VALIDITY OF SELF-REPORT DATA IN HYPERTENSION RESEARCH: FINDINGS FROM THE STUDY ON GLOBAL AGEING AND ADULT HEALTH

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Abstract

Purpose: Several studies indicate little congruence between self-report and biometric data, yet very few have examined the reasons for such differences. This paper contributes to the limited but growing body of literature that tracks inconsistent reports of hypertension using data from the Study on Global Ageing and Adult Health (SAGE). Focusing on five countries with different levels of development (Ghana, China, India, South Africa and Russia), this study offers a comparative perspective that is missing in the literature. **Methodology**: Data were obtained from Wave 1 of the SAGE collected in 2007/2008. A multinomial logit model was used to examine the effects of both demographic and socio-economic variables on the likelihood of respondents self-reporting that they are not hypertensive when their biometric data shows otherwise. We also model the likelihood of respondents self-reporting that they are hypertensive when in fact their biometric data shows otherwise. **Results:** Socio-economic and demographic variables are significantly associated with inconsistent reporting of hypertension. For instance, we observe that wealth is associated with a lower likelihood of self-reporting that one is not hypertensive when biometric data indicate otherwise. **Conclusions**: Tracking such inconsistent reports is crucial to minimizing measurement errors and generating unbiased and more precise parameter estimates in hypertension research.

Keywords: Validity, hypertension, self-reported and biometric data; SES; demographic factors

Introduction:

Despite a major public health concern, hypertension or high blood pressure is a developmental issue. Defined as blood pressure > or = 140/90 mm Hg, hypertension is attributed to 7.1 million deaths globally[1]. Blood pressure reading and reporting constitutes a ratio: Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP); SBP indicates the arterial blood pressure during cardiac contraction and DBP correlates with arterial pressure during cardiac relaxation. Monitoring both SBP and DBP is becoming more acceptable worldwide in the diagnosis, management and prevention of cardiovascular diseases[2]. Recognized as non-communicable disease, blood pressure-related conditions are endemic worldwide[3, 4]. It is well-documented that the hypertension epidemic is a rapid emerging burden of disease in low- and middle-income countries, and this is attributable to the changing demographic characteristics as well as subsequent shift in epidemiological transitions[5]. The incidence of hypertension in developing countries is now about twice the prevalence in developed countries[6].

Most alarming is that levels of awareness, treatment, and control of hypertension in low- and middle income countries are low[7, 8]. Such issues of unawareness and poor control of high blood pressure are attributed to high illiteracy levels, poor access to health facilities and poverty[9]. Faced with existing issues of morbidity and mortality from communicable and infectious diseases[10], most parts of the developing world pay less attention to the deadly impact of non-communicable diseases including hypertension on its populations. In the developing world, prevalence of hypertension is common among urban than rural populations[11]; the wealthy than poor populations[12, 13]; and women self-report high blood pressure than men[13]. Nonetheless, some research suggests disparate findings; the prevalence of hypertension is high among men than women[14]. In the Asia-pacific region, men are more likely to report high blood pressure cases than women[15].

Self-report data through surveys have largely been used in estimating the risks of hypertension within populations. Although inexpensive and useful, the validity and reliability of self-report data have often been questioned mostly due to reporting and selection bias. Such report bias includes problems of recalling diagnosed and undiagnosed high blood pressure, and the potential of respondents misunderstanding the meanings of diastolic and systolic values. Recent attempts to ensuring accurate measurement of the risks of hypertension have called for complementary biometric measurement of respondents' blood pressure. As the growing, yet scant literature suggests, self-report data underestimate the prevalence of hypertension among populations, compared to biometric data[16]. In their study of chronic diseases among older populations in Ghana, Minicuci and colleagues found extreme underestimation in the case of self-reported hypertension compared to data measured through physical examinations[12]. The gap between self-report and data collected using physical examination on hypertension has also been emphasized by researchers in other jurisdictions[17, 18, 19.] While several studies indicate that there is little congruence between self-report and clinical/biometric data, very few have examined the reasons for such differences. In other words, there is scant information on respondents whose self-report data selectively differ from their clinical information on hypertension. This paper contributes to the limited but growing body of literature that tracks inconsistent reports of hypertension using data from the World Health Organization's Study on Global Ageing and Adult Health (SAGE) for five countries. We seek to identify and analyze how the socio-demographic and economic profiles of inconsistent reporters differ from those who answered consistently when self-report data are compared with the biometric data of respondents. Tracking such inconsistent reports is crucial to minimizing measurement errors and generating unbiased and more precise parameter estimates[20]. Also, a focus on five countries with different levels of development (Ghana, China, India, South Africa, and Russia) offers a comparative perspective that is missing in the literature. This becomes even more relevant as disease reporting is often socially and culturally proscribed, and is to a very large extent influenced by gender ideals of masculinity and femininity.

Data and Methods:

We use Wave 1 of the Study on Global Ageing and Adult Health (SAGE) collected in 2007/2008 that builds on the World Health Surveys collected in 2003/04. The SAGE is part of an ongoing program to compile nationally representative longitudinal data on the health and well-being of adult populations aged 50 years and above in six countries (China, Ghana, India, Mexico[1], Russian Federation and South Africa). For comparative purposes however, the SAGE also included a smaller sample of younger adults aged 18-49 years. Ethical clearance was obtained from the WHO and the local ethical authorities for each participating country. Data collection for the second wave is scheduled for 2014.

Measures

The SAGE data had self-reported measures of hypertension. Specifically, respondents were asked if they had ever been diagnosed with high blood pressure (hypertension), to which they answered ‘yes’ or ‘no’. In addition, hypertension was measured through physical examinations using a Boso Medistar Wrist BP Monitor Model S[12]. The biometric examination was performed by asking respondents to remain seated and relaxed with their arms well positioned at the level of their heart. Respondents’ blood pressure was then measured three times with a minute in between each measurement[12]. For the purposes of this study, a respondent was considered

[1] We do not use the data for Mexico mainly due to low response rate (51%) and the magnitude of missing cases on outcome variables.

hypertensive if the average of the three measurements was greater than or equal to 140 mmHg (Systolic BP) or greater than or equal to 90 mmHg (diastolic BP). Freidman-Gerlicz and Lilly demonstrated that errors resulting from misclassification may sometimes arise from the choice of systolic cut-off points and the number of repeated measurements for hypertension[21]. However, this is significantly minimized when systolic cut-points are set in the range of 130-180mm Hg and measurements for blood pressure is done more than twice as is the case in this study[21]. The dependent variable was then computed by comparing self-report data with data extracted through physical examination. Two outcomes are of immense interest given the focus of this study. First, respondents who had self-reported that they are not hypertensive, yet their biometric data indicated otherwise; and second those who self-reported as hypertensive, yet their biometric data indicated they were not. All these categories were compared with respondents whose self-report data matched their biometric data that they are hypertensive.

Independent variables include the socio-economic and demographic characteristics of respondents in addition to some specific variables on respondents' disease conditions. Socioeconomic predictors include respondents' education coded (0=no education, 1=primary education, 2=secondary education, 3=university education); a derived income variable created from a series of questions tapping the wealth status of respondents coded (0=poorest, 1=poorer, 2=middle, 3=richer, 4=richest); the main occupation of participants coded (0=self-employed, 1=public sector, 2=private sector, 3=informal sector), age of respondents (measured in complete years); marital status (0=married/cohabiting, 1=never married, 2=divorced/widowed/separated); place of residence (0=rural, 1=urban), gender (0=male, 1=female). Two predictor variables that reflect the disease state of respondents and often considered co-morbid condition with hypertension are also controlled. These include if respondents have stroke (0=no, 1=yes) and diabetic (0=no, 1=yes).

Data Analysis

A multinomial logit model is used to examine the effects of both demographic and socio-economic variables on the likelihood of respondents self-reporting that they are not hypertensive when their biometric data shows otherwise. We also model the likelihood of respondents self-reporting that they are hypertensive when in fact their biometric data shows otherwise. We use a multinomial logit model due to the polytomous nature of the dependent variable. The model estimates the probability or likelihood of an event occurring through the maximum likelihood function[22]. The multinomial model generates a K-1 set of parameter estimates and compares different categories/outcomes on the dependent variable to a certain base category/outcome. For this study, we maintain the base outcome as respondents whose self-report data match their biometric data as hypertensive. For meaningful interpretations, the coefficients are transformed into odds ratios where covariates greater than 1 in any of the categories of the dependent variable indicate that respondents with those characteristics have higher odds of falling into that category, compared to the base outcome while the reverse is true for covariates less than 1.

Results

Descriptive results provided in Table 1 indicate that South Africa and Ghana have the highest proportion of respondents indicating they are not hypertensive when indeed they are (48.7% and 44.1% respectively). This is followed by China (32.6%), India (20.3%) and Russia (14.6%). On the contrary, quite a substantial proportion of Russians (12.7%) had indicated they were hypertensive when their biometric data showed they are not. This is followed by India

(6.91%), South Africa (6.47%), China (5.35%) and Ghana (2.79%). Respondents whose self-report data matched their clinical/biometric data that they had blood pressure were the highest in Russia (39.7%) followed by South Africa (21.2%), China (19.7%), Ghana (9.43%) and India (4.97%). Sensitivity and specificity analyses performed for all five countries and presented in Table 2 corroborate descriptive results in Table 1. The results show that Ghana has the lowest sensitivity (many false negatives) yet the highest specificity values (few false positives). Russia in turn has the highest sensitivity (few false negatives) and the lowest specificity values (many false positives). This means the probability of classifying a respondent as not hypertensive when indeed they are is highest in Ghana, yet the chance of classifying an individual as hypertensive when they are not is low. This is contrary to the evidence in Russia.

It is interesting to find that illiteracy is highest in India, followed by Ghana, South Africa, China and Russia respectively. Household wealth is distributed fairly evenly across countries. The public sector is the largest employer in Russia, Ghana and China, albeit China and India also have substantial proportion of respondents identify as 'self-employed' or the 'informal sector'. Except for India where the average age of respondents is approximately 52 years, all four countries had the mean age of respondents estimated as 60 years and above. The majority of respondents in India live in the rural areas, followed by China, Ghana, South Africa and Russia.

Bivariate results are presented in Table 2. Socio-economic and demographic variables are significantly associated with inconsistent reporting of hypertension. In Ghana, China, and India, respondents with secondary and higher education compared to those with no education are significantly less likely to say they do not have hypertension when in fact they do have. This is not the case in Russia and South Africa. In all countries, except for India, respondents with higher education are significantly more likely to self-report that they have hypertension when their clinical data shows they are not, compared to those with no education. Higher income is associated with a lower likelihood of self-reporting that one is not hypertensive when indeed they are. For China, Russia and South Africa however, respondents with higher education are significantly more likely to self-report that they are hypertensive when their clinical information show otherwise. Demographic variables are significantly associated with inconsistent reports of hypertension. Older people are significantly less likely to self-report that they are not hypertensive when in fact they are. Similarly, respondents in countries like Russia and India are significantly more likely to self-report that they are hypertensive, when their biometric data shows otherwise. Compared to males, females are less likely to self-report that they do not have hypertension when they do. Except Ghana, respondents living in rural areas are also significantly more likely to self-report that they do not have hypertension when biometric data shows that they do. In all countries, respondents living with diabetes and stroke often considered co-morbid conditions with hypertension are significantly less likely to self-report that they are not hypertensive when their biometric data show that they are.

The multivariate results shown in Table 3 are largely consistent with the bivariate findings. But for the effects of education and occupation that are largely attenuated, we still observe that wealth is associated with a lower likelihood of self-reporting that one is not hypertensive when biometric data indicates otherwise. With the exception of rural/urban residence, whose effects are slightly attenuated by including other variables, the effects of other demographic variables such as age and gender are statistically robust and maintain the same direction as found in the bivariate results. Also, the effects of the other variables reflecting whether respondents live with other co-morbid conditions such as diabetes and stroke follow observations made in the bivariate results.

Discussion:

Although self-report data continue to play a pivotal role in health research, in particular, those related to hypertension and other cardiovascular diseases, data collected through such methods are sometimes compromised and unreliable. This is more so when such techniques are used for sensitive health-related topics. This study examined inconsistencies resulting from self-reported accounts of hypertension using data from the Study on Global Ageing and Adult Health (SAGE) for five countries (Ghana, South Africa, India, China and Russia). Inconsistencies were estimated by comparing respondents' biometric/clinical data with their self-report data. Such inconsistencies include respondents who had self-reported as not hypertensive yet their clinical information had indicated otherwise (ranging from the lowest of about 14.6% for Russia to 48.7% for South Africa) and those who had self-reported as hypertensive although their biometric information proved otherwise (lowest for Ghana (2.79%) and highest for Russia (12.7%). Further analyses were conducted to examine the socio-economic and demographic characteristics of respondents who had reported such inconsistencies. Focusing on this and data from several other countries, this study provides a comparative perspective that is missing in the literature. It is important to note that the high percentage of inconsistent reports especially for some countries raises important questions about the quality of self-report data and are consistent with some studies elsewhere[16-18,23] . Various reasons have been cited for such inconsistent reporting of health behaviors among populations. These include recall or memory errors resulting from respondents' attempt to provide 'accurate' description of past diagnosis, the extent to which also depends on the length of the recall period; the awareness levels of members within the population, which may be partly due to the low levels of blood pressure screening in some countries. For instance, the case of many people living with hypertension yet misclassified as not living with the disease especially in developing countries such as Ghana, South Africa, India, and to some extent China in this analysis may broadly be indicative of the weaker health systems in these countries and symptomatic of the poor awareness, detection and management of hypertensive cases[24, 25, 26]. On the other hand, higher sensitivity in a country like Russia with more cases of respondents identifying themselves as hypertensive when they are not could point to a higher health consciousness which mostly results from increased monitoring of the disease within the population[16].

Of the socio-economic predictors, wealth status demonstrated to be robustly associated with inconsistent reports of hypertension across all countries. For all five countries, respondents from wealthier households, compared to those from poorer households, were significantly less likely to have indicated that they are not hypertensive when they are. This is further testament to how socio-economic differences and access to resources could affect reporting of major health conditions such as hypertension. The finding corroborates our earlier observation that the poor may often live with diseases such as hypertension without knowing, mainly due to limited knowledge and awareness, poor monitoring habits and untimely diagnosis of such conditions. It is thus not by chance that the higher proportion of false negatives demonstrated at the macro level for countries like Ghana and South Africa is reflected at the micro level too. There are systematic differences among demographic groups regarding inconsistent reports of hypertension. The finding that older people and females are less likely to report that they are not hypertensive when their biometric data shows that they are not is consistent with previous studies [5,12,13, 17-19]. Goldman and colleagues argue that older people are less likely to misreport cases of hypertension because they have higher risks of living with chronic diseases and are exposed to screening procedures than the young. As a result, it is very likely young people may live with the disease without knowing compared to the old. Reports from the Demographic and Health Surveys released for South Africa acknowledge for instance that the level of hypertension control for young people is poor compared to the old[27]. Accurate reports of hypertensive cases by women compared to their male colleagues have been attributed to a higher health consciousness perhaps because women frequently utilize health care compared to their male colleagues [13, 16, 28]. In Ghana, rural dwellers were significantly less likely to indicate they are not hypertensive when their biometric data proves otherwise. This is however not the case in India and China where compared to their urban counterparts, rural dwellers were more likely to report they are not hypertensive when in fact they are. Results for India and China are expected given that awareness levels in the rural parts of these countries and for most parts of the low and middle-income countries are quite low[13]. Thus, the finding that rural dwellers in Ghana are more likely to report accurately than urban dwellers is intriguing especially against the backdrop that severe socio-economic gaps exist among rural and urban residents, awareness levels are quite low and access to health care also limited. Research that explores rural/urban differences in the misclassification of hypertensive cases in Ghana is required. It is important to mention, however, that being diabetic and having stroke were the strongly associated with accurate reporting of hypertension in all countries. This is consistent with other studies that also found a history of cardiovascular diseases as a strong predictor of accurate reporting of hypertension[16].

Conclusion

The above findings demonstrate that self-report data collected for hypertension research, although useful should be interpreted with caution. It is similarly important to note the socio-economic and demographic characteristics of groups that inconsistently and selectively report they are hypertensive compared to those who do not. For instance, poorer, younger, and male respondents were particularly more likely to have disagreements between their biometric and self-report data. Also, such inconsistencies were common in low and middle income countries. This means it is important to complement self-report data with biometric data as the latter markedly improves the accuracy of parameters estimated from populations at the individual level. While this study is useful and provides insights into reasons for inconsistent reports in hypertension research, some limitations remain. We realize that the cut points used for determining hypertensive cases may either underestimate or overestimate such cases within a sample. For instance, if defined as a systolic blood pressure of >=160 mmHg (instead of >=140 mmHg), and/or a diastolic blood pressure of >=95 mmHg (instead of >=90 mmHg), the sensitivity and specificity estimates would have changed. It is important to indicate however, that the criteria used for this paper is consistent with the WHO's definition of high blood pressure[3]. While we are confident that the average of three readings of hypertension may be enough to judge if respondents live with the condition, it is also true that more than three biometric measurements of hypertension could limit bias that derives from misclassification of cases.

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Table 1: Distribution of selected dependent and independent variables

	China	India	Russia	S Africa	Ghana
Reporting Cases					
Self-report data matched clinical data	19.7	4.97	39.9	21.2	9.43
Had BP but indicated did not have	32.6	20.3	14.6	48.7	44.1
Indicated had BP but does not have	5.35	6.91	12.7	6.47	2.79
Education					
No Education	36.6	55.6	2.33	43.5	48.5
Primary Education	18.1	15.0	7.19	24.2	24
Secondary Education	39.2	23.1	70.0	26.2	24.1
University Education	6.16	6.31	20.5	6.13	3.49
Income Quintile					
Poorest	17.7	20.4	17.7	17.9	19.2
Poorer	18.2	20.2	19.3	20.2	19.7
Middle	19.90	19.7	19.9	19.5	19.9
Richer	21.7	20.5	20.6	20.9	20.7
Richest	22.5	19.3	22.5	21.5	20.6
Main Occupation					
Public	41.8	9.65	86.1	16.2	79.3
Private	11.4	12.6	9.95	55.2	9.35
Self-employment	43.8	45.5	2.52	4.29	4.09
Informal	3.03	32.2	1.44	24.3	7.28
Age	60.3	52.1	62.4	60.4	60.2
Gender					
Male	50.1	56.3	35.9	45.0	52.5
Female	49.9	43.8	64.1	55.0	47.5
Place of Residence					
Urban	52.1	22.3	75.9	69.0	59.1
Rural	47.9	77.7	24.1	31.0	40.9
Stroke					
No	96.8	98.3	94.4	96.5	97.7
Yes	3.20	1.67	5.59	3.48	2.35
Diabetes					
No	93.7	94.9	91.8	91.6	96.5
Yes	6.28	5.07	8.20	8.43	3.51

Table 2: Specificity and sensitivity analysis for 5 countries using SAGE data, 2008/09

Countries	True +	False +	True -	False -	Specificity	Sensitivity
China	2687	703	5734	4437	0.890787634	0.377175744
India	591	846	7373	2060	0.89706777	0.222934742
Russia	1629	516	1336	600	0.721382289	0.730820996
South Africa	857	256	930	1865	0.784148398	0.314842028
Ghana	301	77	2807	1884	0.973300971	0.137757437

Table 3: Bivariate associations of inconsistent reports of hypertension for 5 countries, SAGE 2008/09

	China		India		Russia		S Africa		Ghana	
Education	A	B	A	B	A	B	A	B	A	B
No Education	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary Education	0.992	0.954	0.706	0.806	2.58*	1.93	0.969	1.77**	0.754*	0.784
	(0.074)	(0.140)	(0.126)	(0.171)	(1.06)	(0.808)	(0.110)	(0.358)	(0.100)	(0.207)
Secondary Education	0.835**	1.73***	0.500***	0.929	2.81**	2.35*	1.38**	2.34***	0.529***	0.797
	(0.051)	(0.180)	(0.071)	(0.152)	(1.07)	(0.896)	(0.169)	(0.491)	(0.066)	(0.193)
Higher Education	0.560***	2.08***	0.341***	0.776	3.30**	3.39**	1.27	2.61**	0.377***	2.11*
	(0.071)	(0.361)	(0.074)	(0.189)	(1.30)	(1.34)	(0.286)	(0.892)	(0.097)	(0.717)
Income Quintile										
Poorest	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Poorer	1.00	1.12	0.572*	0.607	0.814	0.918	0.849	1.67	0.679	0.400
	(0.090)	(0.191)	(0.143)	(0.182)	(0.129)	(0.156)	(0.143)	(0.601)	(0.158)	(0.203)
Middle	0.745***	1.41*	0.430***	0.707	0.885	1.02	0.525***	1.81	0.523**	0.398*
	(0.064)	(0.218)	(0.101)	(0.195)	(0.142)	(0.173)	(0.085)	(0.616)	(0.115)	(0.186)
Richer	0.663***	1.23	0.312***	0.681	1.41*	1.24	0.537***	2.66**	0.287***	0.656
	(0.057)	(0.189)	(0.070)	(0.178)	(0.219)	(0.210)	(0.086)	(0.874)	(0.060)	(0.257)
Richest	0.558***	1.17	0.195***	0.624	1.04	1.50*	0.637**	3.39***	0.209***	1.25
	(0.048)	(0.179)	(0.043)	(0.159)	(0.168)	(0.247)	(0.105)	(1.12)	(0.043)	(0.457)
Main Occupation										
Public	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Private	1.47***	0.887	2.11***	1.37	2.58***	1.65**	0.964	0.730	0.525***	1.50
	(0.136)	(0.125)	(0.465)	(0.343)	(0.440)	(0.319)	(0.130)	(0.162)	(0.079)	(0.383)
Self-Employment	2.34***	0.385***	2.46***	1.35	1.91	1.95	1.09	1.12	0.961	1.05

	(0.137)	(0.045)	(0.424)	(0.265)	(0.672)	(0.703)	(0.319)	(0.500)	(0.239)	(0.503)
Informal	1.67**	0.731	2.87***	1.27	1.59	1.36	0.963	0.593*	1.93**	1.16
	(0.274)	(0.210)	(0.526)	(0.269)	(0.661)	(0.614)	(0.145)	(0.152)	(0.478)	(0.561)
Age	0.968***	1.001	0.974***	0.982***	0.960***	0.977***	0.982***	1.01	0.984***	0.999
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.003)	(0.006)
Gender										
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.753***	0.862	1.18	1.52**	0.411***	1.03	0.587***	0.946	0.519***	1.01
	(0.039)	(0.075)	(0.144)	(0.215)	(0.040)	(0.117)	(0.055)	(0.153)	(0.055)	(0.206)
Place of residence										
Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rural	2.36***	0.304***	1.71***	0.975	1.30*	1.13	1.49***	0.507**	0.373***	1.75*
	(0.129)	(0.035)	(0.223)	(0.145)	(0.150)	(0.142)	(0.161)	(0.113)	(0.041)	(0.397)
Stroke										
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.19***	1.09	0.205***	0.676	0.290***	0.898	0.386***	1.56	0.224***	1.02
	(0.028)	(0.174)	(0.060)	(0.196)	(0.075)	(0.160)	(0.091)	(0.464)	(0.051)	(0.351)
Diabetes										
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.313***	1.05	0.212***	0.957	0.422***	0.650*	0.189***	1.17	0.213***	1.35
	(0.032)	(0.141)	(0.041)	(0.178)	(0.081)	(0.113)	(0.032)	(0.237)	(0.042)	(0.380)

1. For each country, the reference category is "those whose self-report data matched clinical data that they are hypertensive". A is for "those who had BP but indicated they did not have BP." B is for "those who indicated that they had BP but did not have BP."

2. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Multivariate results of inconsistent reports of hypertension for 5 countries, SAGE 2008/09

	China		India		Russia		S Africa		Ghana	
Education	A	B	A	B	A	B	A	B	A	B
No Education	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Primary Education	0.994	0.772	0.747	0.831	2.50^{*}	2.06	1.17	1.54^{*}	0.641^{**}	0.671
	(0.080)	(0.117)	(0.146)	(0.190)	(1.076)	(0.867)	(0.147)	(0.327)	(0.096)	(0.200)
Secondary Education	1.01	1.12	0.591^{**}	0.980	1.58	2.00	1.74^{***}	1.87^{**}	0.476^{***}	0.573
	(0.080)	(0.148)	(0.109)	(0.207)	(0.643)	(0.773)	(0.259)	(0.440)	(0.077)	(0.171)
Higher Education	0.959	1.25	0.583	0.847	1.76	2.73^{*}	1.46	1.86	0.553^{*}	1.11
	(0.141)	(0.246)	(0.164)	(0.267)	(0.748)	(1.10)	(0.366)	(0.695)	(0.166)	(0.476)
Income Quintile										
Poorest	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Poorer	0.969	0.985	0.623	0.623	0.771	0.883	0.887	1.56	0.735	0.406
	(0.091)	(0.170)	(0.156)	(0.187)	(0.126)	(0.151)	(0.153)	(0.568)	(0.176)	(0.208)
Middle	0.797^{*}	1.02	0.488^{**}	0.689	0.806	0.959	0.577^{**}	1.50	0.607^{*}	0.399
	(0.073)	(0.165)	(0.117)	(0.193)	(0.133)	(0.164)	(0.097)	(0.522)	(0.139)	(0.188)
Richer	0.705^{***}	0.833	0.410^{***}	0.699	0.992	1.04	0.578^{**}	2.02^{*}	0.368^{***}	0.653
	(0.066)	(0.139)	(0.098)	(0.191)	(0.165)	(0.180)	(0.100)	(0.682)	(0.081)	(0.269)
Richest	0.628^{***}	0.694^{*}	0.319^{***}	0.681	0.696^{*}	1.20	0.595^{**}	2.16^{*}	0.322^{***}	1.15
	(0.061)	(0.118)	(0.080)	(0.194)	(0.121)	(0.209)	(0.114)	(0.762)	(0.074)	(0.452)
Main Occupation										
Public	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Private	0.971	1.14	1.34	1.14	1.73^{**}	1.42	0.865	0.885	0.783	1.15
	(0.099)	(0.167)	(0.324)	(0.306)	(0.308)	(0.280)	(0.126)	(0.202)	(0.140)	(0.336)
Self-Employment	1.30^{**}	0.988	1.48	1.24	1.18	1.55	0.988	1.15	1.13	0.898
	(0.128)	(0.181)	(0.296)	(0.279)	(0.439)	(0.568)	(0.296)	(0.522)	(0.294)	(0.450)

Informal	1.14	0.972	1.37	1.02	1.33	1.47	0.897	0.822	1.52	1.21
	(0.197)	(0.289)	(0.301)	(0.255)	(0.582)	(0.671)	(0.147)	(0.221)	(0.380)	(0.590)
Age	0.970***	0.996	0.973***	0.983***	0.964***	0.984**	0.989**	1.01	0.973***	0.996
	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.007)	(0.004)	(0.007)
Gender										
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.729***	0.848	0.627**	1.30	0.434***	1.13	0.611***	1.03	0.425***	1.00
	(0.041)	(0.077)	(0.091)	(0.214)	(0.044)	(0.134)	(0.060)	(0.170)	(0.051)	(0.228)
Place of residence										
Urban	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Rural	1.47***	0.297***	0.976	0.895	1.08	1.12	1.36**	0.663	0.611***	1.43
	(0.136)	(0.054)	(0.150)	(0.155)	(0.133)	(0.144)	(0.162)	(0.156)	(0.077)	(0.341)
Stroke										
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.237***	0.958	0.233***	0.797	0.341***	1.03	0.431***	1.44	0.299***	1.05
	(0.037)	(0.158)	(0.071)	(0.236)	(0.089)	(0.190)	(0.108)	(0.421)	(0.070)	(0.374)
Diabetes										
No	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Yes	0.440***	0.869	0.309***	1.14	0.519***	0.662*	0.212***	0.919	0.348***	1.19
	(0.047)	(0.120)	(0.063)	(0.228)	(0.101)	(0.117)	(0.037)	(0.914)	(0.076)	(0.346)

3. For each country, the reference category is “those whose self-report data matched clinical data that they are hypertensive”. A is for “those who had BP but indicated they did not have BP.” B is for “those who indicated that they had BP but did not have BP.”

4. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$