1	1.6	4.4	8.0	9.5	27.8
India, **Chennai, (age≥20), 2011**	6,903	70.8	17.3	7.8	7.7	9.0	8.9	29.7
Pakistan **(Karachi), (age≥20), 2011**	4,016	73.2	10.4	1.9	5.6	8.7	9.3	17.9
China **(age≥18), 2008**	2,991	77.0	4.9	2.0	3.3	18.0	6.1	22.4
UK **(age≥18), 1998**	3395	82.5	18.4	4.2	16.3	33.0	20.9	43.1
USA **(age≥18) , 1998**	427	82.2	14.0	3.0	14.0	40.0	24.0	na
Japan **(age≥20) , 1998**	620	77.8	7.2	1.8	5.2	20.0	8.5	25.0
Spain **(age≥15) , 1998**	12,245	71.1	11.2	2.0	6.9	26.3	12.5	33.0
Canada **(age≥18), 1997**	1518	78.7	22.2	4.0	19.1	43.6	28.6	53.0
Sweden **(age≥18), 1998**	3069	83.5	10.0	2.0	8.0	42.0	30.0	na
Finland **(age≥18), 1992**	2411	79.4	20.0	5.0	18.0	39.0	14.0	na
Germany **(age≥18), 1998**	337	82.2	18.0	3.0	13.0	37.0	18.0	na
Belgium **(age≥18), 2001**	1274	81.0	13.0	3.0	15.0	42.0	21.0	na
New Zealand **(age≥18), 1999**	1328	81.3	17.0	4.0	18.0	37.0	20.0	na
Zimbabwe **(age≥18), 2000**	2350	76.1	20.0	7.0	18.0	41.0	40.0	na
Armenia **(age≥18), 2002**	2222	66.6	26.0	13.0	28.0	64.0	52.0	na

NOTES: EQ5D-VAS: European Quality of Life 5 Dimension – Visual Analogue Scale; na – not available

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 6
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	6
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	8,9
Objectives	3	State specific objectives, including any prespecified hypotheses	9
Methods			
Study design	4	Present key elements of study design early in the paper	9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9, 10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10, 11
Bias	9	Describe any efforts to address potential sources of bias	*12 (adjusted regression model was run to adjust for potential confounders)*
Study size	10	Explain how the study size was arrived at	Not applicable – secondary data analysis
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	12

Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	12
		(*b*) Describe any methods used to examine subgroups and interactions	Not applicable
		(*c*) Explain how missing data were addressed	Not applicable
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	13
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	13
Outcome data	15*	Report numbers of outcome events or summary measures	13
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13
		(*b*) Report category boundaries when continuous variables were categorized	13
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13 - 15
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-18
Generalisability	21	Discuss the generalisability (external validity) of the study results	18 - 19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Health-related Quality of Life Variations by Socio-demographic Factors and Chronic Conditions in three metropolitan cities of South Asia: The CARRS Study

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1 **Title**

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ABSTRACT [237 words]

Objectives: Health-related quality of life (HRQOL) is a key indicator of health. However, HRQOL data from representative populations in South Asia are lacking. This study aims to describe HRQOL overall, by age, gender, and socio-economic status (SES), and examine the associations between selected chronic conditions and HRQOL in adults from three urban cities in South Asia.

Methods: We used data from 16287 adults aged ≥20 years from the baseline survey of the Centre for Cardiometabolic Risk Reduction in South Asia (CARRS) cohort (2010-11). HRQOL was measured using the European Quality of Life 5 dimension - Visual Analogue Scale (EQ5D-VAS), which measures health status on a scale of 0 (worst health status) – 100 (best possible health status).

Results: 16,284 participants completed EQ5D-VAS. Mean age was 42.4 (+/-13.3) years and 52.4% were women. 14% of the respondents reported problems in mobility, and pain/discomfort domains. Mean VAS score was 74 (95% confidence interval [CI]: 73.7, 74.2). Significantly lower health status was found in elderly (64.1), women (71.6), unemployed (68.4), less educated (71.2) and low-income group (73.4). Individuals with chronic conditions reported worse health status than those without (67.4 vs. 76.2): Prevalence Ratio: 1.8 [95%CI: 1.61, 2.04].

Conclusions: Our data demonstrate significantly lower HRQOL in key demographic groups and those with chronic conditions, which are consistent with previous studies. These data provide insights on inequalities in population health status, and potentially reveal unmet needs in the community to guide health policies.

Key words (5)

Health related Quality of Life (HRQOL), EQ5D, Chronic conditions, South Asia, Visual Analogue Scale

Strengths and limitations of this study

- This is the first population level health related quality of life (HRQOL) data from South Asia using EQ5D-VAS including three large metropolitan cities in India and Pakistan with a large sample size (16,284 adults aged ≥20 years).
- Our data provide the first baseline values to be used for monitoring population health status and analysed the relationships between selected chronic conditions and HRQOL.
- HRQOL data presented in this article could be used to complement national health targets by providing a measure of chronic disease burden based on perceived health status rather than solely on mortality and disease prevalence.
- Due to the cross-sectional nature of the data, the causal relationship between socio-economic parameters or chronic conditions and HRQOL cannot be determined.
- Many chronic conditions (respiratory, locomotor, cancer, etc.) were not included in the survey. Therefore, the ranking of most severe health conditions and associated HRQOL is not complete.

Main article [3553 words]

Introduction

Health-related Quality of Life (HRQOL) is a multidimensional concept that provides a broader perspective of health through conveying an individual's ability to function in physical, mental, and social domains of life (1). HRQOL is thus an essential patient-centred outcome measure, which is useful to guide health policies (2, 3). HRQOL is preferred over other health indicators (life expectancy, mortality, morbidity) for measuring chronic disease burden as it incorporates both length and quality of life (4). In South Asia, chronic conditions (diabetes, hypertension and heart diseases) occur at an early age (5) with detrimental effects on length and quality of life (6, 7). In addition, episodes and fear of hypoglycaemia, recurrent heart attacks, stroke and other long-term complications (kidney diseases, diabetic retinopathy) are not always measured as such, though they have a substantial adverse impact on an individual's overall health status (8). Therefore, it is important to quantify the effect of chronic conditions on individuals HRQOL.

There are several disease-specific (Chronic respiratory distress questionnaire, Arthritis Impact Measurement Scale) and generic instruments (Short Form 36, World Health Organization (WHO) – Quality of Life questionnaire, and European Quality of Life Five Dimensions – Visual Analogue Scale (EQ5D-VAS)) available to measure population HRQOL (4, 9-18). However, the EQ5D-VAS is favoured because it is generic, not specific to a particular disease, and it not only includes multidimensional measures of health profile in five dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression), but also includes the single-dimensional measure VAS, to summarize overall health status (1). Also, EQ5D-VAS has been applied and validated for

its use in many population surveys across the world, therefore, it makes the comparison of health status across populations easier.

Data on population HRQOL across socioeconomic status (SES) from South Asia are scarce, and little is known about the relative associations between different chronic conditions and individual HRQOL. The Centre for Cardio-metabolic Risk Reduction in South Asia (CARRS) study (19) had collected data on both EQ5D-VAS and selected chronic conditions from a large representative population of adults in urban South Asia. We used this opportunity to examine population HRQOL in this region. In this paper, we describe the variations in HRQOL by age, gender, and SES, and explore the relationships between selected chronic conditions and HRQOL in a representative sample of adults aged ≥20 years from three metropolitan cities in India and Pakistan. We also analysed the relationship between multidimensional EQ5D measures and single dimensional VAS across major subgroups.

Methods

Study design and setting

We obtained data from the baseline cross-sectional survey of the CARRS cohort (2010-11), which recruited a representative sample of non-pregnant adults aged ≥20 years from three urban cities: Chennai, Delhi, and Karachi. These metropolitan cities with large and heterogeneous populations in terms of demographic profile and economic transitions offer unique opportunities to assess variations in health status across different socio-economic groups. The detailed CARRS study design has been published elsewhere (19). Briefly, a multi-stage cluster random sampling strategy was used with wards (in Delhi and Chennai) or clusters (in Karachi) as the primary sampling units. Using the WHO STEPS survey "Kish method", two participants, one male and one female,

aged ≥20 years (non-pregnant) and meeting the study eligibility criteria, were selected from each randomly selected household (19).

Study measures

Comprehensive and uniform data collection instruments were used to capture measurements in all three sites. A summary of all surveillance measures, methods, and instruments used in the study has been published in detail (19). Briefly, a questionnaire was administered to collect information regarding demographic, socio-economic, behavioural, and past and present health status of the participant.

Trained study staff measured anthropometric parameters (height, weight) using standardized techniques and blood pressure (BP) twice at each participant's home or at a medical camp organized in the community, after five minutes in a seated position using an electronic BP measuring device (Omron Dailan Co., China). If the difference between the first two systolic or diastolic BP readings was more than 10 mmHg or 5 mmHg, respectively, a third reading was taken. Average BP readings of the two/three readings were recorded in the study database. Additionally, fasting blood glucose and glycated haemoglobin (HbA1c) were measured. The overall response rates were 94.7% for questionnaire completion and 84.3% for blood tests.

Population health status was measured using the EQ5D-VAS questionnaire, which consisted of two components; health state description and self-rated health status on VAS. Health state description (profile) includes five dimensions (5D); mobility (walking ability), self-care (ability to wash or dress by oneself), usual activities (ability to work, study, housework), pain/discomfort, and anxiety/depression. The respondents self-rate their level of severity for each dimension using three levels (EQ5D-3L): having no problems, having some or moderate problems, or being unable to do/having extreme problems. The respondents were asked to choose one of the statements which best described their health status on the surveyed day. For example, three levels of 'mobility'

dimension were phrased as "I have no problems in walking," "I have some problems in walking," and "I am confined to bed". Given the possible permutations of different domains and response types, there are potentially 243 (=3^5) different health profiles.

For overall health status, the respondents evaluated their health status using the VAS. The VAS asks respondents to mark health status on the day of the interview on a scale of 0 (worst health status) – 100 (best imaginable health status).

Covariates: Self-reported age at baseline in completed years was used and categorized into 20-24, 25-34, 35-44, 45-54, 55-64, 65-74 and ≥75. Based on participant responses, we categorized employment status into employed, student, housewife, retired, and unemployed. Income class was grouped into three categories based on household monthly income: low-income: less than 10,000 Indian rupees (INR) (equivalent to US$200), middle-income: 10,000-20,000 INR (US$200-400) and high-income strata: greater than 20,000 INR (US$400). We categorized highest education level attained into three categories - up to primary, secondary schooling, and graduates. The marital status was classified as: single, married, widowed, and divorced. Body mass index (Kg/m^2) international classification: of ≤17.9 was used to define the underweight, and 18.0-24.9=normal weight, 25.0-29.9=overweight and ≥30.0=obese. Lifestyle habits like tobacco use was classified based on self-reports as never, former and current user. Data on chronic conditions consisted of self-reported hypertension, diabetes, heart disease, stroke, and kidney disease. In addition, diabetes was categorized into self-reported, newly diagnosed (defined by no self-reported diabetes and fasting blood glucose (FBG) of ≥126 mg/dl, or HbA1c ≥6.5%), pre-diabetes (no self-reported diabetes and FBG ≥100-125 mg/dl or HbA1c ≥5.7-6.4%) and normoglycemia (no self-reported diabetes and FBG<100 mg/dl and HbA1c<5.7%). Similarly, we classified hypertension as: self-reported, newly diagnosed (no self-reported hypertension and BP ≥140/90mmHg),

prehypertension (no self-reported hypertension and BP: 120-139 / 80-89 mmHg) and normotensive (no history of hypertension and BP <120/80 mmHg).

Ethical considerations

The CARRS study has obtained institutional ethics approval from each of the participating institutions: Public Health Foundation of India, All India Institute of Medical Sciences, New Delhi, Madras Diabetes Research Foundation, Chennai, Aga Khan University, Karachi and Rollins School of Public Health, Emory University, USA. Study participants provided written informed consent, before participation in the study.

Analysis

We used Stata (version 14.0 SE; StataCorp, TX, USA) for data analysis. We used the 'svy' command for all analysis to account for the complex survey design (20). Before any of the survey estimation commands were used, the svyset command was used to specify the variables that described the stratification, sampling weight, and primary sampling unit variables. This analysis included data obtained from 16,284 study participants. All the responses coded as refused, unknown, or missing were treated as missing data. The frequency (percentages) and mean were reported to display the level of population health status and the sample characteristics. Percentages of those reporting any problems in EQ5D domains and mean VAS were stratified by respondent's demographic characteristics - age, gender, marital status, and SES - education, income, and employment status; and health-related indicators - presence of chronic conditions, were reported. Additionally, prevalence-ratios of moderate or severe health problems in people with and without chronic conditions were estimated using log binomial regression. Where the model did not reach convergence Poisson regression model was used. The model was adjusted for socio-demographic covariates (age, gender, marital status, education level, and household income) and city. Linear regression analysis was performed to explore the relationship between the VAS and the EQ5D measures across

major subgroups. In the regression model, VAS was used as a dependent variable, and EQ5D measures were treated as independent variables.

Study Results

Characteristics of the study population

A total of 17,274 individuals in 10,002 households were approached in the three study sites (7,596 participants in Chennai, 5,420 in Delhi, 4,258 in Karachi). From these, a total of 16,287 participants were recruited (the overall response rate was 94.3% at the participant level; 6,906 Chennai [90.9%], 5,364 Delhi [98.9%], and 4,017 Karachi [94.3%]). Detailed baseline characteristics of the CARRS cohort is published elsewhere (21-24). Briefly, mean age was 42.4 (+/- 13.3), 52.4% were females, 61% completed secondary schooling, and the majority of respondents (72.5%) reported household income level <INR. 10,000 (US$200). Two-third (66%) of the study population had BMI ≥25, and one-fifth (20%) of the respondents reported current tobacco use and 37.5% had self-reported chronic conditions (hypertension, diabetes, heart disease, stroke or chronic kidney disease).

Overall HRQOL by age and gender

A total of 16,284 study participants completed the EQ5D-VAS [99.9%]. Overall, the percentage of respondents reporting any problems in mobility and pain/discomfort (14% each) were higher than for other domains. Greater health problems were observed with higher age for both men and women (p-value <0.001). [Table 1]. Problems with mobility were higher with advancing age. However, problems with anxiety/depression did not show such trend. Average health status (VAS) reported by the CARRS cohort was 74.5 (95% CI 73.7 – 74.2). [Figure 1]. Women reported lower health status than men (71.6 vs.79.0; p-value<0.001).

74% of the respondents rated a perfect health profile with no difficulties in any EQ-5D domain, and 0.06% rated the worst health profile whereby they had difficulties with every EQ-5D domain. The distribution of the VAS scores was skewed in the direction of best-imagined health state. Only 0.5% respondents rated their health status on VAS under 10, and 10% rated it under 50 [Appendix 1].

HRQOL and socio-economic status

Table 2 and Figure 2 depicts the mean VAS, percentage, and prevalence ratios of respondents reporting moderate or severe problems in the five dimensions, across various sub-groups, respectively. Employed adults and students reported better health status than homemakers, retired, or unemployed participants. We observed almost equal health status in homemakers and retired people. Health status was also similar in the middle- and high-income groups, while it was significantly lower in the low-income group. Individuals with higher education (graduate and above) and high income had higher HRQOL than those with secondary or primary schooling and low-income class. Also, individuals with BMI ≥18-24 Kg/m^2 reported better health status, than those with BMI ≥25 Kg/m^2. Current tobacco users reported better health status than former tobacco users or non-users. However, in a stratified analysis of HRQOL in tobacco users by presence or absence of chronic conditions, tobacco users with chronic conditions reported worse health status than non-users.

HRQOL and chronic conditions

Overall, individuals with chronic conditions reported lower health status than those without chronic conditions. About half of the respondents with self-reported diabetes, hypertension, stroke, heart disease, or chronic kidney disease reported moderate or severe problems in all five domains (Table 2).

Table 3 presents the adjusted prevalence ratio of moderate or severe problems among people with versus without chronic conditions, stratified by sex and cities. Individuals

with chronic conditions reported two times greater problems in mobility, usual activities domains, pain/discomfort, and anxiety/depression, than in individuals without chronic conditions.

Further, a small proportion of individuals with chronic conditions, mostly those with hypertension (10.5%) or diabetes (8.3%) reported having a perfect health state.

Relationship between VAS and EQ5D measures across major sub-groups

We expected that each EQ5D dimension would have an independent relationship with VAS since each of them represents a different aspect of HRQOL. Appendix 2 provides the beta coefficients of the weighted regression models (i.e., with the application of the population sampling weights). In the overall population, having any problems in mobility, self-care, pain/discomfort, and anxiety/depression were associated with VAS scores that were 10-12 points lower. This inverse relationship of lower VAS with higher domain difficulties was larger in men, elderly (>60 years), low-income, less educated, divorced, and high BMI individuals, compared to their respective counterparts. Tobacco users who reported difficulties in all domains of EQ5D had lower VAS scores (indicating lower quality of life). Kidney disease and stroke were the most disabling conditions on all measures.

Discussion

Comparative assessments of HRQOL variations by socio-demographic factors and chronic conditions aid in prioritizing public health targets for intervention. Results from this study indicate that less than 10% of the respondents rated their health status as 100 (i.e. best imagined health state) on VAS. Mobility, pain/discomfort, and anxiety /depression were the most commonly reported problems, with the extent of these problems differing across population subgroup. Elderly (>60 years) and women

reported significantly greater problems in the mobility, pain/discomfort and anxiety/depression domains.

The mean VAS in our study was 74.5, which is lower than reported by most western countries (82.5), but comparable to the results from other low- and middle-income countries (LMIC) (71.1 - 77.8) [Appendix 3] (25-28). Lower health status reported by urban South Asians can be interpreted in a number of ways. The lower scores may be related to generally lower reporting of HRQOL among this group. Alternatively, these scores may reflect morbidity and sub-optimal access to healthcare facilities to address health concerns. South Asians experience chronic conditions at relatively younger ages than other race/ethnic groups and the associated reductions in productivity and income levels may be manifested in these self-reported EQ5D-VAS scores.

A higher percentage of individuals reported problems in mobility dimension (14-17%) in South Asia, which is comparable to results from other LMIC (29). However, problems in anxiety/depression are pretty low in South Asia when compared to the rest of the world; this could be due to under diagnoses of depression related problems or stigma attached to these health conditions. These patterns could also reflect differences in how adults in different parts of the world self-rate their health.

Worse health status in retired or homemakers, compared to employed persons may be related to being homebound or reflect underlying illnesses that may be the factor driving these participants to be homebound and not employed.

In terms of modifiable risk factors, maintaining a healthy BMI cut-off (18-25 Kg/m^2) is favoured because, individuals with BMI <18 Kg/m^2 and ≥25 Kg/m^2, reported greater problems in all five domains. Although, previous studies have shown that lower levels (intensity) of tobacco use are linked with higher HRQOL and regular tobacco users with

worse health status (30, 31), in our study, former tobacco users reported lower HRQOL than current users. This finding may indicate reverse causality, i.e. former tobacco users after experiencing an illness would have quit smoking/tobacco. Further, supported by the fact that tobacco users with chronic conditions or greater difficulties in EQ5D domains had lower VAS scores is suggestive that morbidity and not the habit of tobacco use per se are more closely related to participants' perception of health. However, a causal link between tobacco use and HRQOL cannot be confirmed in this cross-sectional study. Longitudinal analyses of the independent associations between the smoking/tobacco with HRQOL may provide a better understanding of this relationship.

Notably, one in five individuals living with known hypertension or diabetes (average disease duration four years) still reported a perfect health state, indicating that these individuals may feel asymptomatic until they experience a clinical event. Also, very small proportions of patients with heart disease and stroke (with longer duration of illness; average nine years), reported perfect health states, suggesting that these individuals may have adapted to their conditions over time and maybe benefiting from treatment and self-care that improves their self-rated quality of life. However, we did not investigate whether these other factors like adherence influence quality life in those living with chronic conditions.

Due to the differences in statistical analyses, HRQOL measures, socio-demographic characteristics of the sample, and medical conditions selected, the results of this study may not be directly comparable to reports from other countries (32). Nevertheless, a few differences and common findings are noteworthy. Individuals with stroke or chronic kidney disease rated the lowest health status, which is consistent with results reported from other studies done in China, Thailand, and Western populations (28, 33-36). Since the respondent's health status could be affected by how well the condition

was managed, caution is needed in interpreting study results regarding the relative effect of chronic conditions on HRQOL (37-41). A more recent Canadian study conducted by Mo *et al*. indicated a strong relationship between low health utility index (HUI) scores and certain chronic conditions (42). The authors found that arthritis/ rheumatism, heart disease, hypertension, cataracts, and diabetes had a negative impact on HRQOL. In the US, Medical Expenditure Panel Survey data based study reported that, after adjusting for socio-demographic variables, all of the selected chronic conditions were associated with lower EQ5D scores, with effects greatest for emphysema, followed by heart disease, stroke, high BP, diabetes, and asthma(43, 44).

Strengths and limitations of this study

To our knowledge, this is the first population level HRQOL data from South Asia using EQ5D-VAS including three large metropolitan cities in India and Pakistan with a large sample size that has used multistage cluster random sampling strategy and standardized protocols and measurement tools across sites. Our data provide the first baseline values to be used for monitoring population health status and analysed the relationships between selected chronic conditions and HRQOL. This information could be used to complement national targets by providing a measure of chronic disease burden based on perceived health status rather than solely on mortality and disease prevalence. In our secondary data analysis, EQ5D and VAS measures correlated well, which confirms the convergent and discriminate validity of the EQ5D instrument.

There are several limitations to this study. First, due to the cross-sectional nature of the data, the causal relationship between socio-economic parameters/chronic conditions and HRQOL cannot be determined and is not implied. Second, many chronic conditions (respiratory, locomotor, cancer, etc.) were not included in the survey. Therefore, the ranking of most severe health conditions and associated HRQOL is not complete. Third,

the selected chronic conditions were self-reported, and the study investigators did not examine the accuracy of information. However, this poses less of a threat to validity because self-reporting of heart diseases, stroke, and kidney diseases are pretty accurate in community surveys (45-48). Further, hypertension and diabetes were measured in this study using standardized methods. Lastly, EQ5D data were self-reported and the variation in how individuals perceive disability varies widely. However, this should be less of a problem given the large sample size in this study. Fourth, the findings of this study may not be replicable if researchers use a different HRQOL instrument (49-54), which can be tested in a future study.

Public health relevance and Policy implications

HRQOL data from this study provide baseline values for monitoring variations in health for specific population groups on the basis of gender, education, employment, income, presence of chronic conditions and place of residence. This data is also relevant to assess the overall burden of physical and mental health problems that are not disease-specific. In aggregate form, such information could be used to complement national health targets by providing a measure based on health status (quality of life) rather than mortality or disease prevalence alone. Therefore, the policy makers can use the HRQOL measures and resulting data form this study to minimise health disparities and allocate resources among competing health programs based on burden of physical or mental health problems in a specific group(55).

The lower health status reported by females, less educated, unemployed, and low-income groups may indicate higher levels of stress in these groups (17). Other potential contributing factors that are known to influence health status are living conditions, gross domestic product (GDP) per capita, inequities in income distributions,

and access to healthcare (56-61). Therefore, public health initiatives should focus on inter-sectoral approaches to address issues of education, generating more avenues for employment, and improving the quality and access of primary healthcare.

Lastly, the issue of 'clinical' or 'policy' relevance of the difference in EQ5D measures needs much discourse. For example, if the VAS in two groups of the population is 5 or 10 points different from each other, we cannot make a clinical judgment on how much these two groups would differ in their actual health status. These issues relate to determining a minimally significant difference/change in HRQOL and needs investigation in future studies. However, because of HRQOL sensitivity to time trends as shown in previous studies(62-64), these measures are also likely to be useful in determining the effect of major population-based policies or interventions.

Conclusion

HRQOL appears to be lower with higher age and among women in South Asia. Our data demonstrates significantly lower HRQOL in key demographic groups and those with chronic conditions, which are consistent with previous studies. These data provide insights on inequalities in population health status, and potentially reveal unmet needs in the community to guide health policies.

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Conflict of Interest: All authors [KS, DK, RS, MKA, RP, VSA, VM, MMK, MDS, NT KMVN, and DP) declare that they have no conflict of interest to report.

Author's contribution: KS, DP, MKA, RS, NT and KMVN conceptualized and designed the study. KS wrote the first draft of the manuscript. KS and DK performed statistical analysis. RS, VSA, MKA, RP, VM, MMK, MDS, NT, KMVN, and DP contributed significantly in the revision of the manuscript. All authors have approved the submission of this version of the manuscript.

Data sharing statement: KS, DK, and DP have access to study dataset and statistical code. Any request for data sharing should be addressed to the corresponding author (DP).

Tables

Table 1 - Percentage of respondents reporting moderate or severe problems in EQ5D domains, stratified by age and gender

EQ5D Dimensions	20-24 years	25-34 years	35-44 years	45-54 years	55-64 years	65-74 years	≥75 years	Overall
Overall (N)	1179	3752	4672	3539	2005	878	262	16287
Males (N)	591	1614	2128	1723	1026	500	178	7760
Females (N)	588	2138	2544	1816	979	378	84	8527
Mobility								
All respondents (%)	5.3	8.3	13.6	18.1	23.5	31.2	39	14.6
95% CI	[4.0,7.0]	[6.8,10.0]	[11.7,15.9]	[16.1,20.3]	[20.8,26.4]	[27.5,35.2]	[32.7,45.6]	[13.3,15.9]
Male (%)	2.9	3.6	6	8.7	17	20.5	34.7	8.2
95% CI	[1.5,5.6]	[2.6,5.0]	[4.8,7.3]	[7.2,10.4]	[14.1,20.4]	[16.7,24.9]	[27.5,42.7]	[7.3,9.2]
Female (%)	7.8	11.8	20.1	26.9	30.6	45.6	48	20.3
95% CI	[5.9,10.2]	[9.7,14.4]	[17.1,23.4]	[24.0,29.9]	[26.5,35.1]	[40.8,50.6]	[36.2,60.1]	[18.5,22.3]
Self-care								
All respondents (%)	1.6	2.6	3.8	4.7	6.9	9	14.6	4.2
95% CI	[1.0,2.8]	[2.0,3.5]	[2.9,5.0]	[3.8,5.7]	[5.4,8.8]	[6.9,11.8]	[10.3,20.2]	[3.6,4.9]
Male (%)	1.2	1.5	1.7	2.7	5.1	5.2	14	2.6
95% CI	[0.4,3.6]	[0.8,2.5]	[1.0,2.9]	[1.8,3.9]	[3.1,8.2]	[3.3,8.0]	[8.9,21.5]	[2.0,3.3]
Female (%)	2.1	3.5	5.5	6.5	8.9	14.2	15.6	5.6
95% CI	[1.2,3.5]	[2.5,5.0]	[4.1,7.5]	[5.2,8.2]	[6.7,11.6]	[10.6,18.7]	[9.4,24.9]	[4.6,6.8]
Usual activities								
All respondents (%)	2	3.5	4.8	7.1	10.7	16.6	23.1	6.0
95% CI	[1.2,3.2]	[2.8,4.4]	[3.8,5.9]	[6.0,8.4]	[8.9,12.8]	[13.9,19.7]	[17.8,29.4]	[5.4,6.8]
Male (%)	1.3	1.4	1.8	3.2	6.4	11	19.7	3.2
95% CI	[0.5,3.7]	[0.9,2.1]	[1.2,2.7]	[2.3,4.3]	[4.8,8.6]	[7.9,15.2]	[13.8,27.2]	[2.7,3.9]
Female (%)	2.6	5.1	7.2	10.7	15.4	24.1	30.3	8.5
95% CI	[1.6,4.3]	[4.0,6.6]	[5.6,9.2]	[8.8,12.9]	[12.3,19.1]	[20.4,28.1]	[20.7,42.0]	[7.4,9.7]
Pain/Discomfort								
All respondents (%)	6	9.2	13.4	18.6	20.4	27.1	30.3	14.3
95% CI	[4.4,8.1]	[7.7,10.9]	[11.5,15.5]	[16.6,20.7]	[17.9,23.1]	[23.3,31.2]	[24.1,37.2]	[13.0,15.6]
Male (%)	3.6	5.5	7.6	10.6	14.1	16.5	28	8.9
95% CI	[2.3,5.7]	[4.0,7.3]	[6.0,9.6]	[9.1,12.4]	[11.4,17.4]	[13.1,20.7]	[20.7,36.7]	[8.0,9.9]
Female (%)	8.5	11.9	18.2	25.9	27.2	41.2	35.1	19.1
95% CI	[5.7,12.3]	[9.8,14.5]	[15.5,21.3]	[23.0,29.1]	[23.5,31.1]	[35.6,47.0]	[25.0,46.7]	[17.1,21.2]
Anxiety/Depression								
All respondents (%)	4.9	5.8	7.6	9.9	10.9	13.7	18	8.1
95% CI	[3.7,6.6]	[4.8,7.0]	[6.5,8.9]	[8.7,11.4]	[9.4,12.7]	[11.2,16.7]	[13.3,23.7]	[7.4,8.9]
Male (%)	3.7	4.1	5.4	6.7	8.7	7.6	15.7	5.9
95% CI	[2.2,6.0]	[3.1,5.5]	[4.3,6.8]	[5.2,8.5]	[6.8,11.0]	[5.4,10.7]	[10.7,22.6]	[5.2,6.7]
Female (%)	6.2	7.0	9.5	13	13.4	21.9	22.7	10.1
95% CI	[4.4,8.6]	[5.6,8.8]	[7.9,11.4]	[11.0,15.2]	[11.1,16.1]	[18.0,26.5]	[14.0,34.6]	[9.1,11.3]

Abbreviations: CI – confidence interval, EQ5D – European Quality of Life 5 dimension, N – number of participants

Figure 1 - Mean self-rated health status using EQ5D-VAS of respondents by age groups and gender

Figure Legend: This figure presents the mean self-rated health status for overall study population by age-groups and gender. European Quality of Life 5 Dimension - Visual Analogue Scale (EQ5D-VAS) measures health status on a scale of 0 (worst health status) – 100 (best imaginable health status)

*** P-value for difference between mean EQ5D-VAS between males and females at each age-group is statistically significant; p<0.01.**

Figure 2 – Prevalence ratio of moderate or severe health problems by socio-demographic factors and chronic conditions

Figure 2.a. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by employment status. With reference to those who were employed (PR=1), housewife, retired, and unemployed reported greater problems in all five domains. Whereas, students only reported higher anxiety problems compared to employed.

Figure 2.b. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by income-group. With reference to low-income group (PR=1), those in middle- or high-income groups had less problems in all five domains.

Figure 2.c. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by education level. With reference to those primary school education (PR=1), individuals with secondary school or graduates reported significantly lower problems in all five domains.

Figure 2.d. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by marital status. With reference to single (PR=1), those who were married, widower, or divorcee had greater problems in all five domains.

Figure 2.e. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by body mass index (BMI). With reference to underweight i.e. BMI <18Kg/m^2 (PR=1), individuals with overweight (BMI 25-29.9 Kg/m^2) or obesity (BMI≥30Kg/m^2) reported significantly greater problems in all five domains.

Figure 2.f. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by chronic conditions. Compared to those without chronic conditions, individuals with self-reported diabetes, hypertension, heart disease, stroke and kidney disease had twice greater problems in all five domains.

Abbreviations: *AD – Any Dimension, HRQOL – Health-related quality of life, SC – Self-Care, UA – Usual Activities; PR – Prevalence Ratio, EQ5D – European Quality of Life 5 dimension*

Table 2 - Mean EQ-VAS and percentages of respondents reporting moderate or severe problems by various subgroups

	No. of respondents	EQ-VAS		Mobility		Self-care		Usual activities		Pain/discomfort		Anxiety/ depression	
		Mean	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI	(%)	95%CI
Cities													
Chennai	6906	70.7	[70.1,71.4]	17.3	[15.4,19.4]	7.8	[6.5,9.2]	7.7	[6.6,9.0]	10.3	[9.1,11.7]	11.4	[9.8,13.1]
Delhi	5364	78.8	[77.8,79.8]	14.1	[11.9,16.7]	1.6	[1.2,2.1]	4.4	[3.4,5.7]	19.4	[16.9,22.2]	5.2	[4.0,6.6]
Karachi	4017	73.2	[72.6,73.8]	10.4	[9.4,11.5]	1.9	[1.5,2.4]	5.6	[4.9,6.4]	12.9	[11.8,14.2]	7.2	[6.3,8.1]
Employment status													
Employed	7635	77.2	[76.4,78.1]	8.7	[7.7,9.9]	2.4	[1.8,3.1]	2.8	[2.3,3.4]	9.3	[8.3,10.4]	6.2	[5.4,7.1]
Student	361	77.5	[75.2,79.7]	6.5	[4.1,10.0]	1.5	[0.7,3.4]	2.6	[1.3,4.9]	8.3	[5.4,12.7]	7.0	[4.4,10.8]
Homemakers	6781	71.6	[70.7,72.4]	20.9	[18.9,22.9]	5.7	[4.8,6.8]	9.0	[7.8,10.4]	19.7	[17.6,22.0]	9.9	[8.9,11.0]
Retired	765	71.6	[69.9,73.3]	21.0	[17.7,24.6]	7.7	[5.7,10.3]	11.0	[8.5,14.0]	18.1	[15.0,21.8]	9.0	[7.0,11.5]
Unemployed	743	68.3	[66.8,69.9]	17.1	[13.6,21.2]	7.7	[5.7,10.5]	9.5	[7.3,12.4]	16.1	[13.2,19.6]	12.3	[9.8,15.2]
Income class													
Low income group (INR <10000 or US$ 155)	11537	73.4	[72.7,74.1]	15.2	[13.9,16.7]	4.8	[4.1,5.7]	6.8	[6.0,7.6]	14	[12.7,15.4]	9.2	[8.3,10.1]
Middle income group (INR 10000-20000 or US$ 155-310)	2667	75.8	[74.8,76.9]	14.6	[12.6,16.8]	3.5	[2.6,4.7]	4.9	[3.9,6.1]	14.5	[12.4,17.0]	6.4	[5.3,7.6]
High income group (INR >20000 or US$>310)	1975	77.1	[75.9,78.3]	11.0	[8.8,13.8]	1.5	[1.0,2.2]	3.4	[2.3,4.9]	15.5	[12.8,18.6]	5.0	[3.9,6.4]
Education status													
Up to primary school	3604	71.1	[70.1,72.2]	21.6	[19.5,24.0]	5.6	[4.7,6.7]	9.8	[8.5,11.2]	20.8	[18.5,23.3]	10.9	[9.6,12.4]
Secondary school	9924	74.3	[73.5,75.1]	14.0	[12.6,15.5]	4.5	[3.7,5.3]	5.8	[5.1,6.7]	13.0	[11.8,14.4]	8.1	[7.3,9.0]
Graduation and above	2759	77.9	[76.9,78.8]	8.3	[6.7,10.2]	1.6	[1.1,2.2]	2.3	[1.7,3.1]	10.8	[9.0,12.8]	5.0	[4.1,6.0]
Marital Status													
Single	1177	78.2	[76.9,79.6]	6.7	[5.2,8.7]	1.6	[0.9,2.9]	2.0	[1.2,3.2]	7.1	[5.5,9.2]	5.4	[3.9,7.5]
Married	14217	74.3	[73.6,75.0]	14.2	[13.0,15.6]	4.1	[3.5,4.8]	5.7	[5.0,6.5]	14	[12.6,15.4]	7.8	[7.1,8.6]

Widowed	838	67.4	[66.1,68.7]	34.5	[30.5,38.8]	10.2	[8.0,12.9]	18.7	[15.8,22.1]	32.7	[29.3,36.2]	18.2	[15.4,21.3]
Separated/Divorced	55	65.3	[57.9,72.7]	24.6	[11.8,44.3]	10.2	[4.6,21.3]	20.6	[8.8,41.0]	22.3	[12.2,37.2]	25.1	[14.9,39.2]
BMI (Kg/m^2)													
underweight (<18)	756	74.0	[72.3,75.7]	14.9	[11.7,18.8]	3.0	[1.7,5.3]	5.4	[3.7,7.9]	12.9	[10.1,16.5]	9.0	[6.3,12.7]
Normal (18-24.9)	5278	75.1	[74.3,75.9]	11.8	[10.4,13.3]	3.5	[2.8,4.2]	4.8	[4.0,5.7]	11.5	[10.2,13.0]	7.5	[6.6,8.7]
Overweight (25.0-29.9)	4190	73.6	[72.7,74.5]	15.2	[13.4,17.2]	4.8	[3.8,6.0]	6.2	[5.2,7.3]	14.4	[12.6,16.4]	8.2	[7.2,9.4]
Obesity (≥30)	2249	70.4	[69.5,71.2]	22.3	[19.9,24.9]	6.4	[5.1,8.0]	9.1	[7.6,10.9]	20.7	[18.2,23.6]	10	[8.5,11.8]
Tobacco use (Smoke/Chew/other forms)													
Never user	12215	74.1	[73.4,74.8]	15.4	[14.0,16.8]	4.5	[3.8,5.3]	6.4	[5.6,7.2]	14.6	[13.1,16.2]	8.1	[7.3,9.0]
Current user	3758	75.3	[74.3,76.3]	11.8	[10.4,13.4]	3.1	[2.4,4.1]	4.6	[3.8,5.6]	12.9	[11.6,14.5]	7.9	[6.7,9.2]
Former user	314	70.1	[67.0,73.2]	17.6	[13.4,22.8]	4.7	[2.7,8.1]	8.3	[5.6,12.3]	18.1	[13.6,23.7]	12.4	[8.8,17.2]
Chronic conditions (self-reported)													
No	12498	76.2	[75.4,76.9]	11.9	[10.7,13.1]	3.5	[2.8,4.2]	4.5	[3.9,5.2]	11.2	[10.1,12.5]	6.8	[6.0,7.6]
Yes	4699	67.3	[66.6,68.1]	24.6	[22.4,27.0]	6.9	[5.9,7.9]	11.8	[10.5,13.2]	25.5	[23.3,27.9]	13.2	[12.0,14.5]
Diabetes													
No diabetes	4610	75.1	[74.4,75.9]	10.1	[8.9,11.4]	3.3	[2.6,4.1]	4.2	[3.5,5.0]	10.3	[8.8,12.0]	7.5	[6.5,8.6]
Pre-diabetes	5449	74.4	[73.5,75.3]	15.5	[13.6,17.5]	4.2	[3.3,5.2]	6.0	[5.0,7.2]	14.6	[12.9,16.4]	8.0	[7.0,9.1]
Newly diagnosed	2015	74.3	[73.3,75.3]	17.2	[14.7,20.1]	5.0	[3.8,6.5]	8.1	[6.5,10.0]	17.2	[15.0,19.6]	8.5	[7.1,10.1]
Self-reported Diabetes	1661	65.9	[64.8,67.1]	20.9	[18.9,23.1]	6.3	[5.2,7.5]	9.5	[8.3,11.0]	19.8	[18.1,21.7]	10.5	[9.3,11.8]
Hypertension													
Normotension	5695	74.8	[74.0,75.5]	12.8	[11.4,14.3]	3.8	[3.0,4.9]	4.7	[3.9,5.6]	11.6	[9.9,13.6]	6.9	[6.0,8.0]
Prehypertension	4717	76.0	[75.0,76.9]	12.7	[11.2,14.4]	3.7	[2.9,4.6]	5.1	[4.3,6.0]	12.3	[11.0,13.8]	6.5	[5.6,7.5]
Newly diagnosed	2780	75.8	[74.8,76.8]	12.9	[11.0,15.1]	3.0	[2.4,3.8]	5.1	[4.2,6.3]	12.6	[11.0,14.3]	8.4	[7.2,9.9]
Self-reported	2397	66.7	[65.8,67.7]	18.8	[16.8,21.0]	4.9	[4.2,5.7]	8.7	[7.6,9.9]	19.6	[17.8,21.4]	10.8	[9.7,12.0]
Heart Disease													
No	15842	74.6	[73.9,75.2]	14.2	[12.9,15.5]	4.0	[3.4,4.7]	5.6	[5.0,6.4]	13.8	[12.6,15.2]	7.9	[7.2,8.6]
Yes	445	63.3	[61.3,65.2]	31.2	[25.7,37.3]	11.7	[8.3,16.2]	20.8	[16.7,25.7]	31.4	[26.5,36.7]	19.0	[15.0,23.8]
Stroke													
No	16203	74.3	[73.6,75.1]	14.5	[13.3,15.8]	4.1	[3.5,4.8]	6.0	[5.3,6.7]	14.1	[12.9,15.5]	8.1	[7.4,8.8]
Yes	84	62.4	[58.5,66.2]	31.9	[22.0,43.7]	16.8	[10.0,26.7]	18.1	[11.1,28.1]	43.3	[32.3,55.1]	21.2	[13.2,32.2]

Kidney disease														
	No	16175	74.4	[73.7,75.1]	14.6	[13.3,15.9]	4.1	[3.6,4.8]	6.0	[5.3,6.7]	14.1	[12.9,15.5]	8.1	[7.3,8.8]
	Yes	112	62.5	[59.4,65.7]	19.2	[13.1,27.2]	10	[5.7,17.0]	15.1	[9.9,22.3]	31.4	[23.5,40.6]	20.7	[14.1,29.3]

NOTES: Tobacco use, Heart disease, Kidney disease were based on self-reports, newly diagnosed diabetes - defined as no self-reported diabetes and fasting blood glucose (FBG) of ≥126 mg/dl, or HbA1c ≥6.5%), pre-diabetes – no self-reported diabetes and FBG ≥100-125 mg/dl or HbA1c ≥5.7-6.4%), normoglycemia –no self-reported diabetes and FBG<100 mg/dl and HbA1c<5.7%, Newly diagnosed hypertension – defined as no self-reported hypertension and BP ≥140/90mmHg, prehypertension - no self-reported hypertension and BP: 120-139 / 80-89 mmHg and normotensive - no history of hypertension and BP <120/80 mmHg.

Abbreviations: *INR: Indian rupees, mmHg – millimetre of mercury, mg/dl - Milligram/decilitre; US$ - United States Dollar, CI – Confidence Interval*

Table 3: Adjusted prevalence ratio of reporting any problems in individuals with chronic conditions versus those without chronic conditions, by cities and gender

	Mobility		Self-care		Usual activities		Pain/discomfort		Anxiety/depression		Any Dimension	
	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI	PR	95%CI
Overall[$]	1.41	[1.27,1.57]	1.35	[1.09,1.67]	1.70	[1.45,2.01]	1.74	[1.58,1.91]	1.60	[1.40,1.84]	1.45	[1.35,1.56]
Males[^]	1.78	[1.46,2.18]	1.60	[1.10,2.34]	2.01	[1.41,2.87]	1.89	[1.62,2.23]	2.01	[1.55,2.62]	1.63	[1.41,1.88]
Females[^]	1.32	[1.16,1.50]	1.28	[0.99,1.66]	1.67	[1.40,1.99]	1.72	[1.53,1.93]	1.44	[1.23,1.69]	1.39	[1.29,1.52]
Chennai[*]	1.24	[1.05,1.46]	1.08	[0.84,1.40]	1.31	[1.07,1.60]	1.71	[1.45,2.04]	1.56	[1.31,1.86]	1.30	[1.17,1.44]
Males[^]	1.46	[1.07,1.99]	1.12	[0.71,1.76]	1.24	[0.80,1.90]	1.73	[1.34,2.24]	1.75	[1.34,2.30]	1.38	[1.16,1.66]
Females[^]	1.18	[0.97,1.44]	1.08	[0.79,1.47]	1.38	[1.11,1.73]	1.73	[1.38,2.17]	1.46	[1.16,1.83]	1.27	[1.12,1.45]
Delhi[*]	1.66	[1.41,1.95]	3.05	[1.78, 5.25]	2.40	[1.66,3.47]	1.79	[1.54,2.08]	1.84	[1.29,2.63]	1.65	[1.47,1.86]
Males[^]	2.13	[1.52,2.97]	5.14	[1.92,13.78]	3.63	[1.61,8.17]	1.93	[1.50,2.49]	3.45	[1.36,8.80]	1.89	[1.45,2.48]
Females[^]	1.58	[1.31,1.90]	2.23	[1.27,3.94]	2.15	[2.15,2.15]	1.82	[1.51,2.18]	1.56	[1.12,2.18]	1.62	[1.43,1.83]
Karachi[*]	1.41	[1.15,1.72]	1.77	[1.05,3.00]	2.09	[1.58,2.77]	1.64	[1.37,1.97]	1.60	[1.21,2.11]	1.43	[1.25,1.65]
Males[^]	2.51	[1.52,4.13]	1.76	[0.77,4.02]	2.91	[1.62,5.22]	2.28	[1.52,3.42]	2.04	[1.27,3.29]	2.01	[1.44,2.80]
Females[^]	1.24	[1.01,1.53]	2.11	[1.10,4.04]	1.95	[1.44,2.65]	1.50	[1.24,1.81]	1.32	[0.94,1.87]	1.27	[1.10,1.47]

NOTES: Prevalence ratio (PR) were estimated using Poisson regression model as the log binomial regression model did not reach convergence.
[$]adjusted for age, sex, income, education, marital status and city
[*]adjusted for age, sex, income, education, and marital status
[^]adjusted for age, income, education, marital status and city

Abbreviations: CI – Confidence interval, PR – Prevalence ratio,

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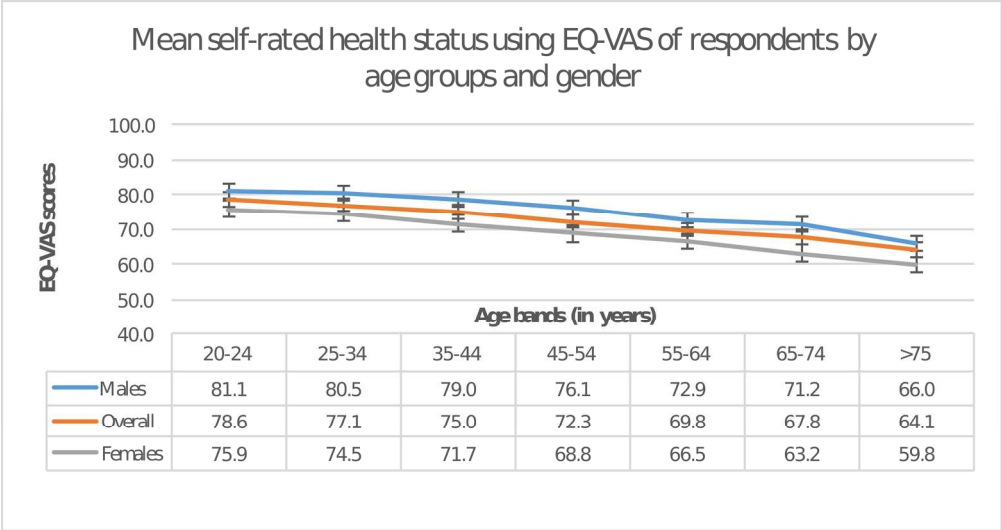

Figure 1 - Mean self-rated health status using EQ5D-VAS of respondents by age groups and gender

Figure Legend: This figure presents the mean self-rated health status for overall study population by age-groups and gender. European Quality of Life 5 Dimension - Visual Analogue Scale (EQ5D-VAS) measures health status on a scale of 0 (worst health status) – 100 (best imaginable health status)
* P-value for difference between mean EQ5D-VAS between males and females at each age-group is statistically significant; p<0.01.

88x47mm (600 x 600 DPI)

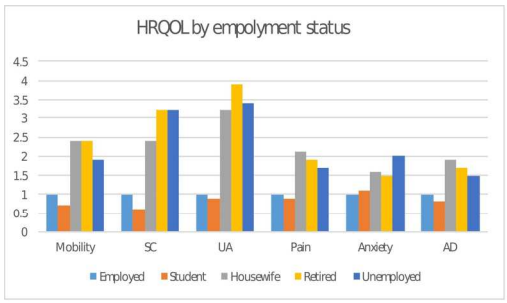

Figure 2.a

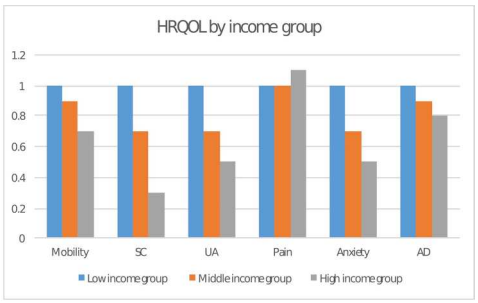

Figure 2.b

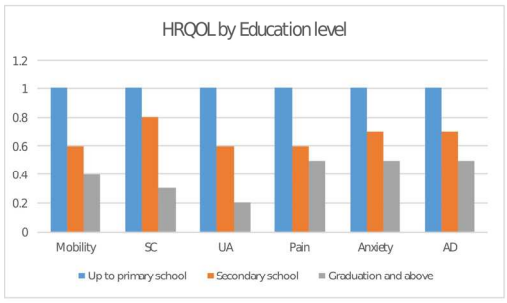

Figure 2.c

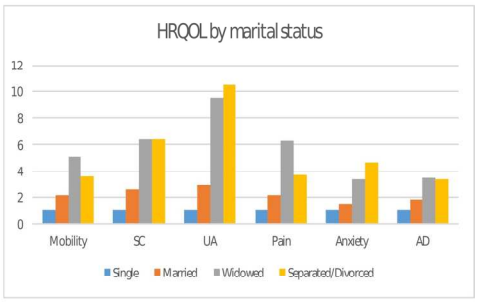

Figure 2.d

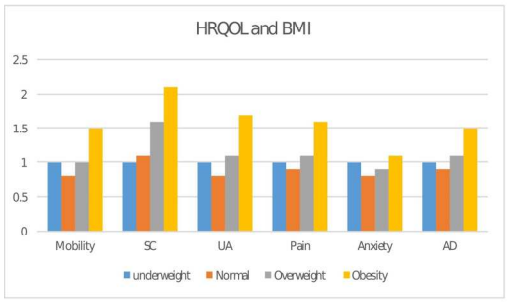

Figure 2.e

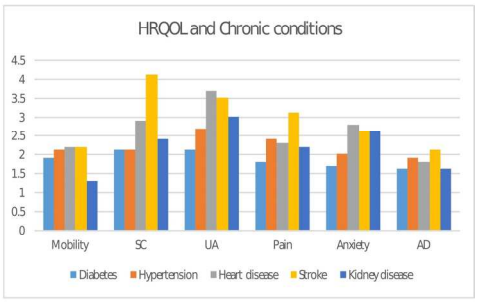

Figure 2.f

Figure 2 – Prevalence ratio of moderate or severe health problems by socio-demographic factors and chronic conditions

Figure 2.a. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains (mobility, self-care, usual activities, pain/discomfort, anxiety/depression and any of the five dimensions) by employment status. With reference to those who were employed (PR=1), housewife, retired, and unemployed reported greater problems in all five domains. Whereas, students only reported higher anxiety problems compared to employed.

Figure 2.b. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by income-group. With reference to low-income group (PR=1), those in middle- or high- income groups had less problems in all five domains.

Figure 2.c. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by education level. With reference to those primary school education (PR=1), individuals with secondary school or graduates reported significantly lower problems in all five domains.

Figure 2.d. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by marital status. With reference to single (PR=1), those who were married, widower, or divorcee had greater problems in all five domains.

Figure 2.e. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by body mass index (BMI). With reference to underweight i.e. BMI <18Kg/m2 (PR=1), individuals with overweight (BMI 25-29.9 Kg/m2) or obesity (BMI≥30Kg/m2) reported significantly greater problems in all five domains.

Figure 2.f. shows the prevalence ratio of moderate or severe difficulties in EQ5D domains by chronic conditions. Compared to those without chronic conditions, individuals with self-reported diabetes, hypertension, heart disease, stroke and kidney disease had twice greater problems in all five domains. Abbreviations: AD – Any Dimension, HRQOL – Health-related quality of life, SC – Self-Care, UA – Usual Activities; PR – Prevalence Ratio, EQ5D – European Quality of Life 5 dimension

181x189mm (300 x 300 DPI)

Web-appendix (supplementary file)

Appendix 1: The distribution of the respondents EQ-VAS values

EQ-VAS score	Number	Percentage (%)	Cum. Percentage (%)
10-	29	0.18	0.18
20-	72	0.44	0.62
30-	88	0.54	1.16
40-	365	2.24	3.4
50-	2,056	12.62	16.03
60-	1,979	12.15	28.18
70-	3,728	22.89	51.07
80-	4,026	24.72	75.78
90-	2,594	15.93	91.71
100-	1,350	8.29	100

Notes: EQ-VAS: European Quality of Life – Visual Analogue Scale, Cum. Percentage – Cumulative percentage

Appendix 2: Relationship between EQ-VAS and EQ5D across major sub-groups

Dependent variable	Mobility	Self-care	Usual care	Pain / discomfort	Anxiety / Depression	Observation
Overall	-10.5 (0.6)	-9.9 (0.9)	-12.4 (0.7)	-10.9 (0.6)	-8.9 (0.8)	16287
Gender						
Male	-12.0 (0.6)	-11.4 (1.1)	-14.6 (0.9)	-11.9 (0.6)	-12.1 (0.7)	7760
Female	-8.1 (0.4)	-7.9 (0.7)	-9.9 (0.6)	-7.7 (0.4)	-9.1 (0.5)	8527
Age groups						
Young (20-44 yrs)	-9.9 (0.5)	-11.0 (0.9)	-12.0 (0.8)	-8.8 (0.5)	-9.3 (0.6)	9603
Middle (45-60 yrs)	-9.0 (0.5)	-10.8 (0.9)	-11.3 (0.8)	-9.0 (0.5)	-10.7 (0.6)	5544
Elderly (>60 yrs)	-11.1 (1.0)	-11.7 (1.6)	-13.1 (1.3)	-11.0 (1.1)	-13.2 (1.4)	1140
Income						
Low income group (INR <10000 or US$ 155)	-10.6 (0.4)	-12.1 (0.7)	-13.2 (0.6)	-10.2 (0.4)	-10.7 (0.5)	11537
Middle income group (INR 10000-20000 or US$ 155-310)	-10.2 (0.8)	-8.9 (1.6)	-10.7 (1.3)	-9.2 (0.8)	-11.8 (1.1)	2667
High income group (INR >20000 or US$>310)	-12 (1.0)	-14.4(2.5)	-15.6 (1.7)	-10.5 (0.9)	-8.2 (1.6)	1975
Level of education						
Up to primary school	-10.8 (0.6)	-12.8 (1.1)	-12.6 (0.8)	-9.9 (0.6)	-11.6 (0.8)	3604
Secondary school	-9.9 (0.4)	-11.1 (0.8)	-12.2 (0.7)	-9.3 (0.4)	-10.2 (0.5)	9924
Graduation and above	-8.9 (1.0)	-8.3 (2.1)	-11.4 (1.8)	-9.8 (0.9)	-8.3 (1.3)	2759
Marital status						
Single	-8.4 (1.9)	-9.4 (3.8)	-15.2 (3.3)	-9.0 (1.8)	-10.8 (2.0)	1177
Married	-10.3 (0.4)	-11.5 (0.6)	-12.3 (0.5)	-9.5 (0.4)	-10.3 (0.5)	14217
Widowed	-9.9 (1.2)	-11.1 (1.8)	-12.9 (1.4)	-10.1 (1.2)	-11.8 (1.5)	838
Divorce	-18.6 (5.8)	-14.1 (7.0)	-24.2 (6.0)	-15.1 (5.6)	-15.6 (5.1)	55
Tobacco use						
No	-10.1 (0.4)	-11.4 (0.6)	-12.4 (0.5)	-9.8 (0.4)	-10.5 (0.5)	12529
Yes	-13.4 (0.8)	-15.5 (1.5)	-16.5 (1.2)	-11.1 (0.7)	-12.6 (0.9)	3758
Alcohol use						
No	-10.6 (0.4)	-12.1 (0.6)	-13.1 (0.5)	-10.2 (0.4)	-11.0 (0.5)	13911
Yes	-10.6 (1.1)	-10.7 (2.0)	-11.4 (1.9)	-8.2 (1.0)	-10.6 (1.2)	2376
BMI						
Underweight	-10.6 (2.4)	-15.6 (5.1)	-15.4 (3.9)	-10.5 (2.9)	-7.8 (4.8)	756
Normal weight	-10.6 (0.9)	-11.6(1.5)	-13.6 (1.2)	-9.2 (0.9)	-9.7 (1.2)	5278
Overweight	-10.3 (1.1)	-12.1 (1.2)	-11.6 (1.3)	-7.7 (0.9))	-8.9 (1.2)	4190
Obesity	-7.4 (0.9)	-9.9 (1.7)	-11.4 (1.3)	-8.0 (0.9)	-8.6 (1.4)	2249
Diabetes						
Diabetes (diagnosed or self-reported)	-10.0 (0.6)	-11.6 (1.1)	-11.6 (0.9)	-9.7 (0.6)	-11.4 (0.8)	3676
Pre diabetes	-10.2 (0.6)	-13.5 (1.0)	-14.1 (0.8)	-9.4 (0.6)	-10.6 (0.7)	5449
No diabetes	-10.9 (0.7)	-11.0 (1.2)	-12.6 (1.1)	-9.9 (0.7)	-10.0 (0.8)	4610
Hypertension						

Diagnosed or Self-reported hypertension	-11.2 (0.6)	-14.7 (1.0)	-14.1 (0.8)	-10.8 (0.6)	-10.8 (0.7)	5074
Pre hypertension	-10.9 (0.7)	-12.4 (1.2)	-14.1 (1.0)	-9.7 (0.7)	-11.2 (0.9)	4717
No hypertension	-9.3 (0.6)	-9.6 (1.0)	-10.4 (0.9)	-8.4 (0.6)	-10.0 (0.7)	5695
Heart disease						
No	-10.5 (0.3)	-11.9 (0.6)	-13.0 (0.5)	-9.9 (0.3)	-10.7 (0.4)	15842
Yes	-9.0 (1.6)	-9.0 (2.5)	-9.5 (1.9)	-7.4 (1.7)	-11.8 (2.0)	445
Stroke						
No	-10.7 (0.3)	-11.9 (0.6)	-13.1 (0.5)	-10.0 (0.3)	-10.8 (0.4)	16203
Yes	-13.7 (3.6)	-18.4 (4.4)	-19.2 (4.1)	-12.2 (3.5)	-16.3 (4.1)	84
Kidney disease						
No	-10.7 (0.3)	-11.9 (0.6)	-13.1 (0.5)	-9.9 (0.3)	-10.8 (0.4)	16175
Yes	-11.6 (3.7)	-21.2 (4.8)	-14.3 (4.2)	-16.4 (3.2)	-16.3 (3.7)	112

NOTES: Tobacco use, Heart disease, Kidney disease were based on self-reports, newly diagnosed diabetes - defined as no self-reported diabetes and fasting blood glucose (FBG) of ≥126 mg/dl, or HbA1c ≥6.5%), pre-diabetes – no self-reported diabetes and FBG ≥100-125 mg/dl or HbA1c ≥5.7-6.4%), normoglycemia – no self-reported diabetes and FBG<100 mg/dl and HbA1c<5.7%, Newly diagnosed hypertension – defined as no self-reported hypertension and BP ≥140/90mmHg, prehypertension - no self-reported hypertension and BP: 120-139 / 80-89 mmHg and normotensive - no history of hypertension and BP <120/80 mmHg. INR: Indian rupees, mmHg – millimeter of mercury, mg/dl - Milligram/deciliter; yrs – years; US$ - United States Dollar

Appendix 3 - The comparison of HRQOL as measured by EQ5D-VAS among different countries

Countries, year of study	N	EQ-VAS	Percentages with any difficulties in EQ5D domain					
		Mean	Mobility	Self-care	Usual activities	Pain / Discomfort	Anxiety / Depression	Any dimension
India, **Delhi (age≥20), 2011**	5,365	78.9	14.1	1.6	4.4	8.0	9.5	27.8
India, **Chennai, (age≥20), 2011**	6,903	70.8	17.3	7.8	7.7	9.0	8.9	29.7
Pakistan **(Karachi), (age≥20), 2011**	4,016	73.2	10.4	1.9	5.6	8.7	9.3	17.9
China **(age≥18), 2008**	2,991	77.0	4.9	2.0	3.3	18.0	6.1	22.4
UK **(age≥18), 1998**	3395	82.5	18.4	4.2	16.3	33.0	20.9	43.1
USA **(age≥18) , 1998**	427	82.2	14.0	3.0	14.0	40.0	24.0	na
Japan **(age≥20) , 1998**	620	77.8	7.2	1.8	5.2	20.0	8.5	25.0
Spain **(age≥15) , 1998**	12,245	71.1	11.2	2.0	6.9	26.3	12.5	33.0
Canada **(age≥18), 1997**	1518	78.7	22.2	4.0	19.1	43.6	28.6	53.0
Sweden **(age≥18), 1998**	3069	83.5	10.0	2.0	8.0	42.0	30.0	na
Finland **(age≥18), 1992**	2411	79.4	20.0	5.0	18.0	39.0	14.0	na
Germany **(age≥18), 1998**	337	82.2	18.0	3.0	13.0	37.0	18.0	na
Belgium **(age≥18), 2001**	1274	81.0	13.0	3.0	15.0	42.0	21.0	na
New Zealand **(age≥18), 1999**	1328	81.3	17.0	4.0	18.0	37.0	20.0	na
Zimbabwe **(age≥18), 2000**	2350	76.1	20.0	7.0	18.0	41.0	40.0	na
Armenia **(age≥18), 2002**	2222	66.6	26.0	13.0	28.0	64.0	52.0	na

NOTES: EQ5D-VAS: European Quality of Life 5 Dimension – Visual Analogue Scale; na – not available

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 6
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	6
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	8,9
Objectives	3	State specific objectives, including any prespecified hypotheses	9
Methods			
Study design	4	Present key elements of study design early in the paper	9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9, 10
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	10, 11
Bias	9	Describe any efforts to address potential sources of bias	*12 (adjusted regression model was run to adjust for potential confounders)*
Study size	10	Explain how the study size was arrived at	Not applicable – secondary data analysis
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	12

Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	12
		(*b*) Describe any methods used to examine subgroups and interactions	Not applicable
		(*c*) Explain how missing data were addressed	Not applicable
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(*e*) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	13
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	13
Outcome data	15*	Report numbers of outcome events or summary measures	13
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13
		(*b*) Report category boundaries when continuous variables were categorized	13
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	13 - 15
Discussion			
Key results	18	Summarise key results with reference to study objectives	15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	16-18
Generalisability	21	Discuss the generalisability (external validity) of the study results	18 - 19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.