Title: Lifestyle for longevity: A case study of chronic disease and healthy lifestyle behaviour in China, India, Mexico, South Africa and Ghana

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Abstract: Behavioural change has been identified as a major driver of effective disease prevention and management in the phase of epidemiological transition globally. This study examines risk and preventive behaviours of chronic disease among adult population controlling for chronic disease status and selected socio-demographic factors. The WHO Study on Global Ageing and Adult Health (SAGE) data were analysed employing factory analysis to measure healthy lifestyle behaviour (HLB) and regression modelling to investigate the predictive factors of HLB controlling for chronic disease status and socio-demographic characteristics. The result shows HLB differentials across the countries studied. Living with at least one chronic disease is associated with increase likelihood of HLB. Age, sex, education, employment and wealth are significant predictors of HLB in most of the countries. The paper argues that the significant differences in HLB in favour of chronic disease persons will chart a new pathway for epidemiological transition in the Global South.

BACKGROUND

The epidemiological and nutritional transitions occurring in many low- and middle-income countries (LMICs) put significant strain on the health system and economic development in these countries. Countries in the regions are not only faced with the challenges of economic under development but also challenges that accompany the double burden of disease (WHO 2002, Unwin et al. 2001, Boutayab 2006, Agyei-Mensah and de-Graft Akins 2010, de-Graft Aikins et al. 2010). Increasing prevalence and burden of non-communicable diseases (NCDs) are major concern and key on current global health agenda. Many countries have initiated health system and policy reforms to curb the impact of chronic disease.

Apart from non-modifiable risk factors (age, sex, and genetic susceptibility), unhealthy lifestyle behaviours such as sedentary lifestyle (physical inactivity), consumption of foods high in saturated fat, harmful consumption of alcohol and tobacco which are high risk of chronic diseases which are linked to urbanisation

and globalisation (Candib 2007, Popkin and Gordon-Larsen 2004 Smith and Mensah 2003 and Popkin 1997) are major risk factors for major NCDs (Steyn and Damasceno 2006, Kruger et al., 2005 and Chitson 1994).

Behavioural change is identified as one of the major drivers of effective disease management. Countries in the Global South are challenged with how to minimize or avoid the negative impact of lifestyle changes that accompany modernization and urbanization. Adoption of both healthy and unhealthy lifestyle behaviour varies across socio-economic status. As posited by Roger and Shoemacher (1971) and supported by Wong et al. 2008, the diffusion of innovation theory describes how unhealthy lifestyle behaviour are adopted earlier by educated and wealthy population while the uneducated poor may adopt these unhealthy behaviours later. Up to 80 per cent of premature deaths from heart disease, stroke and diabetes can be averted with known behavioural and pharmaceutical interventions (WHO 2005). The World Bank group (2011) also estimated that more than half of NCD burden could be avoided through health promotion and preventive initiatives.

The research questions for this study are 1. What is the level of influence of chronic disease status on risk and preventive health behaviour among adult population in countries experiencing epidemiological transition? 2. What socio-demographic characteristics predict healthy lifestyle behaviours in these countries? The paper discusses and argues the implications of the current levels of healthy lifestyle behaviour among persons with and without on the longevity and the epidemiological transition and the burden of chronic disease.

METHODOLOGY

Data source and measurement

Data are drawn from the World Health Organisation (WHO) Study on Global Ageing and Adult Health (SAGE) conducted in China, India, Mexico South Africa and Ghana. The SAGE is a cross-sectional survey, multi-level (household and individual) employing multi-stage stratified random cluster probability sampling. The survey collected information on socio-demographic

characteristics, risk factors and preventive health behaviours, chronic disease status and health service coverage and among others. The nationally representative probability sample survey targeted adult population (18 years and older) with a significant over sampling of households with an adult member aged 50 years and above.

To achieve the objectives and answer the research questions, only individuals with valid response on their chronic disease status were included in the analysis. The question used to included respondents is *"Have you ever been diagnosed with or has a doctor (health professional) told that you have (name of disease condition)"?* Status of arthritis, stroke, angina (angina pectoris – heart disease), diabetes, chronic lung disease, asthma, depression and hypertension for each individual were established with a response category of Yes or No. All individuals who received treatment in terms of medication or any other therapy for the condition during the last two-week preceding the survey were classified as currently living with chronic disease(s). A total of 37,373 individuals were included in the analysis made up of China (14,400), India (11,222), Mexico (2,633), South Africa (4,028) and Ghana (5,090).

Variables and measurements

Healthy lifestyle behaviour in this study made up of (i) Alcohol drinking pattern in the last 12 month (the number of day on the average one standard (see WHO-SAGE 2009) measure of alcoholic beverage was consumed), (ii) Current us of tobacco (smoke, sniff or chew any tobacco product), (iii) Fruit and vegetable (the amount of servings consumed on a typical day),(iv) Physical activity was measured at two levels – 1) Respondent work involve vigorous or moderate intensity activity that cause large increase in breathing or heat rate. 2) Respondent engages in any vigorous or moderate intensity sports, fitness or recreational (leisure) activities that cause large increase in breathing or heart rate. In addition, the number of days the respondent engages in such physical activities both work related physical activity (vigorous and moderate) and leisure related sports or fitness (vigorous and moderate) were considered.

Factor analysis using the principal component method was used to compute an index score of health lifestyle behaviour. For all categorical variables in the healthy lifestyle behaviour (alcohol drinking pattern, tobacco use, physical activity (work related and leisure/sport related) a score of zero (0) was assigned for negative behaviour otherwise a score of one (1) or more was assigned. Thus, for alcohol drinking pattern, a score of four (4) was assigned to a responses of "No Days", 3 for "Less than once a month" 2 for "One to three days per month", 1 for "One to four days per week" and 0 for "Five or more days per week". In the case of tobacco, the score is as follows: 0 for "Yes, daily", 1 for "Yes, but not daily" and 2 for "Not at all". Response of "Yes" engaged in work or recreational (leisure or sport) related vigorous or moderate intensity physical activity received a score of 1 otherwise a score of 0 was assigned. The other components of the healthy lifestyle behaviour index (amount of fruit and vegetable servings consumed on a typical day, number of days engaged in physical activities (vigorous or moderate and work or recreational related) were continues or count variables.

The selected socio-demographic characteristics considered are sex of respondent, age in completed years categorised into 18-49 and 50 years and older, marital status – never married, currently married/cohabiting and formerly married (separated, divorce and widowed), highest level of educational attainment - no education, less than primary, completed primary, completed secondary, completed high school, completed college/university, completed post graduate. Locality type (urban or rural), work status (worked for at least 2 days during the last 7 days), and wealth quintile (poorest, poorer, middle, richer and richest).

Statistical analysis

Descriptive and analytical techniques were employed to arrive at the results. Socio-demographic characteristics of the study population (sex, age, marital status, educational attainment, working status, locality and wealth quintile) were presented descriptively while the association between healthy lifestyle behaviour (alcohol drinking pattern, current use of tobacco, physical active

(vigorous and moderate), recreational (vigorous and moderate) and chronic disease status were examined using biavariate analysis. Chi-square test was conducted to determine the significant association between healthy lifestyle behaviour and chronic disease status. Multivariate linear regression technique was employed in determining the socio-demographic factors that predict healthy lifestyle behaviour while adjusting for chronic disease status.

RESULTS

Table 1: Prevalence of chronic disease by disease type and country

Disease condition	China	India	Mexico	South Africa	Ghana	Total
Ever diagnosed with chronic disease						
Arthritis	2996 (20.8)	1524 (13.6)	284 (10.8)	873 (21.7)	580 (11.4)	6257 (16.7)
Stroke	456 (3.2)	171 (1.5)	112 (4.3)	144 (3.6)	120 (2.4)	1003 (2.7)
Angina	1173 (8.1)	428 (3.8)	53 (2.0)	229 (5.7)	149 (2.9)	2032 (5.4)
Diabetes	869 (6.0)	550 (4.9)	479 (18.2)	370 (9.2)	177 (3.5)	2445 (6.5)
Chronic lung disease	1145 (8.0)	333 (3.0)	144 (5.5)	91 (2.3)	28 (0.6)	1741 (4.7)
Asthma	326 (2.3)	542 (4.8)	82 (3.1)	174 (4.3)	173 (3.4)	1297 (3.5)
Depression	45 (0.3)	409 (3.6)	321 (12.2)	128 (3.2)	69 (1.4)	972 (2.6)
Hypertension	3625 (25.2)	1497 (13.3)	877 (33.3)	1144 (28.4)	617 (12.1)	7760 (20.8)
Currently living with chronic disease						
Arthritis	1180 (8.2)	632 (5.6)	165 (6.3)	606 (15.0)	242 (4.8)	2825 (7.6)
Stroke	264 (1.8)	61 (0.5)	55 (2.1)	94 (2.3)	62 (1.2)	536 (1.4)
Angina	747 (5.2)	191 (1.7)	30 (1.1)	174 (4.3)	63 (1.2)	1205 (3.2)
Diabetes	716 (5.0)	289 (2.6)	402 (15.3)	319 (7.9)	128 (2.5)	1854 (5.0)
Chronic lung disease	445 (3.1)	131 (1.2)	56 (2.1)	61 (1.5)	6 (0.6)	669 (1.9)
Asthma	154 (1.1)	292 (2.6)	36 (1.4)	142 (3.5)	62 (1.2)	686 (1.8)
Depression	17 (0.1)	88 (0.8)	132 (5.0)	69 (1.7)	16 (0.3)	322 (0.9)
Hypertension	2879 (20.0)	724 (6.5)	735 (27.9)	1012 (25.1)	418 (8.2)	5768 (15.4)

Table 2: Prevalence of chronic disease diagnosed and currently receiving treatment by country

CD status	China		India		Mexico		South Africa		Ghana		Total	
	Yes	Total N	Yes	Total N	Yes	Total N	Yes	Total N	Yes	Total N	Yes	Total N
ED with NCD	47.5	14400	32.6	11222	56.3	2633	48.0	4028	27.8	5090	41.0	37373
CL with NCD	32.1	14400	16.2	11222	44.6	2633	39.6	4028	15.5	5090	26.8	37373

Note: CD=Chronic Disease, ED=Ever diagnosed, CL=Currently living

Table 3: Prevalence of tobacco and alcohol consumption by chronic disease status

Tobacco and other smoking	Chronic disease status		Total
	No N (%)	Yes N (%)	N (%)
China			**P=0.000**
Yes, daily	2742 (28.0)	795 (17.2)	3537 (24.6)
Yes, not daily	264 (2.7)	102 (2.2)	366 (2.5)
Not at all	6771 (69.3)	3726 (80.6)	10497 (72.9)
India			**P=0.006**
Yes, daily	3411 (36.3)	627 (34.5)	4038 (36.0)
Yes, not daily	221 (2.3)	65 (3.6)	286 (2.5)
Not at all	5773 (61.4)	1125 (61.9)	6898 (61.5)
Mexico			**P=0.001**
Yes, daily	184 (12.6)	126 (10.7)	310 (11.8)
Yes, not daily	120 (8.2)	60 (5.1)	180 (6.8)
Not at all	1154 (79.1)	989 (84.2)	2143 (81.4)
South Africa			**P=0.278**
Yes, daily	566 (23.3)	337 (21.1)	903 (22.4)
Yes, not daily	98 (4.0)	69 (4.3)	167 (4.1)
Not at all	1770 (72.7)	1188 (74.5)	2958 (73.4)
Ghana			**P=0.000**
Yes, daily	438 (10.2)	32 (4.1)	470 (9.2)
Yes, not daily	119 (2.8)	20 (2.5)	139 (2.7)
Not at all	3744 (87.0)	737 (93.4)	4481 (88.0)
Alcohol use in the last 30 days◆			
China			**P=0.000**
	2334 (23.9)	640 (13.8)	2974 (20.7)
India			**P=0.136**
	616 (6.5)	102 (5.6)	718 (6.4)
Mexico			**P=0.000**
	283 (19.4)	121 (10.3)	404 (15.3)
South Africa			**P=0.000**
	429 (17.6)	191 (12.0)	620 (15.4)
Ghana			**P=0.000**
	1448 (33.7)	150 (19.0)	1598 (31.4)

◆ Proportion of respondents who consumed alcohol

Table 4: Amount of fruit and vegetable servings by chronic disease status

	Chronic disease status		
Amount of fruit	No N (%)	Yes N (%)	Total N (%)
China			**P=0.000**
0 (none)	2852 (29.2)	1063 (23.0)	3915 (27.2)
< 3	3265 (33.4)	1793 (38.8)	5058 (35.1)
3 and above	3660 (37.4)	1767 (38.2)	5427 (37.7)
India			**P=0.000**
0 (none)	3939 (41.9)	583 (32.1)	4522 (40.3)
< 3	5061 (53.8)	1130 (62.2)	6191 (55.2)
3 and above	405 (4.3)	104 (5.7)	509 (4.5)
Mexico			**P=0.020**
0 (none)	216 (14.8)	134 (11.4)	350 (13.3)
< 3	1011 (69.3)	828 (70.5)	1839 (69.8)
3 and above	231 (15.8)	213 (18.1)	444 (16.9)
South Africa			**P=0.154**
0 (none)	364 (15.0)	211 (13.2)	575 (14.3)
< 3	1641 (67.4)	1073 (67.3)	2714 (67.4)
3 and above	429 (17.6)	310 (19.4)	739 (18.3)
Ghana			**P=0.000**
0 (none)	580 (13.5)	74 (9.4)	654 (12.8)
< 3	2621 (60.9)	462 (58.6)	3083 (60.6)
3 and above	1100 (25.6)	P=253 (32.1)	1353 (26.6)
Amount of vegetable			
China			**P=0.007**
0 (none)	364 (3.7)	134 (2.9)	498 (3.5)
< 3	631 (6.5)	340 (7.4)	971 (6.7)
3 and above	8782 (89.8)	4149 (89.7)	12931 (89.8)
India			**P=0.670**
0 (none)	100 (1.1)	22 (1.2)	122 (1.1)
< 3	7577 (80.6)	1449 (79.7)	9026 (80.4)
3 and above	1728 (18.4)	346 (19.0)	2074 (18.5)
Mexico			**P=0.052**
0 (none)	143 (9.8)	86 (7.3)	229 (8.7)
< 3	1049 (71.9)	852 (72.5)	1901 (72.2)
3 and above	266 (18.2)	237 (20.2)	503 (19.1)
South Africa			**P=0.010**
0 (none)	130 (5.3)	70 (4.4)	200 (5.0)
< 3	1718 (70.6)	1076 (67.5)	2794 (69.4)
3 and above	586 (24.1)	448 (28.1)	1034 (25.7)
Ghana			**P=0.046**
0 (none)	166 (3.9)	40 (5.1)	206 (4.0)
< 3	3234 (75.2)	562 (71.2)	3796 (74.6)
3 and above	901 (20.9)	187 (23.7)	1088 (21.4)

Table 5: Number of days engaged in vigorous and moderate fitness activity by chronic disease status

Vigorous fitness	Chronic disease status		Total N (%)
	No N (%)	Yes N (%)	
China			**P=0.000**
None	9266 (94.8)	4420 (95.6)	13686 (95.0)
1-6 days	295 (3.0)	71 (1.5)	366 (2.5)
All 7 days	216 (2.2)	132 (2.9)	348 (2.4)
India			**P=0.121**
None	8948 (95.1)	1708 (94.0)	10656 (95.0)
1-6 days	275 (2.9)	64 (3.5)	339 (3.0)
All 7 days	182 (1.9)	45 (2.5)	227 (2.0)
Mexico			**P=0.078**
None	1391 (95.4)	1141 (97.1)	2532 (96.2)
1-6 days	51 (3.5)	26 (2.2)	77 (2.9)
All 7 days	16 (1.1)	8 (0.7)	24 (0.9)
South Africa			**P=0.000**
None	2298 (94.4)	1558 (97.7)	3856 (95.7)
1-6 days	119 (4.9)	34 (2.1)	153 (3.8)
All 7 days	17 (0.7)	2 (0.1)	19 (0.5)
Ghana			**P=0.046**
None	4189 (97.4)	771 (97.7)	4960 (97.4)
1-6 days	96 (2.2)	11 (1.4)	107 (2.1)
All 7 days	16 (0.4)	7 (0.9)	23 (0.5)
Moderate fitness			
China			**P=0.000**
None	8336 (85.3)	3836 (83.0)	12172 (84.5)
1-6 days	658 (6.7)	289 (6.3)	947 (6.6)
All 7 days	783 (8.0)	498 (10.8)	1281 (8.9)
India			**P=0.021**
None	8093 (86.0)	1550 (85.3)	9643 (85.9)
1-6 days	767 (8.2)	133 (7.3)	900 (8.0)
All 7 days	545 (5.8)	134 (7.4)	679 (6.1)
Mexico			**P=0.199**
None	1371 (94.0)	1108 (94.3)	2479 (94.2)
1-6 days	59 (4.0)	54 (4.6)	113 (4.3)
All 7 days	28 (1.9)	13 (1.1)	41 (1.6)
South Africa			**P=0.035**
None	2238 (91.9)	1500 (94.1)	3738 (92.8)
1-6 days	174 (7.10)	83 (5.2)	257 (6.4)
All 7 days	22 (0.9)	11 (0.7)	33 (0.8)
Ghana			**P=0.000**
None	3735 (86.8)	647 (82.0)	4382 (86.1)
1-6 days	529 (12.3)	128 (16.2)	657 (12.9)
All 7 days	37 (0.9)	14 (1.8)	51 (1.0)

Table 6: Socio-demographic determinants of healthy lifestyle behaviour

Socio-demographic characteristics	China B (Std Error)	India B (Std Error)	Mexico B (Std Error)	South Africa B (Std Error)	Ghana B (Std Error)	Total B (Std Error)
Constant	-.738 (.108)***	-.660 (.134)***	-1.255 (.321)***	-.912 (.218)***	-.610 (.180)**	-.877 (.063)***
Chronic disease status						
Yes	-.065 (.027)*	.026 (.072)	.032 (134)	-.083 (.097)	.042 (.071)	-.049 (.023)*
Sex						
Male	.056 (.025)*	.162 (.066)*	.150 (.136)	.134 (.096)	.143 (.065)*	.029 (.021)
Age category						
50 and older	.033 (.040)	-.002 (.064)	-.192 (.168)	.128 (.152)	-.126 (.076)	.019 (.029)
Marital status						
Currently married/cohabiting	-.003 (.099)	-.098 (.092)	-.196 (.186)	-.063 (.140)	-.270 (.160)	.125 (.053)*
Separated/divorced/widowed	-.039 (.104)	-.291 (.129)*	-.031 (.213)	-.006 (.153)	-.219 (.169)	-.063 (.059)
Type of place of residence						
Rural	-.138 (.032)***	-.063 (.059)	-.018 (.152)	.067 (.110)	-.272 (.060)***	-.086 (.024)***
Educational attainment						
Less than primary	.103 (.042)*	-.013 (.103)	-.018 (218)	-.264 (.139)	-.171 (.088)	.089 (.034)**
Primary	.245 (.042)***	.195 (.088)*	.191 (.229)	-.318 (.136)*	.099 (.087)	.265 (.033)***
Secondary	.193 (.042)***	.214 (.089)*	.477 (.268)	.050 (.143)	.123 (.123)	.318 (.033)***
High school	.325 (.047)***	.336 (.096)***	.106 (343)	.244 (.163)	.132 (.075)	.383 (.036)***
College/university	.375 (.062)***	.386 (.113)**	.037 (260)	.059 (.187)	-.020 (.137)	.411 (.047)***
Post-grad	.506 (.321)	.402 (.165)*	-.342 (.461)	.207 (.350)	-.523 (.436)	.255 (.123)*
Working status						
Working	.050 (.029)	.095 (.060)	-.036 (.142)	.053 (.100)	.101 (.064)	-.012 (.023)
Wealth quintile						
Poorer	.031 (.043)	-.070 (.108)	.080 (.244)	-.394 (.177)*	-.207 (.095)*	-.057 (.037)

Middle	.151 (.043)***	.122 (.106)	.373 (.237)	-.322 (.170)	-.169 (.094)	.052 (.036)
Richer	.203 (.042)***	-.084 (.101)	.256 (.224)	-.273 (.168)	-.176 (.094)	.048 (.035)
Richest	.297 (.044)***	-.025 (.106)	.152 (.228)	-.414 (.171)	-.059 (.100)	.102 (.036)**
Adjusted R square	.036	.036	.005	.014	.036	.034

***$P < 0.001$ **$P < 0.01$ *$P < 0.05$

Reference category: No living with chronic disease, Female, 18-49 years old, Never married, Urban residence No formal education, Currently not working and Poorest.