Systematic Measurement Error in Self-Reported Health: Is anchoring vignettes the way out?

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Is anchoring vignettes the way out?

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Abstract

This paper studies the pattern of non-random measurement error in self-assessed health responses across population subgroups and examines whether anchoring of vignettes can be used to identify this bias. It uses unique data from the World Health Survey (WHS)-SAGE survey(wave 1) from India, that has self-reported assessments of health linked to anchoring vignettes as well as objective measures like measured anthropometrics and performance tests on a range of health domains. Both estimations using individual fixed effects and anchored-vignettes response reveal strong systematic reporting bias across subgroups. Controlling for a battery of objective health measures, we implicitly test and confirm the validity of the 'response consistency' assumption used in vignettes technique. Further analysis using individual fixed effects in a two-stage regression estimation reveals substantial individual reporting bias even after accounting for the usual covariates controlled in a regression. The analysis finds that non-random measurement error in SAH cannot be simply dealt with by controlling for socio-economic covariates in a typical regression framework. This exposes the problem of cross-comparability using self-reported health response in the context of a developing country setting and lends support to the use of vignettes for identifying this bias.

Keywords: Self-assessed health; vignettes approach; measurement error; response consistency

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1. Introduction

One of the ways to examine systematic measurement error in self-reported health is to formalize the problem of heterogeneous reporting behavior and to formulate tests for its occurrence in the context of subjective health information. In order to correct for systematic differences in reporting heterogeneity across sub-populations, a proposed solution is to anchor an individual's self-assessed response on her rating of a vignette description of a hypothetical situation that is fixed for all respondents (King et. al 2004; Bago d'Uva et. al 2011). The idea is based on the underlying assumption that any variation in rating of a vignette (which depicts a fixed level of latent health) would identify systematic reporting bias, which can then be adjusted in the individual's subjective assessment of her own situation.

However the validity of this approach relies on two important assumptions viz. "*vignette equivalence*" (requires that all individuals perceive the vignette description as corresponding to a given state of the same underlying construct) and "*response consistency*" which implies that individuals use the same response categories for their subjective assessment (e.g. of own health) as the categories used for the hypothetical scenarios presented to them in vignettes (Bago d'Uva 2009). This assumption will not hold if there are strategic influences on the reporting of the individual's own situation that are absent from evaluation of the vignette (Bago d'Uva 2011). Also, the assumption of response consistency has not been tested in a developing country setting thus far (Van Soest et. al 2011) where measurement error in survey data is increasingly being acknowledged in empirical studies (Strauss and Thomas 2007). Most studies using data from developing countries focus on measures of self-rated health, nutritional status,

activities of daily living, presence or absence of health conditions, and utilization of care, that are often self-reported and for which the validation data is hard to obtain (Currie et. al 1999). However there has been no formal testing of systematic reporting bias in self-reported health within a developing country context, which the current analysis addresses.

This paper presents a novel framework for analysing individual reporting behavior/systematic measurement error in SAH in a developing country setting. This tests how sub-groups of the population systematically use different thresholds in classifying their health into a categorical measure which helps to figure out bias pattern typically incurred while using nationally representative survey data. Second, it provides a methodological contribution by checking the validity of the oft debated assumption of response consistency used in vignettes approach[1]. Third, it exploits a unique dataset (that has information on self-assessed, objective as well as vignettes rating on identical health domains) to examine what part of the reporting bias remains unexplained even after controlling for the socio- economic characteristics that are usually accounted for in a typical regression.

The finding indicates strong presence of systematic measurement error in SAH across all health domains and validates the vignettes approach to identify this bias. Additionally we also find that accounting for the usual control variables in a regression is not sufficient to pick up this bias and highlight the gravity of the problem of using SAH responses in economic analyses, particularly in the context of a developing country setting. This offers policy insights in terms of developing alternative strategies to tackle

[1] It has been argued that individuals may use different thresholds for rating vignette questions as opposed to rating self-reported health questions.

subjective variation in self-assessed responses in various health domains to make possible greater comparability between distinct socio-economic groups.

The rest of the paper is organized as follows. Section II gives a brief literature review of the problem followed by the description of the theoretical background and empirical model in Section III. Section IV describes the data highlighting the descriptive statistics. Section V lays out the main results followed by robustness checks. Section VI concludes the discussion along with policy implications.

2. Literature Review

Antman et al (2006); Escobal et al.(2008) points a number of reasons to in developing country settings, for which validation data are not readily available. In particular, the literacy level of the general population is lower and health awareness may be lower. This becomes more problematic as self-report is often the only source of information on health status in case of developing countries. Individuals from different population sub-groups are likely to interpret the SAH question within their own specific context and thus use different reference points when asked to respond to the same question (Lindeboom & van Doorslaer, 2004). A number of papers including Sen (1993, 2002) draw instances from developing countries where comparison of reported morbidities indicates that children in the poorest households are the healthiest.

Health and morbidity profile based on National level household surveys like the National Sample Survey in India are typically used to study the utilization of public and private health services by population subgroups (Mishra 2004). Notably it is the primary source of health information that has been extensively used for policy design.

Van Doorslaer and Jones (2003) analyze differences in reporting that may be influenced by socioeconomic characteristics such as age, gender, education, individual experience with illness and the health care system. They find sub-groups of the population systematically use different thresholds in classifying their health into a categorical measure. With respect to the subjective dimension of SAH, Krause et. al (1994) found that people of different age groups tend to think about different aspects of their health when making evaluations.

Bound (2001) highlights that wrong assumption of measurement error in a given variable to be "classical " can introduce serious biases in estimates leading to simple attenuation to misattributing relationships that are not present in the error free data. Furthermore, the study points out that standard methods for correcting for measurement error bias, such as instrumental variables estimation, are valid only when errors are classical in nature and the underlying model is linear, but not, in general, otherwise.

While various techniques have been proposed for achieving comparable response scales across groups, recent reviews (Murray et. al 2002) indicate anchoring vignettes as "the most promising" of available strategies. Anchoring vignettes, in short, reveal how groups may differ in their use of response categories, i.e., in where along the health spectrum individuals locate thresholds between the ordered categories. Although it is becoming popular anchoring vignettes have not been applied to the general self-rated health question (Prokopczyk 2012) despite clear indications of measurement bias in the self-reported data.

One of the very first papers Bago d'uva (2008) to test for systematic differences in reporting behavior across developing countries using a pilot data (not nationally

representative) from Indonesia, India[2] and China rejected reporting homogeneity by different educational groups. However it was beyond the scope of the study to cross-validate the results from vignettes analysis using either objective (biomarkers) or subjective (self-reported) health status which this analysis is able to include. Moreover studying the interstate variations within a country was beyond the scope of their study which is addressed in this analysis. Additionally the study brings out systematic evidence on the extent of unaccounted reporting bias even after controlling the typical SES variables in a regression which has important policy implications.

3. Theoretical framework and Empirical Strategy

Economic circumstances and geographic location may alter health expectations through factors like peer effects, societal norm, access to medical care etc. Reporting of health may vary with education through the awareness factor i.e. conceptions of illness, understanding of disease and knowledge of the availability, access and effectiveness of health care. Reporting of health may vary with education through the awareness factor i.e. conceptions of illness, understanding of disease and knowledge of the availability and effectiveness of health care. Etilé and Milcent (2006) provide evidence of a convex relationship between reporting heterogeneity and income. Banerjee et al.(2004) finds that individuals in the upper third income group report the most symptoms over the last 30 days, and attribute this to higher awareness of health status.

In the light of the empirical literature discussed so far the current analysis tests whether sub-groups of the population systematically use different thresholds in classifying their health into a categorical measure. In order to test the existence of

[2] for India only a pilot data from Andhra Pradesh was analyzed in her paper

systematic measurement error in the SAH across population subgroups we first estimate the ordered probit model for the vignettes responses to identify the reporting biases by covariates.

The first approach of our empirical strategy closely follows the model of King (2004) with some modifications.

Let H_i^V be the reported ordered health status (with options 'very good'=1, 'good=2', 'moderate=3', 'bad=4' and 'very bad=5') for the vignette question, the vector X_i is a vector of observed characteristics (the socio demographic covariates potentially susceptible to systematic reporting bias for example age, gender, education, income, location etc.).

Estimating Equation: $H_i^v = X_i\beta + u_i$ *(1)*

The underlying assumption for this identification relies on the fact that since vignette represents a fixed level of latent health, the difference in cut points by covariates can be attributed to the systematic reporting associated with the X_i's viz. age, gender, education level, income quintiles, sector (rural/urban) or location. The idea is to vary the health status exogenously in each of the hypothetical cases, where any difference in rating of these fixed latent health situations would identify the 'biases' one has in estimation of health state. Hence the coefficient β would identify the reporting bias, where a positive (negative) and significant coefficient would imply over-reporting (under-reporting) of worse health, as degree of worse health /difficulty increases from 1 to 5 in the categorical response of the dependent variable.

As reporting of health status can potentially be influenced by expectations for own health, tolerance of illness, health norm in one's society we include the following in

the X vector: education categories, gender, age groups, body mass index (BMI categories), expenditure quintiles, religion, ethnic groups, sector (urban/rural), underdeveloped state dummy- capturing development in the state (which implicitly captures and controls for the access to effective health care and can be a rough measure for tolerance of illness in the society).

In order to identify any nonlinear effect of income on reporting bias we include expenditure quintiles constructed from average overall monthly household spending. Further we include the sector and a dummy for level of development in the state[3]. In order to see whether reporting bias varies by true health we include the measured body mass index categories (viz. underweight, normal, overweight and obese).

To test for reporting heterogeneity by education level we include six education categories capturing the highest level of education completed: no formal education (reference category), less than primary education, primary, secondary, high school and college or above. Age is categorized into four groups: 18 to 29.9 years (reference category), 30 to 44.9 years, 45 to 60 years and greater than 60.

In our second empirical approach we attempt to identify reporting behavior from variation in self-reported health beyond what is explained by 'true' health as approximated by a battery of objective health measures/performance tests, to cross-examine the reporting behavior as indicated by estimations of hypothetical case vignettes. By this exercise we implicitly check whether 'response consistency' assumption holds which is necessary for any vignette study to be valid.

[3] We use the WHS ranking of development in the sample state (based infant mortality rate, female literacy rate, percentage of safe deliveries and per capita income at the state level).

We consider a sufficiently comprehensive set of objective indicators of health that include physical measurements, scores from performance tests and interviewer impressions. We specifically examine if for a given level of true health (as approximated by an array of measured tests, clinical diagnosis and measured anthropometrics) there exists reporting bias by the socio-demographic covariates (like education, gender, age, income, sector and location) in a systematic way, and whether this pattern of bias identified for each covariate is in line with that indicated by the earlier approach.

Let H^{rep} be the response to any self-reported health question (for example 'how would you rate your health today') having the following values for the options; 'very good'=1, 'good=2', 'moderate=3', 'bad=4' and 'very bad=5'. We regress the self-reported health on the same set of covariates (X_i) but now control for a battery of 'objective' health measures. The underlying idea is any systematic variation in subjective assessments that remains after conditioning on the objective indicators can be attributed to systematic biases in reporting behavior.

$$H_i^{rep} = \alpha H_i^{obj} + X_i b + V_i \qquad (2)$$

This specification hinges on the fact that after correcting for 'true' health the reporting heterogeneity (if any) would be reflected as the coefficients of the covariates in the second equation. Specifically, the assumption is, adding of objective indicators in the estimation would soak up the variation coming from the true/latent health, leaving aside the reporting effects to be identified. So a statistically significant negative coefficient for any covariate would mean the higher probability to report better health in that subgroup compared to the reference group.

The next section discusses the data that we use for our analysis followed by a brief discussion of the summary statistics for the key variables of interest.

4. Data and Summary Statistics

The analysis uses the World Health Survey (WHS)-SAGE Wave 1 survey (carried out from 2007 to 2009) in India[4]. The survey implemented a multistage cluster sampling design resulting in nationally representative cohorts. The data collected included self-reported assessments of health linked to anchoring vignettes, which are hypothetical stories that describe the health problems of third parties in several health domains. This data is special in the sense that it has the information of both 'subjective' and 'objective'(clinical counterpart) measures of identical health questions in addition to the vignettes.

For India the survey covered six states[5] namely Maharashtra, Karnataka, West Bengal, Rajasthan, Uttar Pradesh and Assam. The states were selected randomly such that one state was selected from each region as well as from each level of development category. The level of development was based on four indicators[6] namely: infant mortality rate, female literacy rate, percentage of safe deliveries and per capita income at

[4] Implementation of SAGE Wave 1 was from 2007 to 2010 in six countries over different regions of the world (China, Ghana, India, Mexico, Russian Federation and South Africa)

[5] The 19 states were grouped into six regions: north, central, east, north east, west and south. The sample was stratified by state and locality (urban/rural) resulting in 12 strata and is nationally representative. Of the 28 states, 19 were included in the design which covered 96% of the population.

[6] A composite index of the level of development was computed by giving equal weightage to the four indicators.

the state level. We use the development classification[7] used in WHS to construct a dummy for underdevelopment (=1 for the two least developed states, viz. Rajasthan and Uttar Pradesh, and =0 for the other four states).

4.1 Information on Vignettes

The following sets of vignettes[8] in the data included the following: Mobility and Affect, Pain and Personal Relationships and Vision, Sleep and Energy, Cognition and Self-care. Each individual questionnaire includes only one set of vignettes and each respondent is asked two questions from each vignette. So, around one-fourth of the total sample responds to vignettes questions on each health domain. In all vignettes the region-specific female/male first names were used to match the sex of the respondent. Before reading out the vignette the interviewer insisted the respondents to think about these people's experiences as if they were their own. The interviews were done face-to-face with the selected respondents in the local language(s).The respondent was asked to describe how much of a problem or difficulty the person in the vignette has, in an ordered scale response from 1 to 5 - the same way that they described their own health.

4.2 Self-reported and Objective measures of health

The survey data includes perceptions of well-being and more objective measures of health, including measured performance tests: rapid walk; cognitive tests (verbal

[7] The states were ranked in this decreasing order of development (Maharashtra> Karnataka> West Bengal> Assam> Rajasthan > Uttar Pradesh) based on the composite index of infant mortality rate, female literacy rate, percentage of safe deliveries and per capita income.

[8] A list of the vignette questions are included in the appendix.

fluency, immediate and delayed recall capacity, digit span forward and backward). In the self-evaluation, interviewees responded to direct questions about their own health state, aimed at capturing their perceptions regarding each state of health domain, formulated as, "*Overall, in the last 30 days, how much difficulty did you have in carrying out such activity?*" the responses of which were obtained on a scale of 1 to 5 (1 = none; 2 = mild; 3 = moderate;4 = severe; 5 = extreme/cannot do). The key question on self-reported health is '*How would you rate your health today*?' The response categories were ordered starting from very good, good, moderate, bad, very bad taking value 1 to 5 respectively. Figure 2.1 shows the distribution of the response categories for self-reported health question. As expected, the percentage of individuals who actually report 'extreme good' or 'extreme bad' health is very less. However, as it is evident from Figure 2.1, there is enough variation in the SAH to be utilized in regression equation (2) coming from the 'good', 'moderate', and 'bad' categories.

For each adult respondent, the health worker measured height, weight, grip strength, lung capacity, blood pressure, pulse rate and undertook a battery of performance tests for the respondent in various health domains including memory and mobility. We construct four categories of individuals by body mass index using the measured height and weight: Underweight (BMI < 18.5) ,(Normal BMI 18.5-24.9- reference category in regression), Overweight (BMI 25-29.9), Obese (BMI >30). Body mass index (BMI) information was included in equation to control for a respondent's risk for different health conditions. The distribution of BMI in the sample is shown in Figure 2.2.

For the domain of mobility we have a set of self-reported variables pertaining to difficulty level in moving around and performance of daily activities in the last 30 days.

The distribution of the key question on self-reported mobility in the sample is shown in Figure 2.3.

For objective mobility indicators we have a rapid walk test along with the interviewer's impression of any walking difficulty of the respondent. In the domain of cognition we have self-reported measures of how the individuals would rate their memory and cognition. The following tests are taken to measure cognitive ability: immediate and delayed recall (memory); digit span (concentration and memory); verbal fluency[9].

We have some information of semi-objective measures comprised of reported diagnosed chronic disease including arthritis, stroke, angina, diabetes chronic lung disease, asthma, depression, hypertension, cataracts, oral health, injuries, cancer screening, that we include in estimation (2) for robustness checks. We take the total number of reported chronic illness in the estimation. This is implicitly assigning the same weight for all the diseases, and we also check the results including these as dummies.

The total number of individuals who have the complete information[10] across measured health are 10873 individuals for which the summary statistics are presented in Table 1. The comparison of measured and self-reported height across population subgroups yields very interesting results. Figure 2.4 and Figure 2.5 depicts the graph of average measured and self-reported heights across expenditure quintiles and education categories respectively. The education categories capture the highest level of education

[9] Respondent is given one minute to tell the names of as many animals (including birds, insects and fish) that they can think of.

[10] Around 500 observations do not have scores/not measured on some performance tests, i.e. less than 5% of the sample had missing information on X's, however they were not dropped from the analysis.

which is categorized into six groups: No formal education (=1), below primary(=2), primary (=3), secondary(=4), high school(=5), college and above(=6).

From Figure 2.4, we find on average individuals underreport their true height, which is statistically different than measured height across all expenditure quintiles. Evidently this difference becomes smaller as we go up the expenditure quintiles and for higher education categories. For individuals with highest education that of college and above, this gap is no longer statistically significant. However, this trend is more or less similar by gender.

Disaggregating by development level of the states (Figure 2.6), we find this difference in reported height and measured height is most prominent across individuals from the poorest quintiles, and the pattern of reporting bias is unique for each state. While in relatively more developed states this gap reduces for higher expenditure quintiles(Maharashtra and West Bengal), we do find for less developed states (Rajasthan, Uttar Pradesh, Assam) that this gap persists even for higher expenditure quintiles. By contrast, in the most developed state from our sample, this gap is no longer significant for individuals from second expenditure quintile onwards. Interestingly, while we find individuals on average under-report their true height in Assam, Rajasthan, West Bengal and Maharashtra, there is significant over-reporting of true height in Uttar Pradesh and Karnataka (Figure 2.6).

The picture is very similar across education categories as well (perhaps because of high correlation between education and income), where the difference between true and reported height is the largest and significant in the lowest education groups across all the states under consideration. We compare the most developed state from our sample, viz.

Maharashtra, with a lesser developed state, Rajasthan in this regard (Figure 2.7). Interestingly, we find that the gap between true and self-reported height is significant in Maharashtra only for individuals with education level below primary. However, it is not the case in Rajasthan where this difference is significant and persists for individuals even with secondary schooling.

While doing a similar exercise examining the difference between the mean of measured and self-reported weight (Figure 2.8) by expenditure quintiles and level of development we find that the gap between the mean measured and self-reported weight is significant across all expenditure quintiles (except the richest quintile) for less developed states. However this is not so in developed states, where this gap is not statistically significant for any of the expenditure quintiles. The findings seem to suggest that individuals from lesser developed states (correlated with lesser education and lower access to health facilities) are likely to have different reporting behavior as compared to the ones from developed states. This has important implications given that heterogeneity at the state level do not typically gets controlled in estimations. In the next section we discuss and attempt to connect this suggestive finding of the summary statistics with our regression estimates followed by robustness checks.

5. Results

Equation (1) is estimated separately for 10 health state vignettes from each health domains. The regression estimates of the domains 'Mobility and Affect' 'Pain and Personal Relationships', 'Vision, Sleep and Energy', and 'Cognition and Self-care' are presented in Table 2.2.1, Table 2.2.2, Table 2.23, Table 2.2.4 respectively and the sign

and statistical significance of the parameters from these forty separate regressions are summarized in the Table 2.2. All the ten specifications for each health domain include dummies for education categories, gender, age groups, marital status, body mass index categories, household expenditure quintiles, religion, caste, sector and level of development in one's state.

From the regression estimates of equation (1) we do find a strong evidence of reporting bias across specific population sub-groups for all the health domains. In mobility and affect domain (Table 2.2.1) we find that the 'male' dummy is negative and statistically significant for all the vignette questions for mobility[11]. This finding reveals that males have a greater probability of underreporting worse health than females in the sphere of mobility. We get an interesting result by the expenditure quintiles. We find that individuals from both lower as well as higher quintile have higher probability to report better health compared to the middle income group. Individuals from urban are more likely to under-report worse health, however the effect is statistically significant in half of the regression estimations. In this domain, individuals who are above 60 years of age have higher probability of reporting ill health, statistically significant in 50% of the regressions. The dummy for underdevelopment is negative and statistically significant in nearly all of the regressions.

To summarize the regression estimates of the vignette questions across all the health domains we find some interesting results (Table 2.2). Males, on average, show a clear pattern of under-reporting of worse health consistent across all the health domains[12].

[11] The dependent variable in specification 1,2,5,6,9 and10 deals with Mobility, while dependent variable in specification 3,4,7 is on Affect.
[12] The exception is domain of pain and discomfort (Table 2B).

Out of 40 regression estimates in 72% of the cases, the coefficient on male dummy was found to be negative where it is statistically significant more than half of the time. With regards to the age group, we find with reference to young individuals 18-30 years of age, individuals over 60 years age tend to over-report illness. (The concerned coefficient is positive in 32 cases out of 40 estimations and statistically significant around 50% of the time). This is a pretty standard result in the literature where over-report of worse health is observed for aged individuals. With reference to marital status, we find compared to unmarried/divorced/widowed individual group, currently married individuals tend to under-report illness, although this is not always statistically significant.

Interestingly, those who are underweight and obese mostly tend to over-report worse health compared to individuals with normal body-mass index. With respect to household expenditure quintiles, we find that individuals from the poorest expenditure quintile tends to under-report ill health as compared to individuals from the third quintile, consistently across all the health domains. We do not get any clear pattern of reporting bias across religion or caste groups, although we see some interesting pattern by specific health domains. For instance, in the domain of mobility- while hindus were found to underreport ill-health, scheduled castes were more likely to over-report ill-health. The urban dummy is consistently negative across all the domains suggesting urban individuals tend to under report ill health as compared to rural, and the effect is statistically significant for 57% of the total cases.

Perhaps the most interesting result out of this exercise is the evidence obtained for systematic reporting bias by different states in India. In comparison to the developed states, the underdeveloped state dummy is negative 88% of the cases, and statistically

significant around 80% of the time. Quite strikingly, for the health domains of vision, sleep and energy (Table 2.2.3), 'cognition and self-care' (Table 2.2.4) we find the underdeveloped dummy is negative and statistically significant for *all* the estimates without any exception.

Hence, if we think that this current definition of underdevelopment captures the health access and health standards in the community, we find a stark difference in reporting pattern from the social disadvantaged states. This is perhaps suggestive of the hypothesis that socially disadvantaged individuals fail to perceive and report the presence of illness or health-deficits because an individual's assessment of their health is directly contingent on their social experience. It can perhaps be attributed to lower expectation for own health/higher tolerance for diseases where a particular individual may not see herself as being unhealthy conditional on the health norm/standard prevailing in one's community.

We now discuss the findings from the cross-validation exercise estimating equation (2) and comment on the validity of 'response consistency' assumption across different health domains. We first estimate the dependent variable '*how would you rate your health today*' on the same set of covariates as used in earlier estimation of equation(1), but now include a set of performance tests and interviewer assessments across different health domains (Table 2.3). We subsequently add objective health information in specification (1) through (4) and examine if the addition of more objective information on several health domains completely absorb the variation coming from variation in latent health, leaving only effects that identifies reporting bias.

Specification (1) includes dummies for highest education level, gender, age groups, marital status, expenditure quintiles, religion, caste, sector and level of development in the state. Specification (2) also controls for body mass index categories in addition to controls included in specification (1). We further add (i) the performance test scores for mobility and cognitive ability (ii) biomarkers including tests for lung function; blood pressure (systolic and diastolic);pulse rate; total number of chronic illness diagnosed from(arthritis, stroke, angina, diabetes chronic lung disease, asthma, depression, hypertension, cataracts, oral health, injuries, cancer screening) in specification (3) on top of the controls in specification (2). The last specification (4) adds interviewer assessment dummies for whether the respondent had any problem in the following domain: hearing, vision, walking, shortness of breath, and whether she/he had any overall health problem.

We find individuals with education level secondary and above are more likely to under-report illness that is statistically significant at 1% level across all specifications. The result can perhaps be explained if highly educated respondents feel greater confidence regarding their capacity to handle a given level of health impairment, and thus under rate it more, after controlling for other factors.

Males show consistent patterns of under reporting illness as compared to females, which is again statistically significant for all the specifications. We find compared to the young age group of 18-30 years, with higher age- particularly individuals over 60 years- significantly over report illness, which is consistent with our earlier finding from vignette approach.

We do not find significant difference in reporting bias by marital status. Once we control for objective health information the coefficients lose statistical significance in specification (3) and (4). With respect to household expenditure quintiles we find compared to the middle expenditure group both the poor and the rich tend to understate illness, however this effect is statistically significant only for the highest expenditure group. We also do find statistically significant under-reporting of worse health among urban cohort, hindu and scheduled castes.

To confirm our earlier findings about reporting bias by development level in the state- we find a very strong evidence from this estimation exercise- the underdeveloped dummy is found to be consistently negative and statistically significant across *all* the specifications, implying a underreporting of worse health among the disadvantaged group. Once we control for the interviewer assessments of health states in specification (4) the magnitude of the coefficient on the underdeveloped dummy even rises, confirming that it is picking up reporting bias.

Interestingly across the body-mass index categories we do find statistically significant evidence of over-reporting of worse health among the underweight population, as indicated by our earlier findings. The objective health indicators of rapid walking ability, cognitive score, chronic illness, and interviewer assessments of health situation were all found to be significant and with expected signs, which is reassuring as it implies that better objective/measured health leads to more probability of reporting better health.

We further estimate a vector of self-reported functioning measures in the domain of mobility (results shown in Table 2.4) and daily activities (in Table 2.5). In the

estimation for self-reported mobility we include walking speed, which is predictive of overall health and mobility, level of disability. Specifications (1) through (12) control for some objective health measures that are likely to approximate mobility level (performance tests for timed and rapid walk, interviewer assessment for difficulty in mobility and dummies for body mass index categories) along with the usual covariates: highest education level, gender, age groups, marital status, expenditure quintiles, religion, caste, sector and level of development in the state.

The dependent variables in all the specifications in both Table 2.4 and Table 2.5 takes value 1-5 measuring self reported difficulty level (1=no difficulty; 5=extreme difficulty) faced by the respondent in the specific activity describing some form of mobility (for example in moving around, walking, picking up, crouching, vigorous activities etc.) and daily activity(for example performing household activities, getting to places, washing body, using toilet, carrying etc.). The summary of signs and statistical significance of the estimated coefficients from both these set of regressions from Table 2.4 and Table 2.5 are summarized in Table 2.6. The findings reveal systematic underreporting of worse health among higher educated group, urban and underdeveloped states, again reconfirming our earlier findings.

In the similar spirit we regress self-reported cognitive outcomes (for example how much difficulty one had in remembering and concentrating thing) including objective measures (test of words recalled after delay, digital recall test and verbal fluency) on the same set of covariates as before. The findings (Table 2.7) reveal again the same pattern of reporting bias as identified earlier in vignettes study and resemble the findings from equation (2) in the domains of mobility and general health.

As a further robustness check we regress the objective scores of memory on these covariates (Table 2.8) and check whether males, underdeveloped actually fare better on this. Now this would be a weak test for accepting reporting bias if the covariates which are likely to underreport worse health were also likely to have better objective health; however, one can assume that this serves as a strong test to identify reporting bias in case the direction of bias/sign of coefficients obtained from self-reported response are found to be opposite in comparison to that obtained in estimation of objective health. Interestingly for the dependent variable 'words recalled' we find quite the opposite result for male dummy compared to what was suggested by self-reported memory. While estimation of self-report measure for memory would suggest that males fare better, we find contrary result when we estimate objective memory test for words recalled. This robustness check provides support that males do in fact understate worse health. Similarly, while self-reported memory measure suggested that individuals from underdeveloped states are better off, in contrast when we estimate the objective measures on the same set of covariates we get individuals from underdeveloped states fare worse in this regard, which is statistically significant, confirming our previous findings. As expected individuals from underdeveloped states were found to score lower on both cognitive tests as indicated by the negative and statistically significant coefficient in specification in (2) and (3) in Table 2.8.

As a further robustness check we estimate objective measures of mobility and general health in Table 2.9 using interviewer assessments on the same set of covariates (specification 1 and 3), and also controlling also for body mass index categories (specification 2 and 4). We find that after controlling for body mass index categories

males in fact fare worse in assessed walking difficulty, which falls in line to what was suggested by our earlier results about systematic under-reporting of worse health in self-reported health. Interestingly, coefficient on the underdeveloped dummy for interviewer assessed health problem reveals that individuals from underdeveloped states were more likely to have health problems, which is statistically significant for both specification (2) and (3). This reconfirms our earlier findings and supports the prevailing view of perception bias.

We further utilize individual fixed effects[13] to figure out how much of the variation in individual reporting heterogeneity still remains even after inclusion of the covariates in the estimation of vignette response. The idea behind this exercise is that even though systematic reporting heterogeneity by observables can be accounted for controlling for the covariates in the regression, it remains to be seen how much of the variation remains even after accounting these, i.e., what remains unexplained due to the presence of unobservable factors. This exposes the gravity of the underlying problem that non-random measurement error can be accounted as far as the observables allow, and also helps to check the robustness and validation of the vignette estimation findings.

We carry this exercise using two-stage regression estimation. In the first stage we regress the vignette responses (10 questions per vignette set for each individual) on individual dummies ID_i to get their corresponding coefficients μ's which we use in the second stage as dependent variables to be explained by the usual covariates. Precisely we examine to see how much of individual reporting bias can be explained by including the observables and what part remains to unexplained even after accounting for the usual covariates.

[13] Each individual answers 10 vignette questions in a set

We estimate the following set of equations:

$$H_i^v = ID_i\mu + v_i \qquad (3)$$

$$\mu = X_i\beta + u_i \qquad (4)$$

We present the results in table 2.10. We present the histogram of the estimated coefficients in Figure 2.9, Figure 2.10, Figure 2.11, Figure 2.12. The distribution reveals substantial reporting heterogeneity across individuals (significantly different from zero), for which we examine how much of this can be explained by the covariates. The OLS regression estimates are presented in Table 2.10. The results confirm our previous findings. Precisely we get males were more likely to favorably rank their health state (statistically significant for vignette set A and C); individuals above 60 years were likely to overstate bad health (statistically significant for vignette set A, C and D). Both the quintiles above and below the middle expenditure group were likely to understate ill health. Again we get striking result for the level of development in the state, where the underdeveloped dummy is always significant and negative for all the four sets of vignettes.

This has important implications given the fact that heterogeneity within country, at the state level is often not included as control, as we find we have substantial systematic heterogeneity along this line that can mess up the statistical inference. However it is reassuring to find that the pattern of systematic bias indicated by the vignettes exercise through equation (1) seems to be in line with the results obtained from the two-stage estimation, and hence it lends support to the use of vignettes in identifying this bias.

Also, important to note here is that the R-square for estimations (1) to (4) is just explaining 3% (in domain of Mobility and affect)to 7% (in domain of Cognition and self-care) of the variation in the self-reported behavior[14]. This is alarming given the fact that we get to only control for the observables in the regression, controlling for which leaves much reporting heterogeneity at the individual level typically unaccounted for. Hence this reinstates the point that biases in self-reported measure cannot even be fully controlled by identifying and accounting for the sources of systematic measurement error across the observables.

6. Conclusion and Policy insights

One of the key challenges in the analysis and interpretation of health survey data is improving the interpersonal comparability of subjective indicators- that comes with systematic measurement error- as a consequence of differences in the ways that individuals understand and use the available responses for a given question. In this paper we examine the pattern of reporting differences in SAH from a nationally representative survey in India and find evidence that measurement error in SAH systematically varies with demographic characteristics, such as the age, gender, education and community characteristics such as sector and level of development in the state. This has important implications on several aspects.

First one should be careful in inter-personal comparison of health status using self-reported health data. This will be particularly important with regard to measuring performance in achievement of the government targets in improving population health, for instance one of the Millennium Development Goals has been targeting to reduce child

[14] The inclusion of the interaction terms of the covariates also does not seem to improve the R square.

and maternal morbidity, where reporting of diagnosed illness is the primary source for identifying the incidence of a disease, collected through household surveys (Dixon et al. 2007).

With the increased interest in health issues in children, women of reproductive age and elderly, self-reported data on morbidity, utilization and expenditure on health care, perceived well being[15] ,self-rated ranking of health service delivery used in citizen and community report cards needs to be carefully used in inter-personal comparison. Government reports based on self-reported indicators collected on maternity care and immunization for a comparison of health expenditure profile across households or in drawing causal inference of a program needs to be re-examined in the light of this problem. Further one has to reflect on the problem that non-random measurement error cannot be simply dealt with by controlling for the covariates in a typical regression framework.

The findings provide a strong empirical evidence to confirm the prevailing view that socially disadvantaged individuals (as captured here by residing in a less developed state) fail to perceive and report the presence of illness or health-deficits. Hence, even within a country there is strong evidence on systematic reporting bias, hence the problem of cross-population comparability with self-reported data remains a serious issue. This also calls for paying special attention to account for state-level heterogeneities in typical regression estimations to reduce some of the issues with systematic bias by the socio-economic disadvantage level of the community.

[15] Gilligan & Hoddinott 2009 use self-perceived well-being as an outcome of interest in examining the causal impact of PSNP-food security program in Ethiopia.

The findings presented here suggest that it is necessary to account for how different population subgroups/individuals see and evaluate their health using different thresholds and thus it calls for adjustment for systematic variation in measurements of self-rated health. The current evidence indicates that self-reported measures of health cannot be directly compared across population sub-groups, because groups differ in how they use subjective response categories. The problem is further complicated as this systematic variation cannot be accounted for by just including the socio-economic characteristics in a typical regression framework. The challenge is to develop alternative strategies to account for the subjective variation in health perception in its various domains and to make possible greater comparability between distinct socio-economic groups.

This analysis lends support to the use of vignettes data to use them to extract information on reporting behavior and identify the bias in SAH data to improve comparability of existing household surveys in a developing country setting. Since household interview based surveys are considerably less expensive to conduct than household examination surveys, and this type of data will be utilized to estimate distribution and levels of severity of health, the problem of comparability has to be addressed. One of the ways forward would be to enrich the household surveys by adding questionnaire with a section on the vignettes that would help identify the thresholds one is using for SAH thus making it feasible to be used for statistical inference.

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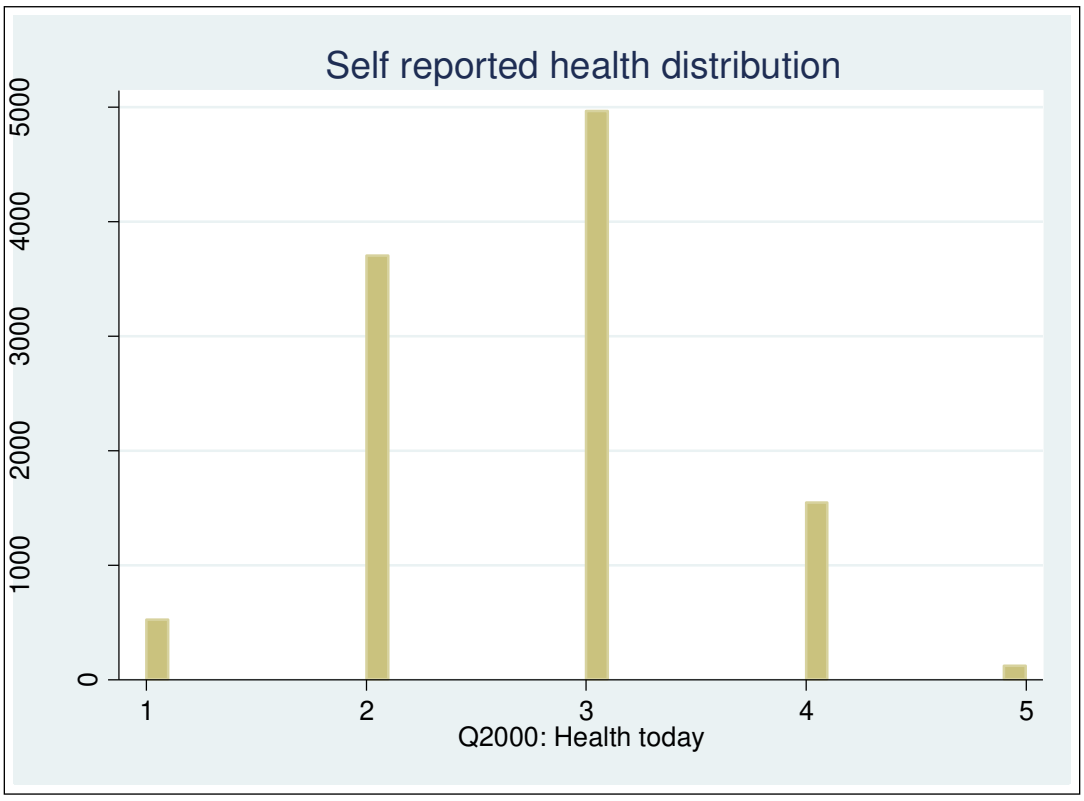
Table 1: Descriptive Statistics

Variables		
Education Categories	**Mean**	**Std. Dev.**
No Formal Education	0.45	0.50
Below Primary	0.10	0.31
Primary	0.16	0.36
Secondary	0.12	0.33
High School	0.11	0.31
College and Above	0.06	0.24
Individual Characteristics		
Male	0.39	0.49
Age groups		
18-29.9	0.14	0.34
30-44.9	0.22	0.41
45-60	0.32	0.47
Above 60	0.32	0.47
Marital Status		
Currently Married	0.78	0.42
BMI Categories (measured)		
Underweight (BMI< 18.5)	0.35	0.48
Normal (BMI 18.5-24.9)	0.51	0.50
Overweight (BMI 25-29.9)	0.11	0.31
Obese (BMI>30)	0.03	0.17
Household Characteristics		
Household's Expenditure Quintiles		
Q1	0.21	0.41
Q2	0.16	0.37
Q3	0.22	0.42
Q4	0.22	0.41
Q5	0.17	0.38
Religion (Hindu=1)	0.84	0.37
Caste (SC/ST=1)	0.41	0.49
Regional characteristics		
Urban	0.25	0.43
Underdeveloped dummy (=1 for states: Rajasthan, UP)	0.38	0.49
N=10873		

Figure 2.1: Distribution of Self-reported health response



Note :SAH is on a 1-5 scale , where 1=very good; 5=very poor

Figure 2.2: Distribution of Body Mass Index (BMI) in sample

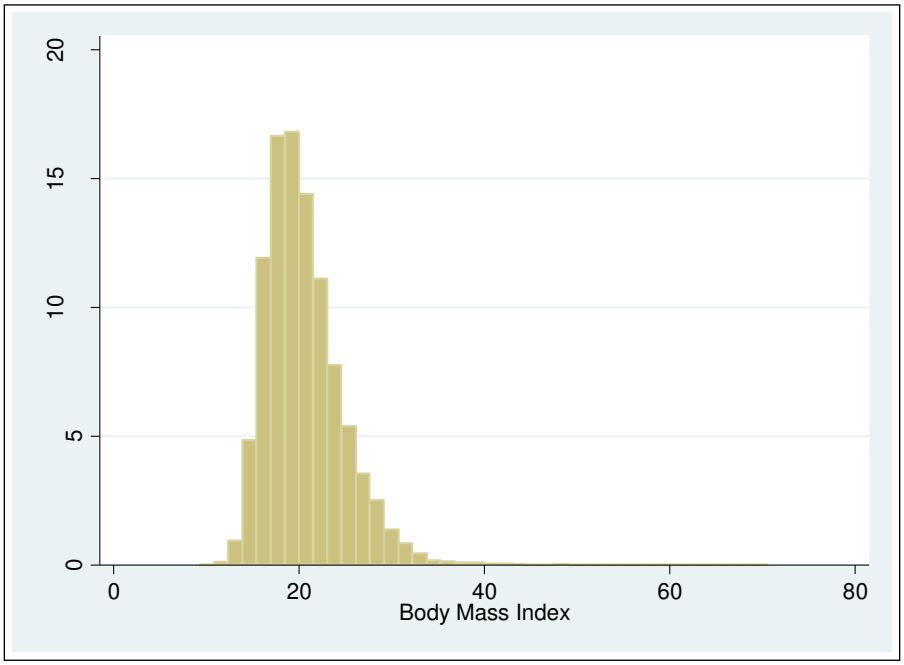
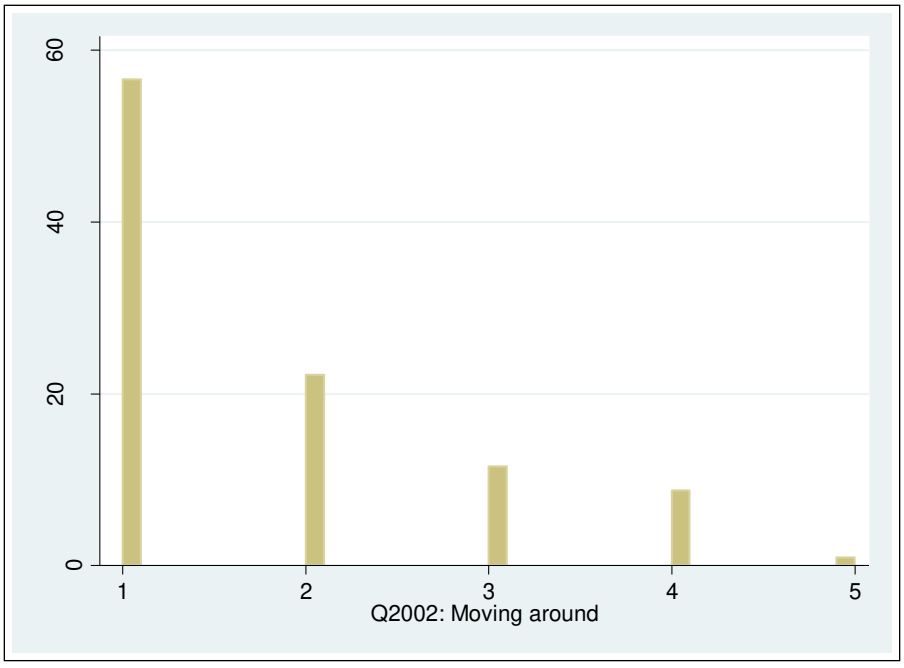


Figure 2.3: Distribution of Self reported mobility



Note :SAH is on a 1-5 scale , where 1=very good; 5=very poor

Figure 2.4: Average self reported and measured height by expenditure quintiles

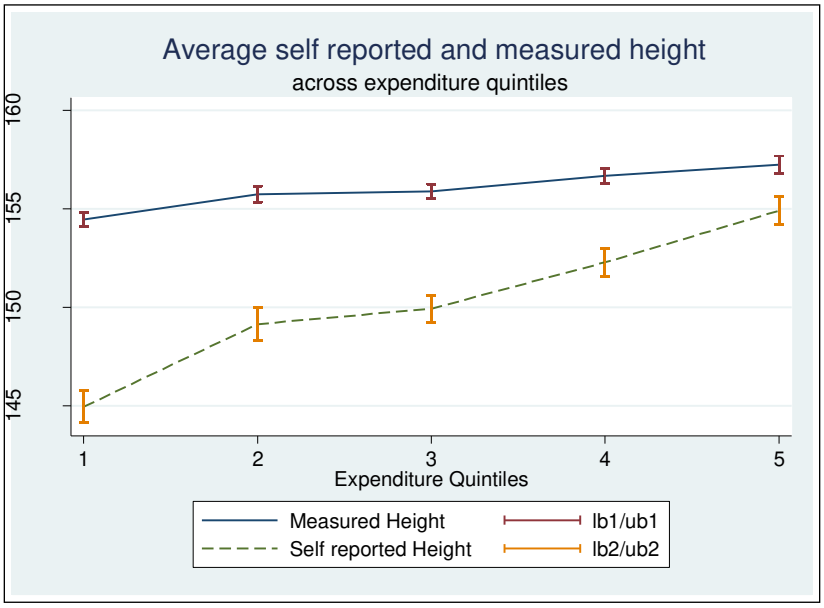
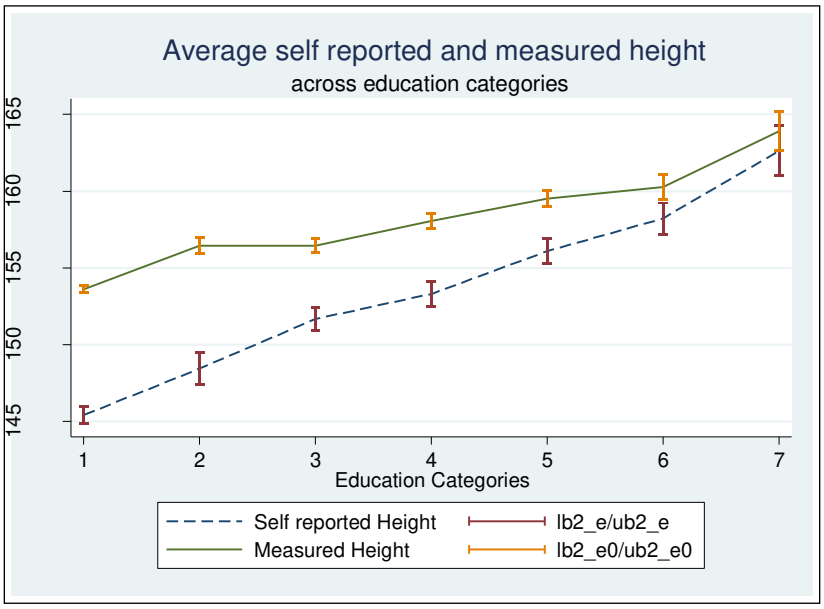


Figure 2.5: Average self reported and measured height by education categories



Note: Categories include:No formal education (=1), below primary(=2), primary (=3), secondary(=4), high school(=5), college (=6) Post-graduate degree completed(=7)

Figure 2.6. Average Self reported and Measured height by expenditure quintiles and state

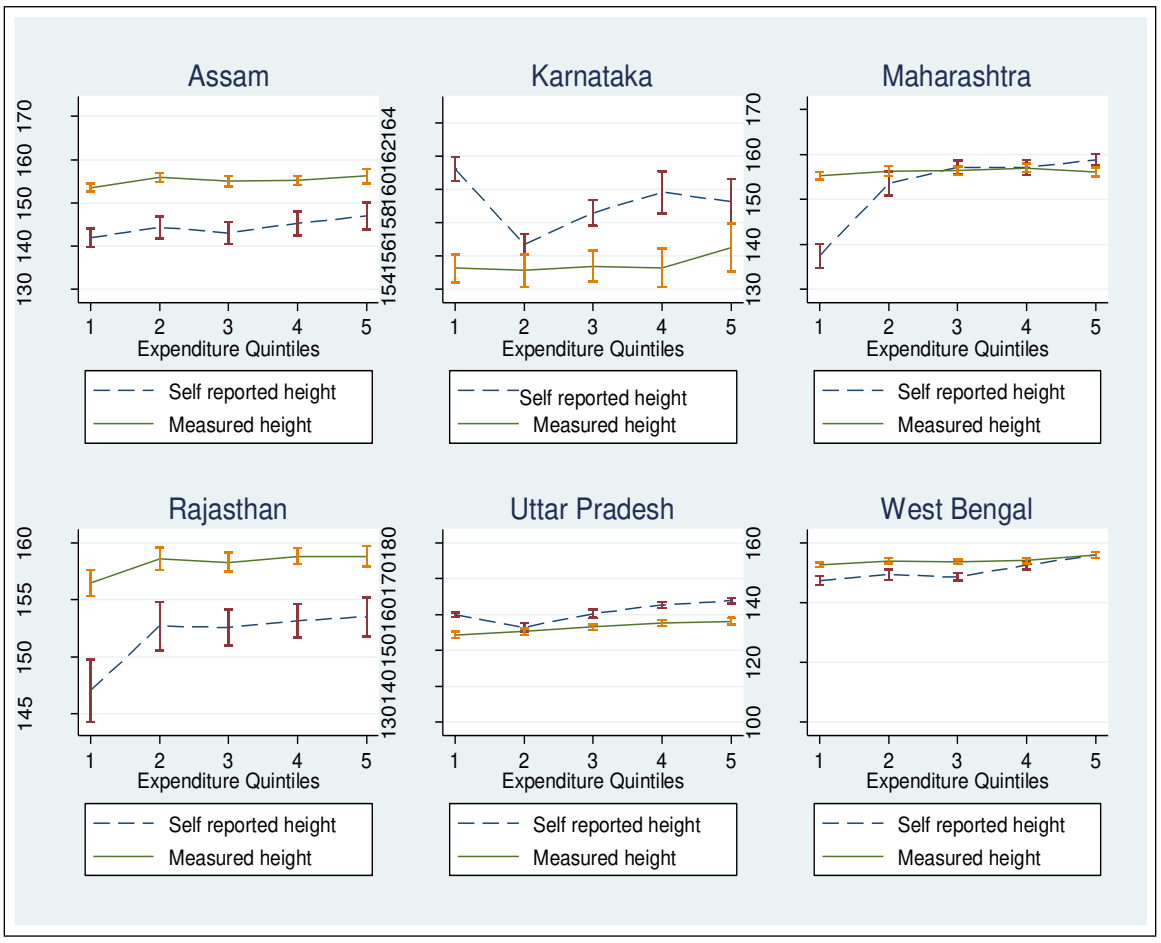
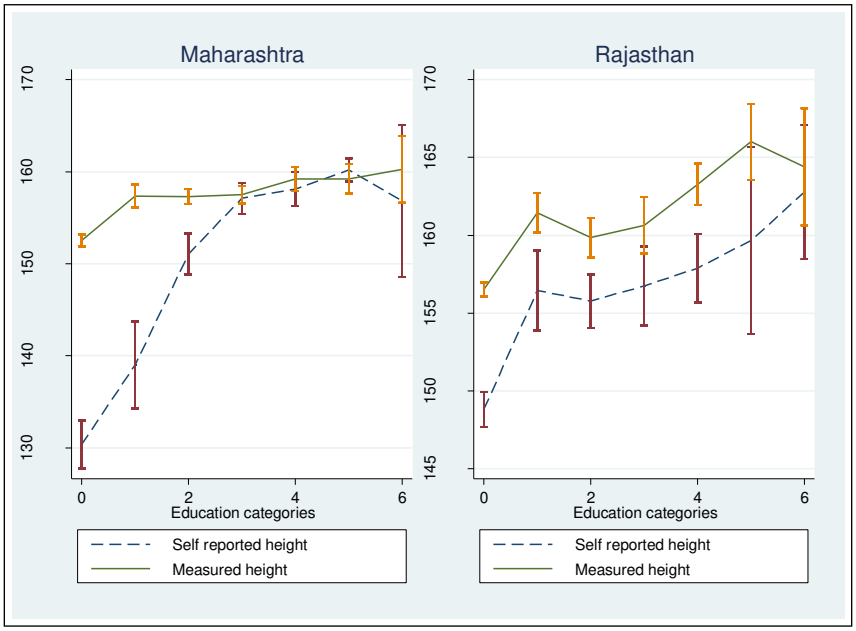


Figure 2.7: Comparison of Self reported and Measured height by education categories in two states.



Note: Categories include:No formal education (=1), below primary(=2), primary (=3), secondary(=4), high school(=5), college and above (=6)

Figure 2.8: Comparison of Self reported and Measured weight by development level and expenditure

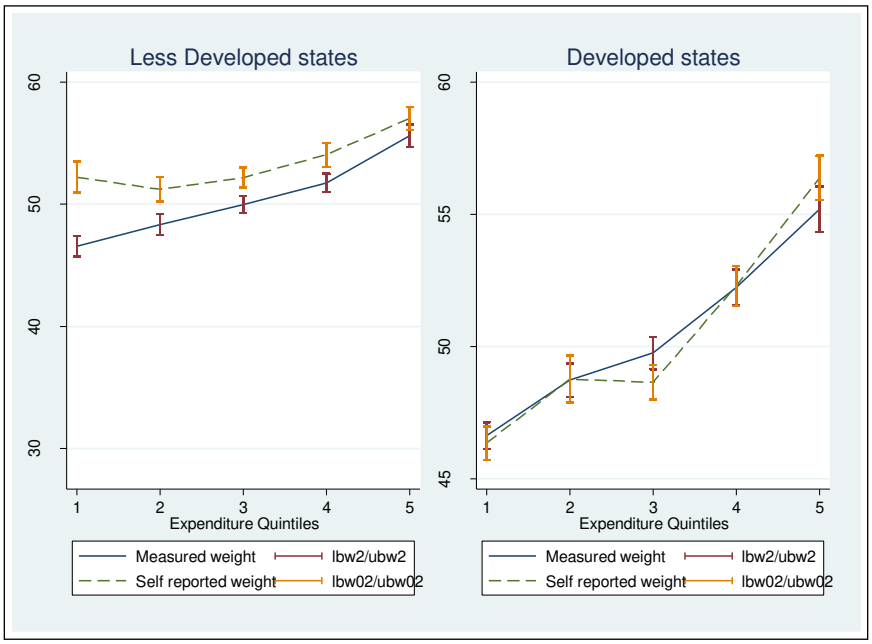


Table 2.2: Summary Table of 40 Ordered Probit Regressions with Vignettes data

Variables	Positive and Significant	Positive and Insignificant	Negative and Significant	Negative and Insignificant
Education Categories				
(Ref category: No formal education)				
Below Primary	2	**22**	3	13
Primary	0	17	8	15
Secondary	3	13	4	**20**
High School	5	14	3	18
College and Above	7	15	3	1 5
Individual Characteristics				
Male	4	7	**19**	10
Age groups				
(Ref category: Age 18-29.9 years)				
30-44.9	3	27	2	8
45-60	5	20	3	12
Above 60	13	**19**	1	7
Marital Status				
Currently Married	2	13	6	**19**
BMI Categories (measured) (Ref category: Normal BMI 18.5-24.9)				
Underweight (BMI< 18.5)	5	**24**	0	11
Overweight (BMI 25-29.9)	2	14	2	22
Obese (BMI>30)	3	**19**	3	15
Household's Expenditure Quintiles				
(Ref category: Q3)				
Q1	0	8	12	**20**
Q2	1	17	4	18
Q4	1	16	7	16
Q5	4	18	3	15
Religion (Hindu=1)	1	14	5	**20**
Caste (SC/ST=1)	**16**	8	8	8
Regional characteristics	0	1	4	32
Urban	0	6	11	**23**
Underdeveloped	1	4	**32**	3

Table 2.2.1: Vignettes set 1: Mobility and Affect

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Education Categories										
(Ref category: No formal education)										
Below Primary	0.02	-0.03	**0.19****	0.12	0.01	-0.06	0.07	0.01	0.01	-0.04
Primary	-0.01	-0.07	0.10	0.01	0.04	0.01	0.09	0.03	0.00	0.00
Secondary	0.08	-0.07	0.09	-0.05	0.00	-0.01	-0.09	**-0.12***	**0.14***	0.03
High School	0.06	-0.09	0.11	-0.01	**0.14***	-0.00	-0.09	**-0.18****	0.09	0.06
College and Above	-0.07	**-0.21****	0.09	-0.07	0.18	0.15	-0.03	-0.10	0.02	0.03
Individual Characteristics										
Male	**-0.12****	**0.12****	**-0.18*****	**-0.18*****	**-0.25*****	**-0.10***	-0.03	**-0.10****	**-0.15*****	-0.05
Age groups										
(Ref category: Age 18-29.9 years)										
30-44.9	-0.02	0.09	0.03	0.01	0.03	0.02	0.12	0.04	**0.17****	**0.15****
45-60	0.04	0.09	0.05	0.03	-0.03	-0.03	-0.01	-0.09	**0.12***	**0.20*****
Above 60	**0.15****	**0.21*****	0.13*	0.11	0.12	0.11	0.08	0.03	**0.23*****	**0.26*****
Marital Status										
Currently Married	0.06	-0.03	0.01	0.05	0.00	-0.02	-0.02	0.01	-0.06	-0.07
BMI Categories (measured)										
(Ref category: Normal BMI 18.5-24.9)										
Underweight (BMI< 18.5)	0.01	0.04	-0.07	-0.06	-0.05	0.02	0.03	0.00	-0.06	-0.03
Overweight (BMI 25-29.9)	0.03	-0.01	-0.06	-0.05	**0.13***	0.08	**-0.20*****	**-0.15****	-0.02	0.06
Obese (BMI>30)	-0.00	**0.23***	-0.15	**-0.25***	0.11	0.21	0.01	0.03	**0.24***	0.10
Household's Expenditure Quintiles										
(Ref category: Q3)										
Q1	-0.08	**-0.16****	**-0.21*****	**-0.22*****	-0.07	**-0.18*****	**-0.10***	**-0.13****	**-0.17*****	**-0.14****
Q2	-0.06	-0.06	**-0.14****	**-0.14****	0.05	0.02	-0.03	-0.06	-0.09	-0.07
Q4	-0.04	-0.06	**-0.13****	**-0.12****	-0.04	-0.09	-0.04	**-0.12***	**-0.12****	**-0.17*****
Q5	0.00	0.06	**-0.14***	-0.10	-0.01	-0.02	0.03	-0.02	-0.06	-0.05
Religion (Hindu=1)	-0.06	**-0.10***	0.01	0.08	**-0.15*****	**-0.12****	-0.06	-0.05	0.01	-0.07
Caste (SC/ST=1)	**0.12*****	0.05	0.03	0.03	**0.10****	**0.10****	-0.03	0.02	**0.22*****	**0.16*****
Regional characteristics										
Urban	**-0.12****	**-0.12****	-0.05	-0.02	-0.04	-0.09*	-0.04	-0.01	**-0.09***	**-0.14*****
Underdeveloped	**-0.14*****	**0.12*****	**-0.26*****	**-0.12****	**-0.36*****	**-0.13*****	-0.02	0.02	**-0.20*****	0.05
Observations	2,674	2,674	2,674	2,674	2,674	2,674	2,674	2,674	2,674	2,674

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.2: Vignettes set 2: Pain and Personal Relationships

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Education Categories										
(Ref category: No formal education)										
Below Primary	-0.05	-0.09	0.03	**0.15****	0.07	0.05	-0.12	-0.05	-0.08	-0.09
Primary	**-0.17*****	**-0.12****	-0.03	-0.02	0.04	0.03	-0.04	-0.01	-0.10	-0.09
Secondary	-0.02	**-0.21*****	0.09	**0.20*****	-0.07	-0.02	-0.02	-0.01	-0.01	0.00
High School	-0.01	-0.11	0.03	0.07	0.07	0.03	-0.08	-0.10	-0.01	-0.01
College and Above	**-0.19***	**-0.25****	0.16	**0.23****	0.07	-0.01	-0.13	-0.07	-0.00	0.00
Individual Characteristics										
Male	-0.06	-0.03	-0.08	**-0.13*****	**-0.11****	**-0.14*****	**0.15*****	**0.13*****	**0.09***	-0.03
Age groups										
(Ref category: Age 18-29.9 years)										
30-44.9	0.05	-0.03	0.06	0.11	0.01	0.09	0.02	-0.06	0.01	0.05
45-60	0.02	-0.03	-0.01	0.07	**-0.12***	-0.01	0.02	-0.08	-0.03	0.07
Above 60	0.10	0.03	-0.05	0.02	-0.12	0.00	-0.03	-0.09	-0.08	0.05
Marital Status										
Currently Married	-0.05	0.04	**-0.11****	**-0.09***	-0.08	-0.04	**-0.14*****	**-0.10***	-0.07	-0.02
BMI Categories (measured)										
(Ref category: Normal BMI 18.5-24.9)										
Underweight (BMI< 18.5)	0.01	-0.02	0.05	0.04	0.02	0.02	0.04	0.04	0.03	-0.01
Overweight (BMI 25-29.9)	-0.02	-0.08	-0.03	-0.02	-0.02	0.04	0.10	0.10	-0.03	-0.01
Obese (BMI>30)	0.10	-0.14	0.05	0.09	0.04	0.01	-0.19	-0.08	**-0.21***	-0.18
Household's Expenditure Quintiles										
(Ref category: Q3)										
Q1	-0.09	**-0.11***	**-0.15****	-0.05	-0.09	-0.03	**-0.11***	-0.08	-0.03	-0.07
Q2	0.07	0.05	-0.08	-0.05	**-0.12***	-0.08	0.05	0.09	0.06	**0.12***
Q4	0.04	0.09	-0.04	-0.10	-0.08	-0.00	0.04	0.04	0.04	0.02
Q5	-0.05	0.00	**-0.13***	**-0.16****	0.07	-0.06	0.06	0.08	0.02	0.05
Religion (Hindu=1)	-0.02	**0.13****	-0.08	0.00	0.07	0.01	-0.08	-0.06	**-0.12****	**-0.13****
Caste (SC/ST=1)	**0.13*****	**0.08***	-0.04	**-0.09****	**0.15*****	0.06	**-0.12*****	**-0.11****	-0.06	-0.06
Regional characteristics										
Urban	-0.06	-0.07	-0.01	-0.02	-0.08	-0.00	0.01	-0.03	0.01	-0.03
Underdeveloped	-0.05	0.03	**-0.20*****	0.01	**-0.25*****	**-0.15*****	**-0.37*****	**-0.19*****	**-0.23*****	-0.02
Observations	2,729	2,729	2,729	2,729	2,729	2,729	2,729	2,729	2,729	2,729

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.3: Vignettes set 3: Vision, Sleep and Energy

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Education Categories										
(Ref category: No formal education)										
Below Primary	0.12	0.11	0.01	-0.01	0.06	0.09	0.06	0.06	0.03	0.01
Primary	0.01	**-0.13****	-0.03	0.03	0.01	**-0.11***	-0.08	-0.08	-0.00	-0.08
Secondary	0.08	0.00	-0.04	-0.09	**0.18****	0.09	0.07	0.08	0.01	0.00
High School	**0.30*****	**0.14***	-0.06	**-0.16****	0.12	-0.00	-0.11	-0.08	0.03	**-0.15***
College and Above	**0.47*****	**0.26*****	0.05	-0.14	**0.17***	0.03	**0.24****	0.15	**0.18***	-0.03
Individual Characteristics										
Male	-0.07	-0.04	-0.05	-0.08	0.01	0.01	**-0.18*****	**-0.21*****	**-0.13*****	**-0.09***
Age groups										
(Ref category: Age 18-29.9 years)										
30-44.9	-0.04	0.00	-0.03	-0.11	**0.15****	0.07	0.05	0.02	-0.02	-0.07
45-60	0.03	0.05	0.09	-0.00	**0.14****	**0.12***	0.02	-0.01	0.01	-0.04
Above 60	0.08	0.07	0.11	0.08	**0.20*****	0.11	0.00	0.01	0.05	-0.01
Marital Status										
Currently Married	-0.08	**-0.09***	0.00	0.07	0.01	-0.08	-0.02	-0.02	0.06	-0.02
BMI Categories (measured)										
(Ref category: Normal BMI 18.5-24.9)										
Underweight (BMI< 18.5)	0.00	-0.02	0.03	0.05	0.03	-0.00	**0.09****	**0.08***	**0.09****	**0.10****
Overweight (BMI 25-29.9)	-0.10	0.02	0.01	0.01	-0.11	-0.06	0.04	**0.12***	-0.00	-0.02
Obese (BMI>30)	-0.05	0.07	-0.19	0.02	**-0.20***	-0.08	0.11	**0.22***	0.09	0.13
Household's Expenditure Quintiles										
(Ref category: Q3)										
Q1	0.00	-0.05	-0.06	-0.04	0.02	-0.05	0.05	-0.00	0.03	-0.04
Q2	-0.01	-0.06	-0.09	0.00	-0.05	0.00	0.03	0.08	0.07	0.05
Q4	-0.10	**-0.12****	-0.08	0.06	-0.02	-0.02	0.08	0.02	0.09	0.02
Q5	-0.08	-0.04	-0.06	0.05	0.05	0.07	0.07	-0.02	0.07	0.10
Religion (Hindu=1)	-0.04	-0.02	0.01	-0.03	-0.02	0.06	-0.02	0.05	-0.04	0.06
Caste (SC/ST=1)	**0.08***	**0.11*****	-0.04	**-0.17*****	**-0.08***	0.01	-0.02	-0.06	**-0.20*****	**-0.12*****
Regional characteristics										
Urban	**-0.13****	**-0.12****	-0.01	0.05	-0.08	**-0.10***	-0.08	-0.02	**-0.12****	-0.03
Underdeveloped	**-0.37*****	**-0.09****	**-0.25*****	**-0.21*****	**-0.10****	**-0.10****	**-0.42*****	**-0.23*****	**-0.36*****	**-0.30*****
Observations	2,771	2,771	2,771	2,771	2,771	2,771	2,771	2,771	2,771	2,771

*** p<0.01, ** p<0.05, * p<0.1

Table 2.2.4: Vignettes set 4: Cognition and Self-care

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Education Categories										
(Ref category: No formal education)										
Below Primary	**-0.12***	-0.09	**-0.12***	**-0.13***	0.06	0.03	-0.02	0.07	0.01	-0.03
Primary	**-0.11***	**-0.11***	-0.09	-0.05	0.08	0.02	0.02	0.04	**-0.12***	**-0.15****
Secondary	**-0.13***	-0.05	-0.04	-0.08	-0.09	-0.04	**-0.15****	-0.10	-0.01	-0.03
High School	-0.04	-0.01	-0.08	-0.07	0.09	0.11	**0.18****	**0.15****	0.02	0.04
College and Above	-0.06	-0.08	-0.01	-0.04	0.06	0.10	**0.18***	0.16	0.05	-0.03
Individual Characteristics										
Male	0.03	0.01	0.01	**-0.09***	**-0.12****	**-0.19*****	**-0.16*****	**-0.19*****	0.07	0.02
Age groups										
(Ref category: Age 18-29.9 years)										
30-44.9	0.05	0.03	0.08	0.09	0.06	0.01	**-0.15****	**-0.16****	0.11	0.10
45-60	0.11	0.05	0.10	0.08	0.07	0.07	**-0.19*****	**-0.18****	**0.13***	0.04
Above 60	**0.24*****	**0.19*****	**0.18****	**0.21*****	**0.12***	**0.15****	**-0.14***	-0.12	0.11	**0.14****
Marital Status										
Currently Married	-0.06	-0.03	-0.01	0.05	0.08	**0.09***	0.05	**0.09***	**-0.10***	-0.09
BMI Categories (measured)										
(Ref category: Normal BMI 18.5-24.9)										
Underweight (BMI< 18.5)	-0.00	0.07	0.05	0.04	0.04	0.00	0.01	-0.04	**0.10****	0.05
Overweight (BMI 25-29.9)	-0.03	-0.05	-0.02	-0.06	-0.07	-0.03	0.06	0.02	0.01	0.04
Obese (BMI>30)	-0.13	-0.07	-0.13	0.01	0.06	-0.11	-0.09	-0.02	0.01	0.09
Household's Expenditure Quintiles										
(Ref category: Q3)										
Q1	0.02	-0.01	-0.09	**-0.15****	0.03	-0.06	0.06	0.08	-0.04	-0.03
Q2	0.04	0.05	-0.01	-0.09	-0.01	**-0.11***	0.09	0.05	-0.06	-0.04
Q4	**0.13****	0.09	-0.04	**-0.11***	-0.05	-0.05	0.03	0.09	0.07	0.03
Q5	**0.13***	0.10	-0.01	0.00	**0.13***	0.09	**0.11***	**0.15****	-0.02	-0.05
Religion (Hindu=1)	-0.07	-0.04	-0.00	-0.06	-0.00	0.05	0.02	0.03	0.03	-0.01
Caste (SC/ ST=1)	**0.19*****	**0.17*****	0.01	0.02	**0.12*****	**0.16*****	**0.13*****	**0.13*****	**-0.12*****	-0.06
Regional characteristics										
Urban	-0.02	-0.06	**-0.11****	**-0.11****	0.04	-0.01	0.07	-0.02	-0.01	0.03
Underdeveloped	**-0.52*****	**-0.41*****	**-0.25*****	**-0.08***	**-0.38*****	**-0.19*****	**-0.28*****	**-0.23*****	**-0.23*****	**-0.09****
Observations	2,699	2,699	2,699	2,699	2,699	2,699	2,699	2,699	2,699	2,699

*** p<0.01, ** p<0.05, * p<0.1

Table 2.3: Dependent variable: Self reported health

VARIABLES **Health Today**		(1)	(2)	(3)	(4)
	Below Primary	-0.10***	-0.09**	-0.07*	-0.07*
Education Categories *(Ref category: No formal education)*	Primary	-0.10***	-0.08**	-0.04	-0.03
	Secondary	-0.25***	-0.23***	-0.16***	-0.14***
	High School	-0.38***	-0.36***	-0.25***	-0.23***
	College and Above	-0.63***	-0.60***	-0.46***	-0.44***
Individual Characteristics	Male	-0.12***	-0.13***	-0.09***	-0.08***
Age groups *(Ref category: Age 18-29.9 years)*	30-44.9	0.51***	0.53***	0.50***	0.47***
	45-60	0.82***	0.85***	0.76***	0.70***
	Above 60	1.18***	1.19***	1.04***	0.91***
Marital Status	Currently Married	-0.06**	-0.05*	-0.04	-0.03
	Q1	-0.02	-0.04	-0.02	-0.03
Household's Expenditure Quintiles *(Ref category: Q3)*	Q2	-0.04	-0.05	-0.05	-0.05
	Q4	-0.01	0.00	0.02	0.03
	Q5	-0.09**	-0.07**	-0.09**	-0.08**
	Religion (Hindu=1)	-0.19***	-0.19***	-0.18***	-0.17***
	Caste (SC/ST=1)	-0.05**	-0.06***	-0.08***	-0.11***
Regional characteristics	Urban	-0.11***	-0.10***	-0.10***	-0.08***
	Underdeveloped	-0.27***	-0.27***	-0.26***	-0.32***
BMI Categories (measured) *(Ref category: Normal bmi 18.5-24.9)*	Underweight (bmi< 18.5)		0.20***	0.17***	0.15***
	Overweight (bmi 25-29.9)		0.02	0.00	-0.01
	Obese (bmi>30)		0.08	0.01	0.00
	Rapid Walk			-0.32***	-0.08
	Cognitive score 1			-0.02	-0.02
	Cognitive score 2			-0.06***	-0.06***
	Cognitive score 3			0.00	0.00
Performance Tests	Chronic illness			0.25***	0.20***
	Lung function			0.00	0.00
	Blood Pressure Systolic			0.00	0.00
	Blood Pressure Diastolic			0.00	0.00
	Pulse rate			0.00***	0.00***
	Hearing				0.35***
	Vision				0.17***
Interviewer Assessments	Walking				0.36***
	Shortness of breath				0.28***
	Overall health problem				0.33***
	Observations	10873	10873	10873	10873

Table 2.4 : Dependent Variables: Self-reported Functioning measures across various domains of Mobility

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Education Categories						
(Ref category: No formal education)						
Below Primary	-0.05	**-0.07***	-0.02	-0.06	-0.02	-0.02
Primary	**-0.06***	-0.05	-0.04	**-0.09*****	-0.03	**-0.09*****
Secondary	**-0.23*****	**-0.30*****	**-0.26*****	**-0.26*****	**-0.22*****	**-0.27*****
High School	**-0.23*****	**-0.30*****	**-0.20*****	**-0.37*****	**-0.28*****	**-0.27*****
College and Above	**-0.50*****	**-0.52*****	**-0.51*****	**-0.60*****	**-0.60*****	**-0.51*****
Individual Characteristics						
Male	**-0.27*****	**-0.14*****	**-0.36*****	**-0.44*****	**-0.44*****	**-0.38*****
Age groups						
(Ref category: Age 18-29.9 years)						
30-44.9	**0.48*****	**0.48*****	**0.49*****	**0.35*****	**0.56*****	**0.52*****
45-60	**0.83*****	**0.84*****	**0.86*****	**0.70*****	**1.00*****	**0.98*****
Above 60	**1.27*****	**01.31*****	**1.18*****	**1.09*****	**1.40*****	**1.41*****
Marital Status						
Currently Married	-0.03	-0.05*	0.02	0.02	-0.01	0.00
Household's Expenditure Quintiles						
(Ref category: Q3)						
Q1	**0.08****	-0.03	-0.01	0.02	0.03	-0.01
Q2	0.06	-0.02	**0.06***	**0.07***	**0.07****	0.05
Q4	0.04	-0.01	-0.03	**0.06***	-0.03	-0.01
Q5	0.00	0.03	-0.03	-0.02	0.02	-0.05
Religion (Hindu=1)	**-0.12*****	**-0.13*****	**-0.11*****	**-0.14*****	**-0.12*****	**-0.16*****
Caste (SC/ST=1)	**0.14*****	**-0.06****	**0.07*****	-0.00	**0.11*****	0.03
Regional characteristics						
Urban	**-0.11*****	**-0.17*****	**-0.09*****	-0.03	**-0.06****	**-0.08*****
Underdeveloped	**-0.18*****	**-0.04***	**-0.22*****	**-0.33*****	**-0.22*****	**-0.06****
BMI Categories (measured)						
(Ref category: Normal BMI 18.5-24.9)						
Underweight (BMI< 18.5)	**0.08*****	**0.12*****	**0.06****	**0.07*****	**0.07*****	**0.11*****
Overweight (BMI 25-29.9)	**0.12*****	**0.06***	**0.12*****	**0.10****	**0.15*****	**0.19*****
Obese (BMI>30)	**0.27*****	**0.27*****	**0.20*****	**0.30*****	**0.35*****	**0.27*****
Walk Difficulty						
Timed walk	-0.34	0.22	-0.24	-0.03	-0.35	-0.14
Rapid Walk	-0.36	**-0.46***	-0.12	**-0.59****	-0.29	**-0.43***
Interviewer Assessment	**-0.73*****	**-0.34*****	**-0.49*****	**-0.37*****	**-0.50*****	**-0.54*****
Observations	10,873	10,873	10,873	10,873	10,873	10,873

*** p<0.01, ** p<0.05, * p<0.1

The dependent variables in all the specifications takes value 1-5 measuring self reported difficulty level (1=no difficulty; 5=extreme difficulty) faced by the respondent in the specific activity describing some form of mobility.

Continuation of Table 2.4: Dependent Variables: Self-reported functioning measures across various domains of Mobility

Variables	(7)	(8)	(9)	(10)	(11)	(12)
Education Categories						
(Ref category: No formal education)						
Below Primary	-0.00	-0.02	-0.06	0.01	**-0.08****	-0.04
Primary	**-0.08****	**-0.07***	**-0.10****	**-0.08****	**-0.10*****	**-0.21*****
Secondary	**-0.28*****	**-0.22*****	**-0.18*****	**-0.26*****	**-0.25*****	**-0.25*****
High School	**-0.24*****	**-0.24*****	**-0.17*****	**-0.21*****	**-0.38*****	**-0.34*****
College and Above	**-0.55*****	**-0.49*****	**-0.42*****	**-0.62*****	**-0.56*****	**-0.45*****
Individual Characteristics						
Male	**-0.42*****	**-0.28*****	**-0.09*****	**-0.15*****	**-0.18*****	**-0.18*****
Age groups						
(Ref category: Age 18-29.9 years)						
30-44.9	**0.44*****	**0.51*****	**0.35*****	**0.42*****	**0.21*****	**0.44*****
45-60	**0.80*****	**1.03*****	**0.76*****	**0.77*****	**0.44*****	**0.84*****
Above 60	**1.23*****	**1.50*****	**1.19*****	**1.13*****	**0.76*****	**1.15*****
Marital Status						
Currently Married	0.02	-0.01	-0.02	**-0.09*****	**-0.14*****	0.02
Household's Expenditure Quintiles						
(Ref category: Q3)						
Q1	0.03	0.04	**0.12*****	**0.07****	-0.05	0.06
Q2	0.04	0.04	**0.13*****	**0.06***	-0.04	**0.08****
Q4	-0.02	-0.01	-0.07	0.01	-0.02	0.04
Q5	-0.03	-0.03	**-0.10****	**-0.08****	0.00	-0.06
Religion (Hindu=1)	**-0.14*****	**-0.11*****	**-0.08****	**-0.12*****	**-0.08****	-0.00
Caste (SC/ST=1)	**0.14*****	**0.08*****	**0.09*****	**0.18*****	**-0.10*****	**0.13*****
Regional characteristics						
Urban	**-0.16*****	**-0.13*****	0.03	**-0.05***	**-0.06****	-0.05
Underdeveloped	**-0.34*****	**-0.20*****	-0.05	**-0.08*****	**-0.30*****	**-0.30*****
BMI Categories (measured)						
(Ref category: Normal BMI 18.5-24.9)						
Underweight (BMI< 18.5)	**0.11*****	0.03	**0.06****	**0.09*****	**0.10*****	0.04
Overweight (BMI 25-29.9)	0.05	**0.17*****	0.07	0.04	**0.09****	**0.09****
Obese (BMI>30)	**0.19*****	**0.32*****	0.10	**0.14****	**0.18*****	**0.17****
Walk Difficulty						
Timed walk	0.41	0.24	**-0.69****	-0.15	0.01	-0.43
Rapid Walk	**-0.88*****	**-0.78*****	0.17	-0.36	-0.33	0.19
Interviewer Assessment	**-0.36*****	**-0.46*****	**-0.29*****	**-0.39*****	**-0.37*****	**-0.52*****
Observations	10,873	10,873	10,873	10,873	10,873	10,873

*** p<0.01, ** p<0.05, * p<0.1

The dependent variables in all the specifications takes value 1-5 measuring self reported difficulty level (1=no difficulty; 5=extreme difficulty) faced by the respondent in the specific activity describing some form of mobility.

Table 2.5: Dependent Variables: Self reported Functioning measures across various domains of Daily Activities

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Education Categories											
(Ref category: No formal education)											
Below Primary	-0.05	-0.04	-0.06	**-0.09****	**-0.08****	**-0.12****	-0.06	0.01	-0.07	-0.05	**-0.09****
Primary	**-0.09*****	**-0.16*****	**-0.16*****	**-0.12*****	**-0.09****	**-0.12*****	**-0.19*****	**-0.17*****	**-0.18*****	**-0.14*****	**-0.19*****
Secondary	**-0.27*****	**-0.22*****	**-0.16****	**-0.31*****	**-0.23*****	**-0.21*****	**-0.09***	**-0.22*****	**-0.23*****	**-0.31*****	**-0.40*****
High School	**-0.29*****	**-0.28*****	**-0.33*****	**-0.25*****	**-0.26*****	**-0.22*****	**-0.18*****	**-0.33*****	**-0.30*****	**-0.43*****	**-0.45*****
College and Above	**-0.58*****	**-0.50*****	**-0.54*****	**-0.57*****	**-0.44*****	**-0.49*****	**-0.39*****	**-0.61*****	**-0.61*****	**-0.59*****	**-0.69*****
Individual Characteristics											
Male	**-0.39*****	**-0.07***	**-0.03**	**-0.29*****	**-0.20*****	**-0.18*****	**-0.16*****	**-0.25*****	**-0.19*****	**-0.30*****	**-0.16*****
Age groups											
(Ref category: Age 18-29.9 years)											
30-44.9	**0.31*****	**0.22*****	**0.38*****	**0.32*****	**0.39*****	**0.35*****	**0.34*****	**0.50*****	**0.43*****	**0.31*****	**0.29*****
45-60	**0.70*****	**0.58*****	**0.68*****	**0.73*****	**0.82*****	**0.73*****	**0.66*****	**0.89*****	**0.76*****	**0.65*****	**0.70*****
Above 60	**1.15*****	**0.95*****	**1.00*****	**1.06*****	**1.23*****	**1.11*****	**1.04*****	**1.24*****	**1.14*****	**1.09*****	**1.16*****
Marital Status											
Currently Married	0.03	-0.06	**-0.07***	-0.03	**-0.06****	-0.02	**-0.07****	-0.03	-0.01	**-0.05***	-0.05
Household's Expenditure Quintiles											
(Ref category: Q3)											
Q1	0.03	0.00	0.03	0.01	-0.04	-0.00	-0.01	0.03	0.06	-0.04	**-0.09*****
Q2	0.02	0.01	-0.04	-0.01	-0.02	0.03	-0.02	0.06	0.00	0.03	-0.02
Q4	0.02	-0.02	-0.02	-0.02	**0.06***	-0.01	-0.01	-0.00	-0.03	0.00	-0.02
Q5	0.02	-0.03	-0.05	**-0.08****	0.02	0.02	-0.05	-0.04	**-0.12*****	-0.05	**-0.06***
Religion (Hindu=1)	**-0.18*****	**-0.14*****	**-0.15*****	**-0.17*****	**-0.16*****	**-0.10*****	-0.01	**-0.07****	-0.01	**-0.09*****	**-0.11*****
Caste (SC/ST=1)	**0.06*****	0.02	-0.04	**0.06****	0.03	-0.01	0.03	**0.07*****	**0.07****	**0.08*****	-0.01
Regional characteristics											
Urban	**-0.07*****	0.00	0.00	**-0.06****	**-0.20*****	**-0.06***	0.03	**-0.09*****	**-0.10*****	**-0.11*****	-0.01
Underdeveloped	**-0.27*****	**-0.17*****	**-0.21*****	**-0.28*****	**-0.16*****	**-0.23*****	**0.25*****	**-0.30*****	0.02	**0.15*****	**0.19*****
BMI Categories (measured)											
(Ref category: Normal BMI 18.5-24.9)											
Underweight (BMI< 18.5)	**0.11*****	**0.15*****	**0.10*****	**0.08*****	**0.13*****	**0.11*****	**0.10*****	**0.07*****	**0.07****	**0.10*****	**0.12*****
Overweight (BMI 25-29.9)	**0.14*****	0.08	0.05	0.02	**0.08****	**0.10****	-0.03	**0.15*****	**0.11****	**0.10****	**0.13*****
Obese (BMI>30)	**0.36*****	**0.20****	**0.22****	**0.21*****	**0.26*****	**0.24*****	0.06	**0.33*****	**0.27*****	**0.23*****	**0.28*****
Walk Difficulty											
Timed walk	0.08	-0.48	**-1.00*****	0.13	0.39	**-0.55***	-0.31	-0.22	**-0.55***	-0.26	-0.22
Rapid Walk	**-0.71*****	-0.14	0.35	**-0.65****	**-0.92*****	-0.17	-0.04	-0.13	-0.04	**-0.46***	**-0.44***
Interviewer Assessment	**-0.55*****	**-0.51*****	**-0.63*****	**-0.50*****	**-0.39*****	**-0.56*****	**-0.36*****	**-0.64*****	**-0.59*****	**-0.43*****	**-0.55*****
Observations	10,873	10,873	10,873	10,873	10,873	10,873	10,873	10,873	10,873	10,873	10,873

*** p<0.01, ** p<0.05, * p<0.1

The dependent variables in all the specifications takes value 1-5 measuring self reported difficulty level (1=no difficulty; 5=extreme difficulty) faced by the respondent in the specific activity describing some form of daily activities.

Table 2.6 : Summary Table of Ordered Probit Regressions with Self reported data

	Positive and Significant	Positive and Insignificant	Negative and Significant	Negative and Insignificant
Education Categories				
(Ref category: No formal education)				
Below Primary	0	2	6	15
Primary	0	0	20	3
Secondary	0	0	23	0
High School	0	0	23	0
College and Above	0	0	23	0
Individual Characteristics				
Male	0	0	22	1
Age groups				
(Ref category: Age 18-29.9 years)				
30-44.9	23	0	0	0
45-60	23	0	0	0
Above 60	23	0	0	0
Marital Status				
Currently Married	0	6	7	10
Household's Expenditure Quintiles				
(Ref category: Q3)				
Q1	3	11	1	8
Q2	6	10	0	7
Q4	2	5	0	16
Q5	0	7	5	11
Religion (Hindu=1)	0	0	20	3
Caste (SC/ST=1)	13	4	2	4
Regional characteristics				
Urban	0	4	16	3
Underdeveloped	3	1	18	1
BMI Categories (measured)				
(Ref category: Normal BMI 18.5-24.9)				
Underweight (BMI< 18.5)	21	2	0	0
Overweight (BMI 25-29.9)	16	6	0	1
Obese (BMI>30)	21	2	0	0
Walk Difficulty				
Timed walk	0	7	4	12
Rapid Walk	0	3	10	10
Interviewer Assessment	0	0	23	0

Table 2.7: Dependent Variable: Self reported Cognitive difficulty

VARIABLES	(1)	(2)
Self reported cognition	**Memory**	**Concentration**
Education Categories		
(Ref category: No formal education)		
Below Primary	-0.12***	-0.11***
Primary	-0.09**	-0.10***
Secondary	-0.30***	-0.33***
High School	-0.38***	-0.42***
College and Above	-0.52***	-0.69***
Individual Characteristics		
Male	-0.18***	-0.07**
Age groups		
(Ref category: Age 18-29.9 years)		
30-44.9	0.53***	0.48***
45-60	0.88***	0.81***
Above 60	1.22***	1.23***
Marital Status		
Currently Married	-0.08***	-0.08***
Household's Expenditure Quintiles		
(Ref category: Q3)		
Q1	-0.00	-0.02
Q2	-0.01	-0.01
Q4	0.03	-0.00
Q5	-0.01	-0.03
Religion (Hindu=1)	-0.15***	-0.05
Caste (SC/ST=1)	0.01	-0.01
Regional characteristics		
Urban	-0.23***	-0.13***
Underdeveloped	-0.10***	-0.10***
Cognitive tests		
Cognitive Score 1	-0.04***	-0.04***
Cognitive Score 2	-0.08***	-0.07***
Words recalled	-0.03***	-0.02***

*** p<0.01, ** p<0.05, * p<0.1

The dependent variables in both the specifications takes value 1-5 measuring self reported difficulty level (1=no difficulty; 5=extreme difficulty) faced by the respondent in remembering and concentrating things Objective measures include (test of words recalled after delay, digital recall test and verbal fluency)

Table 2.8: Dependent Variable: Objective Memory and Cognitive tests

VARIABLES	(1)	(2)	(3)
Objective memory tests	**Words recalled**	**Score1**	**Score2**
Education Categories			
(Ref category: No formal education)			
Below Primary	0.24***	0.43***	0.51***
Primary	0.39***	0.71***	0.78***
Secondary	0.57***	0.94***	1.11***
High School	0.80***	1.22***	1.46***
College and Above	0.98***	1.55***	1.84***
Individual Characteristics			
Male	-0.07***	0.31***	0.40***
Age groups			
(Ref category: Age 18-29.9 years)			
30-44.9	-0.25***	-0.21***	-0.20***
45-60	-0.56***	-0.42***	-0.34***
Above 60	-0.85***	-0.63***	-0.49***
Marital Status			
Currently Married	0.08***	0.07***	0.05*
Household's Expenditure Quintiles			
(Ref category: Q3)			
Q1	-0.12***	-0.10***	-0.03
Q2	-0.05	-0.06*	-0.03
Q4	0.04	0.03	0.08**
Q5	0.12***	0.14***	0.20***
Religion (Hindu=1)	0.04	-0.02	-0.05*
Caste (SC/ST=1)	-0.01	-0.13***	-0.08***
Regional characteristics			
Urban	0.16***	0.09***	0.15***
Underdeveloped	0.11***	-0.11***	-0.23***

*** p<0.01, ** p<0.05, * p<0.1

The dependent variables in all the specifications are objective measures of Memory and Cognition including (test of words recalled after delay, digital recall test and verbal fluency.)

Table 2.9: Dependent Variable: Objective measures of difficulty in Mobility and General health

Objective Mobility Measures		(1) Assessed Walk	(2) Assessed Walk	(3) Assessed Health	(4) Assessed Health
Education Categories					
(Ref category: No formal education)					
Below Primary		-0.11	-0.11	-0.03	-0.04
Primary		-0.12	-0.13*	-0.02	-0.03
Secondary		-0.16*	-0.16*	-0.23***	-0.24***
High School		-0.31***	-0.32***	-0.11**	-0.12**
College and Above		-0.29**	-0.31**	-0.17**	-0.18***
Individual Characteristics					
Male		0.08	**0.09***	-0.13***	-0.12***
Age groups					
(Ref category: Age 18-29.9 years)					
30-44.9		0.32**	0.31*	0.26***	0.25***
45-60		0.79***	0.77***	0.47***	0.45***
Above 60		1.34***	1.32***	0.73***	0.72***
Marital Status					
Currently Married		-0.12**	-0.12**	-0.00	-0.00
Household's Expenditure Quintiles					
(Ref category: Q3)					
Q1		0.08	0.08	-0.05	-0.05
Q2		-0.06	-0.06	-0.04	-0.04
Q4		-0.02	-0.02	-0.09**	-0.09**
Q5		-0.16**	-0.16**	-0.08*	-0.09**
Religion (Hindu=1)		-0.01	-0.00	-0.02	-0.02
Caste (SC/ST=1)		0.06	0.06	0.22***	0.22***
Regional characteristics					
Urban		0.01	0	-0.11***	-0.12***
Underdeveloped		**0.53*** **	**0.53*** **	**0.14*** **	**0.14*** **
Underweight			0.07		0.03
Overweight			0.15*		0.15***
Obese			0.32**		0.17**
Observations	10,873	10,873	10,873	10,873	10,873

*** p<0.01, ** p<0.05, * p<0.1

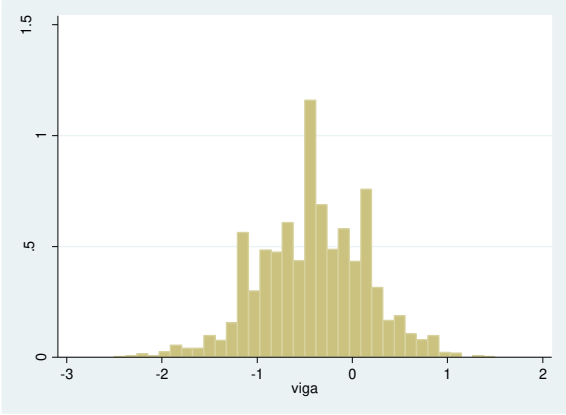
The dependent variables in all the specifications are interviewer assessed difficulty (dummy variable) in Mobility and General health
Specification (2) and (4) controls for body mass index categories.

Table 2.10 Estimations of two-stage regressions using individual fixed effects

VARIABLES	(1) Vignette Set A	(2) Vignette Set B	(3) Vignette Set C	(4) Vignette Set D
Education Categories				
Below Primary	0.02	-0.03	0.04	-0.11
Primary	0.00	-0.05	-0.05	-0.10*
Secondary	-0.01	-0.02	0.03	-0.11*
High School	0.00	-0.01	-0.01	-0.03
College and Above	0.01	-0.02	0.11**	-0.05
Individual Characteristics				
Male	**-0.08*** **	-0.01	**-0.07*** **	0.03
Age groups				
30-44.9	0.05	0.03	0.00	0.04
45-60	0.02	-0.01	0.04	0.10
Above 60	**0.11*** **	-0.01	**0.07***	**0.21*** **
Marital Status				
Currently Married	-0.01	**-0.06** **	-0.02	-0.05
BMI Categories (measured)				
Underweight (bmi< 18.5)	-0.01	0.02	0.04*	0.00
Overweight (bmi 25-29.9)	-0.02	-0.01	-0.01	-0.03
Obese (bmi>30)	0.05	-0.05	0.01	-0.12
Household's Expenditure Quintiles				
Q1	**-0.16*** **	**-0.07** **	-0.01	0.02
Q2	-0.08**	0.01	0.01	0.03
Q4	**-0.11*** **	0.01	-0.00	0.11*
Q5	-0.05	-0.01	0.02	0.11*
Religion (Hindu=1)	-0.04	-0.01	-0.00	-0.06
Caste (SC/ST=1)	0.08***	-0.01	-0.05**	0.17***
Regional characteristics				
Urban	**-0.06** **	-0.02	**-0.06** **	-0.02
Underdeveloped	**-0.09*** **	**-0.12*** **	**-0.22*** **	**-0.47*** **
Constant	-0.29***	-0.16***	-0.44***	2.45***
Observations	2,673	2,728	2,770	2,698
R-squared	0.03	0.02	0.04	0.07

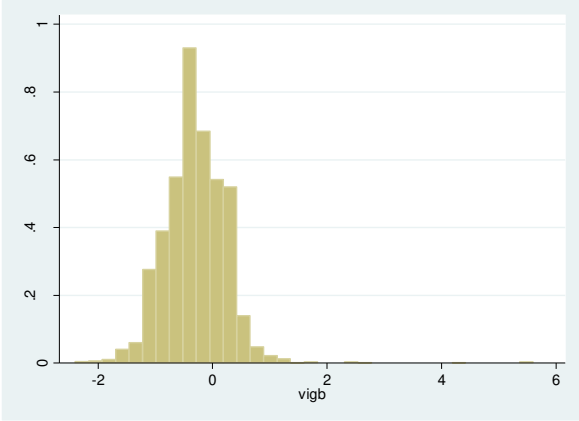
*** p<0.01, ** p<0.05, * p<0.1

Figure 2.9: Distribution of estimated coefficients for individual reporting from Vignette set A



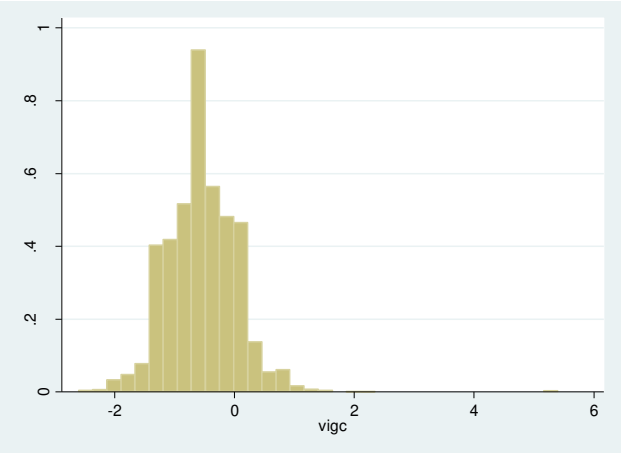
Note: Health domains in set A includes Mobility and Affect

Figure 2.10: Distribution of estimated coefficients for individual reporting from Vignette set B



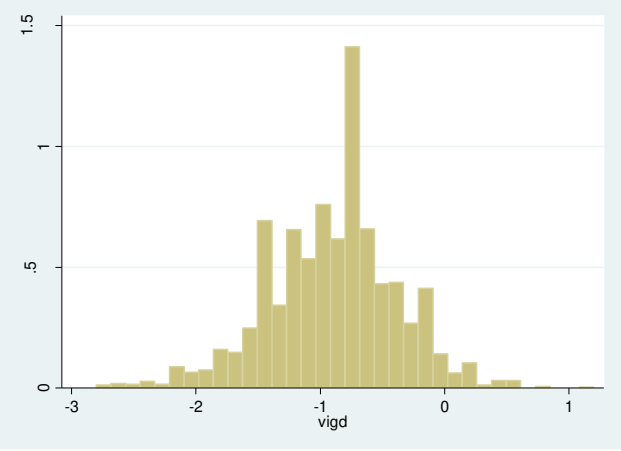
Note: Health domains in set B includes Pain and Personal Relationships

Figure 2.11: Distribution of estimated coefficients for individual reporting from Vignette set C



Note: Health domains in set A includes Vision, Sleep and Energy

Figure 2.12: Distribution of estimated coefficients for individual reporting from Vignette set D



Note: Health domains in set A includes Cognition and Self-Care

Appendix

List of five sample vignettes from each health domain in WHS-SAGE Survey questionnaire

Set A Affect and Mobility

[Alan] is able to walk distances of up to 200 metres without any problems but feels tired after walking one kilometre or climbing up more than one flight of stairs. He has no problems with day-to-day physical activities, such as carrying food from the market.

[Manjima] enjoys her work and social activities and is generally satisfied with her life. She gets depressed every 3 weeks for a day or two and loses interest in what she usually enjoys but is able to carry on with her day to day activities.

[Miriam] does not exercise. She cannot climb stairs or do other physical activities because she is obese. She is able to carry the groceries and do some light household work.

[Vladimir] is paralyzed from the neck down. He is unable to move his arms and legs or to shift body position. He is confined to bed.

[Ang] has already had five admissions into the hospital because she has attempted suicide twice in the past year and has harmed herself on three other occasions. She is very distressed every day for the most part of the day, and sees no hope of things ever getting better. She is thinking of trying to end her life again.

Set B Pain and Personal Relationships

[Elizabeth] has difficulty climbing up and down the stairs and walking. She is not able to go out as much as she would like to but has many friends who come and visit her at home. Her friends find her a source of great comfort.

[Markus] has pain in his knees, elbows, wrists and fingers, and the pain is present almost all the time. It gets worse during the first half of the day. Although medication helps, he feels uncomforTable when moving around, holding and lifting things.

[Nobu] is blind and lives in a remote rural area. His family does not allow him to leave the house because they fear he will get hurt. His family tells him that he is a burden to them. Their criticism upsets him and he cries.

[Laura] has a headache once a month that is relieved one hour after taking a pill. During the headache she can carry on with her day to day affairs.

[Isabelle] has pain that radiates down her right arm and wrist during her day at work. This is slightly relieved in the evenings when she is no longer working on her computer.

Set C Vision, Sleep and Energy

[Damien] wakes up almost once every hour during the night. When he wakes up in the night, it takes around 15 minutes for him to go back to sleep. In the morning he does not feel well-rested and feels slow and tired all day.

Antonio] can read words in newspaper articles (and can recognize faces on a postcard size photograph). He can recognize shapes and colours from across 20 metres but misses out the fine details.

[Paolo] has no trouble falling asleep at night and does not wake up during the night, but every morning he finds it difficult to wake up. He uses an alarm clock but falls back asleep after the alarm goes off. He is late to work on four out of five days and feels tired in the mornings.

[Jennifer] only reads if the text is in very large print, such as 10 lines per page. Otherwise she does not read anything. Even when people are close to her, she sees them blurred.

[Noemi] falls asleep easily at night, but two nights a week she wakes up in the middle of the night and cannot go back to sleep for the rest of the night. On these days she is exhausted at work and cannot concentrate on her job.

Set D Cognition and Self-Care

[Anne] takes twice as long as others to put on and take off clothes, but needs no help with this. Although It requires an effort, she is able to bathe and groom herself, though less frequently than before. She does not require help with feeding.

[Sue] can find her way around the neighborhood and know where her own belongings are kept, but struggles to remember how to get to a place she has only visited once or twice. She is keen to learn new recipes but finds that she often makes mistakes and has to reread several times before she is able to do them properly

[Theo] cannot concentrate for more than 15 minutes and has difficulty paying attention to what is being said to him. Whenever he starts a task, he never manages to finish it and often forgets what he was doing. He is able to learn the names of people he meets but cannot be trusted to follow directions to a store by himself

[Sandra] lives on her own and has no relatives or friends nearby. Because of her arthritis, she is housebound. She often stays all day in the same clothes that she has slept in, as changing clothes is too painful. A neighbour helps her wash herself.

[Victor] requires no assistance with cleanliness, dressing and eating. He occasionally suffers from back pain and when this happens he needs help with bathing and dressing. He always keeps himself tidy.