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Activity limitations and participation restrictions among people with non-communicable diseases in Ghana

Emmanuel Banchani[1]* [iD], Eric Y. Tenkorang[1] and William Midodzi[2]

[1]Department of Sociology, Memorial University, St. John's, Canada and [2]Faculty of Medicine, Division of Community Health and Humanities, Memorial University, St. John's, Canada
*Corresponding author. Email: eb1043@mun.ca

Abstract

Anecdotal evidence suggests that non-communicable diseases (NCDs) contribute substantially to mortality, morbidity and disability in Ghana. Nonetheless, no data are presently available on Ghanaians with disability from major NCDs, such as hypertension, diabetes and stroke. Using data from the 2007/2008 Ghana World Health Organization Study on Global Ageing and Adult Health (SAGE) and applying ordinary least squares techniques, the prevalence of and associations between activity limitations and participation restrictions in Ghanaians with NCDs are examined in the present study. The results show stroke is the major contributor to activity limitations and participation restrictions among the Ghanaian population with NCDs. The study results further revealed that respondents with higher education reported high levels of disability compared to those with no education. The results suggest that functioning can be restored by providing assistive technologies, such as wheelchairs, prosthetic limbs, walking aids, *etc.*, that can enhance participation of persons with disability in society.

Introduction

Globally, about 2.4 billion people lived with disability in 2019 (Cieza *et al.*, 2020). In Ghana, the prevalence of disability ranges between 2.1 and 3 per cent of the population (Ghana Statistical Service, 2013; Tetteh *et al.*, 2021). Evidence suggests the prevalence of disability is higher among older adults and those with non-communicable diseases (NCDs) (Rowland *et al.*, 2014).

Disability is a multi-dimensional concept; therefore, its conceptualisation and measurement can be complex, varying across time and context (Agaronnik *et al.*, 2019; Theis *et al.*, 2019; World Health Organization (WHO), 2020). There are two competing models of disability: medical and social (Swain and French, 2000;

Anthony, 2011). The medical model focuses on an impairment or a health condition as the cause of disability (Swain and French, 2000; Anthony, 2011). Medical interventions, including diagnosis and treatment, aim to restore the individual to a functioning level (Marks, 1997; Sullivan, 2011). In contrast, in the social model, disability is socially constructed, the consequence of negative labels, prejudice and discriminatory societal attitudes directed at persons with bodily impairments (Anthony, 2011). These discriminatory societal attitudes create barriers for people with disabilities preventing them from participating fully in society (Llewellyn and Hogan, 2000; Goodley, 2001; Shakespeare and Watson, 2002; Sullivan, 2011).

Both models of disability have made significant contributions to our understanding of disability, but they have limitations. For instance, the medical model focuses on impairment as an important determinant of disability with the assumption that people with disabilities are dependent, weak, needy and defective, while the social model ignores diseases and injuries as contributing factors (Owens, 2015; Retief and Letšosa, 2018). The WHO has proposed the International Classification of Functioning, Health and Disability (ICF) model to combine the strengths and deal with the weaknesses of these two competing models (Pinilla-Roncancio, 2015). This paper employs a variant of the ICF model to examine relationships between NCDs and disability in Ghana.

The ICF model

The ICF model integrates medical and social perspectives of disability using a biopsychosocial approach where health conditions and structural factors mediate how disability is experienced (Peterson, 2005; Mitra and Shakespeare, 2019), making it a universal framework for understanding, assessing and measuring disability and functioning (WHO, 2002). The validity of the ICF as a tool for understanding disability has been confirmed in Western countries (Andrews *et al.*, 2009; Luciano *et al.*, 2010; Almazán-Isla *et al.*, 2017; Papelard *et al.*, 2019), but it has not been applied in non-Western contexts, *e.g.* sub-Saharan Africa and Ghana. This gap motivated the present study.

The ICF model has two distinct components (Resnik and Plow, 2009; Castaneda *et al.*, 2014). The first distinguishes four concepts that operationalise disability: *body functions*, *body structures*, *activity limitations* and *participation restrictions* (Hemmingsson and Jonsson, 2005; Benson and Oakland, 2011; Heerkens *et al.*, 2018). Body functions refer to the physiological functions of body systems, while body structures refer to the anatomy of the body, such as organs, limbs and their components (Benson and Oakland, 2011). Activity limitations refer to difficulties an individual may have executing activities, while participation restrictions deal with problems he or she may experience in life situations (Aljunied and Frederickson, 2014; Maxwell *et al.*, 2018). Domains of activity limitations and participation restrictions include learning, mobility, self-care, domestic life, interpersonal interactions and relationships, major life areas, and community, social and civic life. The second component of the ICF model examines contextual factors, at both the structural and the individual level. Structural factors include support and relationships, services and policies, and attitudes. These factors act as facilitators of or barriers to functioning in society (Loke *et al.*, 2015). Individual-level factors include age, gender, education, religion and lifestyle characteristics.

The ICF uses a hierarchical nested classification system and coding scheme to define dimensions of disabilities (*see* Table 1). For instance, the classification systems changing and maintaining body position, carrying, moving and handling objects, and walking and moving are nested within the mobility domain which, in turn, is nested within activity limitations. The self-care domain is also nested within activity limitations. Similarly, interpersonal relationships and informal relationships are nested within domestic life domains, while community, civic and social life are nested within the major life areas; both, in turn, are nested within participation restrictions. Finally, the classification system health services is nested in the systems, services and policies domain, which, in turn, is nested in the structural level. Because of data limitations, we did not include body functions and body structures in this analysis; we only considered activity limitations and participation restrictions as measures of disability.

Based on the ICF model, we developed a conceptual framework to explain the links between NCDs and various dimensions of disability (*see* Figure 1). The framework begins with a health condition (disease) mediated by structural and individual factors. These three variables (health condition, structural factors, individual-level factors) affect how disability is experienced and produced.

NCDs and disability

NCDs, including hypertension, diabetes and stroke, are the main contributors to disability in Western countries (Klijs *et al.*, 2011; Richards *et al.*, 2016). The resulting functional limitations, such as amputations, blindness and speech difficulties, create challenges in self-care, mobility and social participation (Gregg *et al.*, 2000; Sturm *et al.*, 2002; Elias and Elias, 2007). Even though some policy documents acknowledge the contributions of NCDs to morbidity, mortality and disability in Ghana (Ministry of Health, 2011), accurate knowledge is lacking because epidemiological data are limited. The most common causes of disability in Ghana are road accidents, amputation, cataracts, leprosy, measles and polio (Adjei-Amoako, 2016). The most common types of disability are visual impairment, hearing impairment, and intellectual and learning disabilities (Slikker, 2009; Adjei-Amoako, 2016).

While NCDs are major risk factors in disability, the opposite may also be true: some evidence indicates people living with disabilities are at risk of developing NCDs, *e.g.* because of sedentary lifestyles (Dixon-Ibarra and Horner-Johnson, 2014; Krahn *et al.*, 2015). Another risk factor is socio-economic status: people with disabilities with low socio-economic status may have poor nutrition and face challenges in accessing preventive health programmes and affordable health services (WHO, 2011). This may in turn increase their likelihood of living with NCDs. In this paper, we use data from the WHO to examine relationships between NCDs and disability in Ghana.

Methods
Data

Data for the study came from the 2007/2008 Ghana WHO Study on Global Ageing and Adult Health (SAGE). SAGE is an ongoing programme monitoring

Table 1. Domains of the International Classification of Functioning, Disability and Health (ICF)

Body functions[1]	Body structures[2]	Activities and participation[3]	Environmental factors[4]
Mental functions	Structure of the nervous system	Learning and applying knowledge	Products and technology
Sensory functions and pain	The eye, ear and related structures	General tasks and demands	Natural environment and human-made changes to environment
Voice and speech functions	Structures involved in voice and speech	Communication	Support and relationships
Functions of the cardiovascular, haematological, immunological and respiratory systems	Structure of the cardiovascular, immunological and respiratory systems	*Mobility* Changing and maintaining body position: d410 Changing basic body position d415 Maintaining a body position d420 Transferring oneself Carrying, moving and handling objects: d430 Lifting and carrying objects d435 Moving objects with lower extremities d440 Fine hand use d445 Hand and arm use Walking and moving: d450 Walking d455 Moving around d460 Moving around in different locations d465 Moving around using equipment	Attitudes
Functions of the digestive, metabolic and endocrine systems	Structures related to the digestive, metabolic and endocrine systems	Self-care: d510 Washing oneself d520 Caring for body parts d530 Toileting d540 Dressing d550 Eating d560 Drinking d570 Looking after one's health	Services, systems and policies: e580 Health services, systems and policies

(*Continued*)

Table 1. (*Continued.*)

Body functions[1]	Body structures[2]	Activities and participation[3]	Environmental factors[4]
Genitourinary and reproductive functions	Structure related to genitourinary and reproductive systems	*Domestic life*	
Neuromusculoskeletal and movement-related functions	Structures related to movement	Interpersonal interactions and relationships: d710 Basic interpersonal interactions d720 Complex interpersonal interactions d730 Relating with strangers d740 Formal relationships d750 Informal social relationships d760 Family relationships d770 Intimate relationships	
Functions of the skin and related structures	Skin and related structures	*Major life areas*	
		Community, social and civic life: d910 Community life d920 Recreation and leisure d930 Religion and spirituality d950 Political life and citizenship	

Notes: 1. Code letter is 'b'. 2. Code letter is 's'. 3. Code letter is 'd'. 4. Code letter is 'e'.
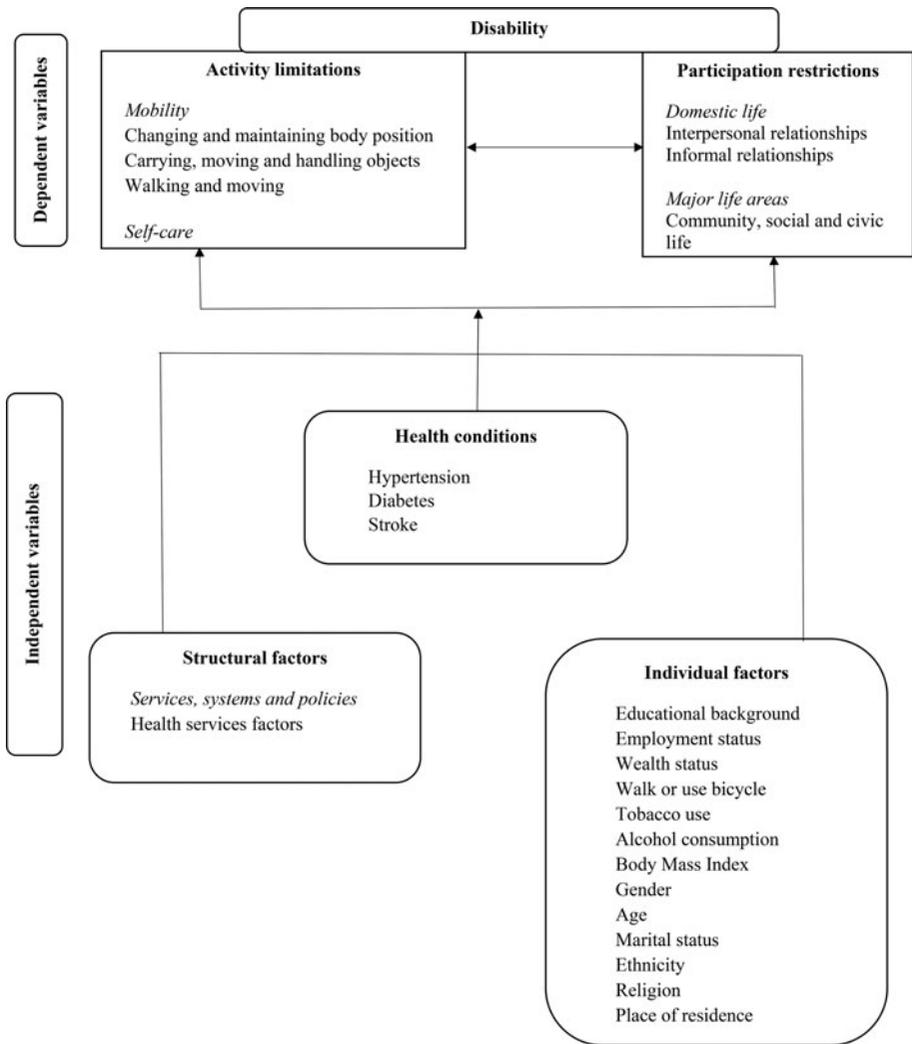
Figure 1. Conceptual framework of the links between non-communicable diseases and disability.
Source: Adapted from the World Health Organization (2001).

the wellbeing of older persons in six countries (China, Ghana, India, Mexico, Russia and South Africa). The goal is to provide, strengthen, gather, process and manage data on older persons to facilitate policy planning and monitoring. SAGE includes adults aged 50 years and older, as well as a small group of persons aged 18 years. The SAGE survey asks respondents about their household characteristics, socio-demographic characteristics, perceived health status, preventive and risky health behaviours, chronic conditions, health services coverage and utilisation, subjective wellbeing and social networks. Anthropometric measurements, blood pressure and dry blood spots for biomarkers are also collected.

In addition, respondents are asked if they have had a stroke, cancer, diabetes or hypertension.

To select participants, SAGE employed a multi-stage sampling technique, selecting households from 251 Enumeration Areas, with a final 5,373 individuals chosen for interviews. The sample was stratified by administrative region and type of locality, resulting in 20 strata. The final SAGE sample comprised 5,348 individuals (a response rate of 93.8%). The sample for the present study was limited to 4,209 respondents who answered questions on various domains of disability.

Measures

Dependent variables

The dependent variables measuring disability included variables for activity limitations and participation restrictions. Based on the ICF model (WHO, 2001), we created four categories of activity limitations. The first three are under the mobility domain of the ICF model (changing and maintaining body position; carrying, moving and handling objects; walking and moving), and the last is self-care. The questions on the mobility and self-care domains asked participants, overall, how much difficulty they had in the last 30 days executing an activity in either domain. The responses were rated on a five-point Likert scale, with 1 = none, 2 = mild, 3 = moderate, 4 = severe and 5 = extreme/cannot do. Because there were very few 'extreme/ cannot do' answers, they were merged with the 'severe' category. Latent variables were created using Principal Component Analysis (PCA), as shown in Table 2. Positive values on the scale indicated the participant had a severe/extreme disability, while negative values indicated mild to no disability. Factor loadings from these scales range from 0.45 to 0.91 and the reliability coefficient Cronbach alpha ranges from 0.62 to 0.93.

To determine participation restrictions, we used the ICF model categories for domestic life (interpersonal relationships and informal relationships) and major life areas (community, civic and social life). Participants were asked to recall how often they had been involved in the community in the last 12 months. The responses were rated on a five-point Likert scale, with 1 = never, 2 = once or twice per year, 3 = once or twice per month, 4 = once or twice per week and 5 = daily. Positive/negative values on the scale indicated that participants had higher/lower participation. PCA was used to create all latent variables (*see* Table 2).

Independent and control variables

The focal independent and control variables (*see* Table 2) were based on the ICF framework that identifies a health condition (disease), environmental factors and personal factors as contributing to disability. We conceptualised three NCD conditions, *i.e.* hypertension, diabetes and stroke, as health conditions (diseases) and used them as focal independent variables. Following the WHO and Ghana Health Service cut-off points, we defined normal systolic blood pressure as equal to or less than 140 mmHg and diastolic blood pressure as equal to or less than 90 mmHg (WHO, 2010*a*; Ghana Health Service (GHS) (nd)). The SAGE data

Table 2. Operationalisation of scalar and categorical variables

Description
Activity limitations:
Changing and maintaining body position — A summative index weighted by factor loadings derived from these variables. Overall in the last 30 days, how much difficulty did you have: in standing up from sitting down?; in standing for long periods?; with climbing one flight of stairs without resting? with stooping, kneeling or crouching?; with getting up from standing up? Factor loadings ranged from 0.683 to 0.871. Reliability coefficient Cronbach's alpha = 0.897
Carrying, moving and handling objects — A summative index weighted by factor loadings derived from these variables. Overall in the last 30 days, how much difficulty did you have: in picking up things with your fingers (such as picking up a coin from a table)?; with carrying things?; in extending your arms above shoulder level? Factor loadings ranged from 0.695 to 0.845. Reliability coefficient Cronbach's alpha = 0.645
Walking and moving — A summative index weighted by factor loadings derived from these variables. Overall in the last 30 days, how much difficulty did you have: with moving around?; in vigorous activities (vigorous activities require hard physical effort and cause large increases in breathing or heart rate)?; in walking 100 metres?; in walking a long distance such as a kilometre?; with moving around inside your home (such as walking across a room)?; with getting where you want to go, using private or public transport if needed? Factor loadings ranged from 0.643 to 0.846. Reliability coefficient Cronbach's alpha = 0.848.
Self-care — A summative index weighted by factor loadings derived from these variables. Overall in the last 30 days, how much difficulty did you have: with self-care, such as bathing/washing or dressing yourself?; in taking care of and maintaining your general appearance (*e.g.* grooming, looking neat and tidy)?; in staying by yourself for a few days (3–7 days)?; in bathing/washing your whole body?; in getting dressed?; with eating (including cutting up your food)?; with getting to and using the toilet? Factor loadings ranged from 0.799 to 0.889. Reliability coefficient Cronbach's alpha = 0.933
Participation restrictions:
Interpersonal relationships — A summative index weighted by factor loadings derived from these variables. Overall in the last 30 days, how much difficulty did you have: with personal relationships or participation in the community?; in dealing with conflicts and tensions with others?; with making new friendships or maintaining current friendships?; with dealing with strangers? Factor loadings ranged from 0.894 to 0.921. Reliability coefficient Cronbach's alpha = 0.929
Community, social and civic life — A summative index weighted by factor loadings derived from these variables. How often in the last 12 months have you: attended any public meeting in which there was discussion of local or school affairs?; met personally with someone you consider to be a community leader?; attended any group, club, society, union or organisational meeting?; worked with other people in your neighbourhood to fix or improve something? Factor loadings ranged from 0.719 to 817. Reliability coefficient Cronbach's alpha = 0.738
Informal relationships — A summative index weighted by factor loadings derived from these variables. How often in the last 12 months have you: had friends over

(Continued)

Table 2. (*Continued.*)

Description
to your home?; been in the home of someone who lives in a different neighbourhood than you do or had them in your home?; socialised with co-workers outside work?; attended religious services (not including weddings and funerals)?; gotten out of the house/your dwelling to attend social meetings, activities, programmes or events or to visit friends or relatives? Factor loadings ranged from 0.450 to 0.841. Reliability coefficient Cronbach's alpha = 0.689

Health services factors:	
Person-centred	A summative index weighted by factor loadings derived from these variables. For your last visit to a health-care provider, how would you rate the following: your experience of being greeted and talked to respectfully?; experience of how clearly health-care providers explained things?; your freedom to choose your health-care provider?; the way the health services ensured you could talk privately to the health-care providers? Factor loadings ranged from 0.705 to 0.808. Reliability coefficient Cronbach's alpha = 0.738
Comprehensiveness	A summative index weighted by factor loadings derived from these variables. For your last visit to a health-care provider, how would you rate the following: the amount of time waited before being attended to?; experience of being involved in making decisions about health care or treatment? Factor loadings ranged from 0.584 to 0.795. Reliability coefficient Cronbach's alpha = 0.634
Quality	A summative index weighted by factor loadings derived from these variables. For your last visit to a health-care provider, how would you rate the following: how satisfied are you with the health-care services?; the way health care in your country involves you in deciding what services it provides and where it provides them? Factor loadings ranged from 0.856 to 0.856. Reliability coefficient Cronbach's alpha = 0.622

Variable	Description	Measurement
Health insurance	Whether the person was a registered member or not with the National Health Insurance Scheme	0 = no, 1 = yes
Control variables:		
Socio-economic variables:		
Educational background	Highest level of education completed by participants	0 = no education, 1 = primary education, 2 = secondary/higher education
Employment status	Whether respondents were currently employed	0 = no, 1 = yes
Wealth status	Income quintiles were derived from the household ownership of durable goods, dwelling characteristics and access to services such as improved water, sanitation and cooking fuel. Using	0 = poorest, 1 = poorer, 2 = middle, 3 = richer, 4 = richest

(*Continued*)

Table 2. (*Continued.*)

	Description	
	a Bayesian post-estimation (empirical Bayes) method, households were arranged on the asset ladder, where the raw continuous income estimates are transformed into quintiles	
Lifestyle variables:		
Walk or use bicycle	Walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places	0 = no, 1 = yes
Tobacco use	Ever smoked tobacco or used smokeless tobacco?	0 = no, 1 = yes
Alcohol consumption	Have you consumed alcohol in the last 30 days?	0 = no, 1 = yes
Body Mass Index (BMI)	BMI variable was created from anthropometric measures (height and weight of respondents)	0 = underweight, 1 = normal, 2 = overweight, 3 = obese
Socio-demographic variables:		
Gender	Whether participant is female or male	0 = male, 1 = female
Age	Age of participants in years	Continuous scalar measure
Marital status	Current marital status of study participants	0 = married/co-habiting, 1 = never married, 2 = divorced/widowed/separated
Ethnicity	What is your background or ethnic group?	0 = Akan, 1 = Ewe, 2 = Ga, 3 = Adangbe, 4 = Northern languages, 5 = other
Religion	Religious denomination of participants	0 = none, 1 = Christian, 3 = Islam, 4 = traditional, 5 = other
Place of residence	Current residential place of participants	0 = rural, 1 = urban

include systolic and diastolic measurements taken at three time-points by trained interviewers using a Boso Medistar Wrist BP Monitor Model S (Minicuci *et al.*, 2014). We used the average of the biometric measures as an indicator of hypertension. Thus, the hypertension measure was created as a binary outcome based on the averages of the systolic blood and diastolic pressure measures and coded 1 if the individual was hypertensive and 0 otherwise. This technique has been used by previous research examining the validity of hypertension measures (Duda *et al.*, 2007; Friedman-Gerlicz and Lilly, 2009; Tenkorang *et al.*, 2015). For the diabetes and

stroke variables, study participants were asked if they had ever been diagnosed by a health professional with these conditions. As the responses were binary, 'yes' was coded as 1 and 'no' as 0. Health services and health insurance were conceptualised as environmental factors, while socio-economic and demographic factors and life-style variables were personal measures (*see* Table 1).

Health services factors were derived using WHO's *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies* (WHO, 2010*b*: 3). We used three key characteristics to measure health services. The first was person-centredness, *i.e.* when services are organised around the person, not the disease; when services are person-centred, users perceive health services to be responsive to them. The second was comprehensiveness, *i.e.* when health services are provided for and appropriate to the needs of the target population. The third was quality. Respondents were asked about their experiences and were instructed to provide answers on a five-point Likert scale, from 1 = very good to 5 = very bad. These responses were reverse-coded for easy interpretation: positive/negative values indicated very good/poor health services.

Analysis

We used ordinary least squares regression (OLS) models because the dependent variables were continuous. Before performing the analysis, we performed diagnostic tests to determine whether the variables met the assumptions of the OLS technique. Because of the hierarchical nature of the SAGE data, with respondents nested within households, and as most regression models are built under the assumption of independence, we imposed a cluster variable to ensure the standard errors were not biased and to produce robust parameter estimates. We used Stata 14.SE for the analysis and adopted the following OLS model:

$$Y_j = \alpha_0 + \beta_1 HYP + \beta_2 DIAB + \beta_3 STR + \beta_4 EDU + \beta_5 X_5 \ldots + \beta_6 P_6 + \varepsilon$$

where Y_j represents the level of disability reported by a respondent j; α_0 is the intercept; β_1, β_2, β_3, β_4, β_5 … β_6 are coefficients; and *HYP*, *DIAB*, *STR*, *EDU*, X_5 and P_6 are the independent and control variables.

Results

Descriptive results

Table 3 shows the distribution of the study variables. The univariate analysis results clearly show the study participants reported higher activity limitations in all categories (changing and maintaining body position; carrying, moving and handling objects; walking and moving; self-care) and lower participation (community, civic and social life; informal relationships). Results also show that 53.87 per cent of the participants who had systolic and diastolic blood pressure measured were hypertensive. Study participants who reported being diagnosed with diabetes or stroke conditions constituted 3.47, and 2.04 per cent of the sample, respectively. Turning to the environmental factors, respondents

Table 3. Univariate distribution of variables

	%	Mean	SD	Minimun	Maximum
Dependent variables:					
Changing and maintaining body position		0.547	1.20	−0.68	4.06
Carrying, moving and handling objects		0.436	1.21	−0.59	5.09
Walking and moving		0.512	1.23	−0.67	4.55
Self-care		0.264	1.23	−0.42	6.06
Interpersonal relationships		0.405	1.27	−0.56	3.76
Community, civic and social life		−0.122	1.04	−2.05	3.42
Informal relationships		−0.017	1.03	−2.62	2.05
Independent variables:					
NCD conditions:					
Hypertension:					
No	46.13				
Yes	53.87				
Diabetes:					
No	96.53				
Yes	3.47				
Stroke:					
No	97.96				
Yes	2.04				
Structural factors:					
Health services:					
Person-centred		0.067			
Comprehensiveness		−0.056			
Quality		0.008			
Insurance:					
No	63.37				
Yes	36.63				
Individul factors:					
Lifestyle factors:					
Body Mass Index:					
Underweight	13.80				
Normal	55.87				
Overweight	18.84				

(*Continued*)

Table 3. (*Continued.*)

	%	Mean	SD	Minimun	Maximum
Obese	11.50				
Vigorous work:					
No	51.45				
Yes	48.55				
Walk or bike:					
No	23.02				
Yes	76.98				
Tobacco use:					
No	76.10				
Yes	23.90				
Alcohol consumption:					
No	41.59				
Yes	58.41				
Socio-economic factors:					
Education level:					
No education	47.79				
Primary	24.01				
Secondary/tertiary	28.19				
Employment status:					
No	25.82				
Yes	74.18				
Wealth status:					
Poorest	18.50				
Poorer	19.14				
Middle	20.19				
Richer	21.19				
Richest	20.97				
Socio-demographic factors:					
Gender:					
Male	52.40				
Female	47.60				
Age		60.08			
Marital status:					
Married/co-habitating	60.19				

(*Continued*)

Table 3. (*Continued.*)

	%	Mean	SD	Minimun	Maximum
Single	2.45				
Divorce/separated	37.36				
Ethnicity:					
Akan	51.08				
Ewe	6.02				
Ga-Adangbe	10.24				
Northern languages	11.89				
Other	20.78				
Religion:					
None	4.66				
Christian	70.71				
Islam	15.11				
Traditional	8.69				
Other	0.83				
Place of residence:					
Rural	58.93				
Urban	41.07				

Notes: SD: standard deviation. NCD: non-communicable disease.

generally reported good people-centred and quality health services, but poor comprehensive health services. As for the personal/individual-level factors, those engaging in vigorous work or walking/biking comprised 48.55 and 76.98 per cent of the sample, respectively. Body Mass Index measurements indicated 13.80 per cent of the respondents were underweight and 11.50 per cent were obese. Those with no education represented 47.79 per cent, while those with secondary/higher education comprised 28.19 per cent of the study sample; 74.18 per cent were employed and 25.82 per cent were not. The majority were married, male and lived in rural areas.

Bivariate results

The bivariate results are presented in Table 4. As the table shows, respondents with NCD conditions (hypertension, diabetes and stroke) reported severe/extreme activity limitations compared to those with no NCD conditions. For instance, respondents affected by stroke reported lower levels of participation in their community, civic and social life and in their informal relationships than those unaffected by stroke. Those who reported receiving very good person-centred and comprehensive health services reported lower levels of activity limitations

Table 4. Bivariate analysis of activity limitations and participation restrictions among people with non-communicable diseases (NCDs) in Ghana

	Activity limitations				Participation restrictions		
	Changing and maintaining body position	Carrying, moving and handling objects	Walking and moving	Self-care	Interpersonal relationships	Community, civic and social life	Informal relationships
NCD conditions:							
Hypertension:							
No	0	0	0	0	0	0	0
Yes	0.106*	0.189***	0.206***	0.217***	0.238***	−0.143***	0.226***
	(0.0432)	(0.0415)	(0.0426)	(0.0439)	(0.0506)	(0.0386)	(0.0415)
Diabetes:							
No	0	0	0	0	0	0	0
Yes	0.440***	0.523***	0.427***	0.363**	0.431***	−0.200*	−0.0799
	(0.120)	(0.143)	(0.111)	(0.132)	(0.123)	(0.0868)	(0.0892)
Stroke:							
No	0	0	0	0	0	0	0
Yes	1.314***	1.343***	1.593***	1.464***	0.700***	−0.523***	−0.389*
	(0.164)	(0.198)	(0.191)	(0.241)	(0.169)	(0.0996)	(0.151)
Structural factors:							
Health services:							
Person-centred	−0.136***	−0.275***	−0.116***	−0.357***	−0.409***	0.303***	0.0300
	(0.0263)	(0.0297)	(0.0300)	(0.0381)	(0.0321)	(0.0250)	(0.0423)

Comprehensiveness	−0.0887**	−0.0905**	−0.0295	−0.0229	−0.173***	0.101**	−0.324***
	(0.0270)	(0.0296)	(0.0260)	(0.0292)	(0.0393)	(0.0313)	(0.0298)
Quality	0.0295	0.141***	0.0509	0.203***	0.181***	−0.0716**	0.233***
	(0.0297)	(0.0375)	(0.0324)	(0.0484)	(0.0358)	(0.0255)	(0.0302)
Insurance:							
No	0	0	0	0	0	0	0
Yes	0.213***	0.153**	0.215***	0.0892	0.0757	−0.0235	−0.0849
	(0.0462)	(0.0475)	(0.0459)	(0.0510)	(0.0524)	(0.0401)	(0.0440)
Individual factors:							
Lifestyle factors:							
Body Mass Index:							
Underweight	0	0	0	0	0	0	0
Normal	−0.398***	−0.367***	−0.442***	−0.251***	−0.385***	0.153**	0.162**
	(0.0640)	(0.0654)	(0.0671)	(0.0702)	(0.0748)	(0.0503)	(0.0541)
Overweight	−0.404***	−0.394***	−0.449***	−0.259**	−0.449***	0.187**	0.173*
	(0.0764)	(0.0788)	(0.0764)	(0.0787)	(0.0891)	(0.0669)	(0.0723)
Obese	−0.0951	−0.213*	−0.0615	−0.0716	−0.313**	0.0305	−0.0777
	(0.0891)	(0.0877)	(0.0938)	(0.101)	(0.0977)	(0.0730)	(0.0901)
Vigorous work:							
No	0	0	0	0	0	0	0
Yes	−0.521***	−0.354***	−0.399***	−0.207**	−0.0505	0.230***	0.573***
	(0.0521)	(0.0575)	(0.0527)	(0.0640)	(0.0702)	(0.0523)	(0.0559)

(*Continued*)

Table 4. (*Continued.*)

	Activity limitations				Participation restrictions		
	Changing and maintaining body position	Carrying, moving and handling objects	Walking and moving	Self-care	Interpersonal relationships	Community, civic and social life	Informal relationships
Walk or bike:							
No	0	0	0	0	0	0	0
Yes	−0.167*	−0.151*	−0.335***	−0.181*	−0.165*	0.234***	0.719***
	(0.0778)	(0.0727)	(0.0818)	(0.0801)	(0.0821)	(0.0659)	(0.0582)
Tobacco use:							
No	0	0	0	0	0	0	0
Yes	−0.0156	0.0660	0.0325	0.0735	−0.0307	0.0786	0.0214
	(0.0532)	(0.0531)	(0.0525)	(0.0540)	(0.0564)	(0.0435)	(0.0540)
Alcohol consumption:							
No	0	0	0	0	0	0	0
Yes	−0.129*	−0.139**	−0.130*	−0.100	−0.141*	0.164***	−0.119*
	(0.0546)	(0.0530)	(0.0524)	(0.0535)	(0.0593)	(0.0434)	(0.0477)
Socio-economic factors:							
Education level:							
No education	0	0	0	0	0	0	0
Primary	−0.529***	−0.384***	−0.460***	−0.250***	−0.443***	0.295***	0.117*
	(0.0561)	(0.0538)	(0.0549)	(0.0539)	(0.0623)	(0.0517)	(0.0542)

Secondary/tertiary	−0.731***	−0.582***	−0.605***	−0.403***	−0.646***	0.358***	0.115
	(0.0563)	(0.0569)	(0.0554)	(0.0570)	(0.0651)	(0.0529)	(0.0612)
Employment status:							
No	0	0	0	0	0	0	0
Yes	−1.024***	−0.885***	−1.208***	−0.735***	−0.845***	0.640***	0.460***
	(0.0575)	(0.0607)	(0.0589)	(0.0612)	(0.0589)	(0.0449)	(0.0441)
Wealth status:							
Poorest	0	0	0	0	0	0	0
Poorer	−0.0333	0.0214	0.0864	0.0788	−0.0711	0.142*	0.245***
	(0.0644)	(0.0636)	(0.0629)	(0.0680)	(0.0719)	(0.0632)	(0.0638)
Middle	0.000972	0.120	0.147*	0.270**	−0.0396	0.181**	0.422***
	(0.0790)	(0.0772)	(0.0744)	(0.0872)	(0.0850)	(0.0670)	(0.0682)
Richer	−0.178*	−0.0949	−0.0287	0.00755	−0.304***	0.199**	0.319***
	(0.0755)	(0.0707)	(0.0708)	(0.0773)	(0.0894)	(0.0709)	(0.0744)
Richest	−0.271***	−0.200**	−0.137	−0.146	−0.385***	0.226**	0.0568
	(0.0800)	(0.0752)	(0.0746)	(0.0803)	(0.0923)	(0.0759)	(0.0820)
Socio-demographic factors:							
Gender:							
Male	0	0	0	0	0	0	0
Female	0.435***	0.247***	0.381***	0.170***	0.338***	−0.410***	−0.0751
	(0.0398)	(0.0414)	(0.0395)	(0.0405)	(0.0445)	(0.0348)	(0.0400)
Age	0.0414***	0.0348***	0.0402***	0.0234***	0.0319***	−0.0145***	−0.00616***
	(0.00155)	(0.00170)	(0.00165)	(0.00168)	(0.00179)	(0.00129)	(0.00122)

(*Continued*)

Table 4. (*Continued.*)

	Activity limitations				Participation restrictions		
	Changing and maintaining body position	Carrying, moving and handling objects	Walking and moving	Self-care	Interpersonal relationships	Community, civic and social life	Informal relationships
Marital status:							
Married/co-habitating	0	0	0	0	0	0	0
Single	0.000136	0.106	0.123	0.391*	0.235	−0.305**	−0.110
	(0.133)	(0.138)	(0.141)	(0.172)	(0.139)	(0.105)	(0.121)
Divorce/separated	0.653***	0.453***	0.616***	0.325***	0.500***	−0.453***	−0.0986*
	(0.0424)	(0.0474)	(0.0428)	(0.0480)	(0.0492)	(0.0372)	(0.0394)
Ethnicity:							
Akan	0	0	0	0	0	0	0
Ewe	−0.140	−0.119	−0.0611	−0.330***	−0.106	0.563***	−0.402***
	(0.0720)	(0.0916)	(0.0831)	(0.0919)	(0.0853)	(0.109)	(0.0751)
Ga-Adangbe	−0.0997	−0.164*	−0.200**	−0.329***	−0.120	0.301***	−0.429***
	(0.0711)	(0.0760)	(0.0762)	(0.0793)	(0.0842)	(0.0900)	(0.0803)
Northern languages	−0.203**	−0.196*	−0.208**	−0.264**	−0.241**	0.130	−0.0873
	(0.0672)	(0.0768)	(0.0710)	(0.0901)	(0.0808)	(0.0826)	(0.0917)
Other	0.0183	−0.00759	−0.0338	−0.0848	−0.0245	0.0848	−0.299**
	(0.0931)	(0.0878)	(0.0805)	(0.0901)	(0.118)	(0.0827)	(0.0947)

Religion:							
None	0	0	0	0	0	0	0
Christian	−0.00140	0.0314	0.0305	0.0936	−0.203	0.333*	0.159
	(0.107)	(0.123)	(0.0940)	(0.0918)	(0.196)	(0.133)	(0.0842)
Islam	−0.0656	0.0323	−0.0557	0.0192	−0.305	0.396**	0.385***
	(0.135)	(0.146)	(0.119)	(0.117)	(0.220)	(0.152)	(0.101)
Traditional	0.136	0.0704	0.165	0.0931	−0.255	0.642***	−0.333**
	(0.159)	(0.152)	(0.126)	(0.114)	(0.247)	(0.155)	(0.120)
Other	0.123	0.272	0.187	0.219	0.0200	0.0163	0.154
	(0.209)	(0.200)	(0.209)	(0.229)	(0.269)	(0.217)	(0.176)
Place of residence:							
Rural	0	0	0	0	0	0	0
Urban	−0.0313	0.000874	0.0243	0.00517	−0.150	−0.187**	−0.173*
	(0.0637)	(0.0728)	(0.0638)	(0.0856)	(0.0824)	(0.0653)	(0.0831)

Note: Standard errors are in parentheses.
Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

and lower levels of participation in their interpersonal relationships. However, they reported higher levels of participation in their community, civic and social life. Compared to those without health insurance, those with health insurance reported higher levels of activity limitations. In terms of personal/individual-level factors, compared to those who were underweight, those who were obese reported lower levels on activity limitations when carrying, moving and handling objects, and lower participation in their interpersonal relationships. Similarly, those who engaged in vigorous work or walking/biking reported no/moderate activity limitations and high participation in their community, civic and social life and in their informal relationships than those who did not. Participants with higher education and those who were employed reported no/moderate activity limitations and higher participation in their community, civic and social life than whose without education or who were unemployed. Females reported more severe/extreme activity limitations and lower participation in their community, civic and social life than their male counterparts. Finally, older people reported a higher prevalence of disability (activity limitations and participation restrictions).

Multivariate results

Tables 5 and 6 show the multivariate results for the three models. The first model incorporated NCDs as health conditions, the second included structural factors and the third added individual-level factors (lifestyle, socio-economic and demographic factors).

As Model 1 shows, individuals with diabetes and stroke reported severe/extreme activity limitations (changing and maintaining body position (diabetes: $\beta = 0.333$, $p < 0.01$; stroke: $\beta = 1.252$, $p < 0.01$), carrying moving and handling objects (diabetes: $\beta = 0.406$, $p < 0.01$; stroke: $\beta = 1.253$, $p < 0.001$), walking and moving (diabetes: $\beta = 0.287$, $p < 0.01$; stroke: $\beta = 1.515$, $p < 0.001$) and self-care (stroke: $\beta = 1.390$, $p < 0.001$[1]), and higher participation in their interpersonal relationships than those without diabetes and stroke. Specifically, those reporting a stroke indicated lower participation in their community, civic and social life (stroke: $\beta = -0.473$, $p < 0.001$; hypertension: $\beta = 0.235$, $p < 0.001$) and in their informal relationships (stroke: $\beta = -0.434$, $p < 0.01$) than those who did not. The direction of the coefficients, for instance, indicates that stroke patients have higher coefficients pertaining to activity limitations and lower coefficients pertaining to participation restrictions, thus contributing the highest burden of disability.

Structural factors, including health services characteristics and health insurance, were incorporated into Model 2. As the model shows, study participants who found person-centred health services to be very good reported no/moderate activity limitations (maintaining and changing body position, carrying, moving and handling objects, walking and moving); they also reported lower participation in their interpersonal relationships. Interestingly, further analysis revealed that those who indicated person-centred and comprehensive health services as very good had higher levels of participation in their community, civic and social life.

Model 3 included individual-level factors. Compared to the underweight, the obese reported severe/extreme activity limitations on maintaining and changing

Table 5. Multivariate analysis of activity limitations among people with non-communicable diseases (NCDs) in Ghana

	Changing and maintaining body position			Carrying, moving and handling objects			Walking and moving			Self-care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
NCD conditions:												
Hypertension:												
No	0	0	0	0	0	0	0	0	0	0	0	0
Yes	0.0770	0.0427	−0.0608	0.159***	0.0865*	0.00308	0.173***	0.147***	0.0183	0.187***	0.101**	0.0347
	(0.0426)	(0.0413)	(0.0345)	(0.0406)	(0.0375)	(0.0351)	(0.0419)	(0.0413)	(0.0359)	(0.0426)	(0.0362)	(0.0370)
Diabetes:												
No	0	0	0	0	0	0	0	0	0	0	0	0
Yes	0.333**	0.266*	0.155	0.406**	0.323*	0.266*	0.287**	0.223*	0.0952	0.231	0.144	0.104
	(0.120)	(0.118)	(0.0963)	(0.145)	(0.139)	(0.118)	(0.110)	(0.109)	(0.0945)	(0.132)	(0.124)	(0.116)
Stroke:												
No	0	0	0	0	0	0	0	0	0	0	0	0
Yes	1.252***	1.246***	0.894***	1.253***	1.291***	0.989***	1.515***	1.513***	1.066***	1.390***	1.458***	1.182***
	(0.165)	(0.166)	(0.144)	(0.198)	(0.198)	(0.183)	(0.191)	(0.192)	(0.161)	(0.240)	(0.237)	(0.226)
Structural factors:												
Health services:												
Person-centred		−0.125***	−0.130***		−0.261***	−0.271***		−0.105***	−0.105***		−0.347***	−0.352***
		(0.0259)	(0.0225)		(0.0273)	(0.0251)		(0.0285)	(0.0257)		(0.0337)	(0.0317)
Comprehensiveness		−0.0741**	−0.0583*		−0.0614*	−0.0505		−0.0121	−0.0151		0.0145	0.0247
		(0.0279)	(0.0273)		(0.0297)	(0.0287)		(0.0261)	(0.0238)		(0.0287)	(0.0274)

Table 5. (*Continued.*)

	Changing and maintaining body position			Carrying, moving and handling objects			Walking and moving			Self-care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Quality		0.0222	0.0482		0.129***	0.145***		0.0424	0.0662*		0.192***	0.191***
		(0.0271)	(0.0249)		(0.0315)	(0.0305)		(0.0293)	(0.0269)		(0.0395)	(0.0369)
Insurance:												
No		0	0		0	0		0	0		0	0
Yes		0.182***	0.00456		0.106*	−0.0381		0.182***	−0.00290		0.0389	−0.0509
		(0.0461)	(0.0359)		(0.0454)	(0.0423)		(0.0449)	(0.0385)		(0.0461)	(0.0463)
Individual factors:												
Lifestyle factors:												
Body Mass Index:												
Underweight			0			0			0			0
Normal			−0.0696			−0.122*			−0.123*			−0.0871
			(0.0524)			(0.0536)			(0.0534)			(0.0608)
Overweight			−0.00787			−0.106			−0.0761			−0.0471
			(0.0603)			(0.0670)			(0.0613)			(0.0671)
Obese			0.246**			0.0498			0.259***			0.138
			(0.0738)			(0.0735)			(0.0766)			(0.0838)
Vigorous work:												
No			0			0			0			0
Yes			−0.254***			−0.128**			−0.0441			−0.00976
			(0.0429)			(0.0472)			(0.0444)			(0.0522)

Walk or bike:				
No	0	0	0	0
Yes	0.102	0.0725	−0.0718	0.0161
	(0.0633)	(0.0641)	(0.0656)	(0.0759)
Tobacco use:				
No	0	0	0	0
Yes	0.0343	0.0822	0.0804	0.110*
	(0.0469)	(0.0470)	(0.0498)	(0.0476)
Alcohol consumption:				
No	0	0	0	0
Yes	0.0362	−0.00630	−0.00558	0.0111
	(0.0420)	(0.0452)	(0.0469)	(0.0508)
Socio-economic factors:				
Education level:				
No education	0	0	0	0
Primary	−0.147**	−0.0810	−0.0802	−0.0766
	(0.0478)	(0.0478)	(0.0476)	(0.0525)
Secondary/tertiary	−0.300***	−0.249***	−0.187**	−0.199**
	(0.0572)	(0.0613)	(0.0569)	(0.0626)
Employment status:				
No	0	0	0	0
Yes	−0.554***	−0.521***	−0.784***	−0.517***
	(0.0525)	(0.0581)	(0.0572)	(0.0606)

(Continued)

Table 5. (*Continued.*)

	Changing and maintaining body position			Carrying, moving and handling objects			Walking and moving			Self-care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Wealth status:												
Poorest			0			0			0			0
Poorer			−0.00714			0.0293			0.0973*			0.0752
			(0.0538)			(0.0558)			(0.0471)			(0.0588)
Middle			0.0303			0.0936			0.162**			0.219**
			(0.0632)			(0.0632)			(0.0576)			(0.0678)
Richer			−0.0570			−0.00699			0.0659			0.0640
			(0.0627)			(0.0631)			(0.0572)			(0.0691)
Richest			−0.140*			−0.0912			−0.0461			−0.0752
			(0.0682)			(0.0721)			(0.0667)			(0.0812)
Socio-demographic factors:												
Gender:												
Male			0			0			0			0
Female			0.168***			0.0575			0.145***			0.0188
			(0.0425)			(0.0424)			(0.0406)			(0.0438)
Age			0.0297***			0.0255***			0.0280***			0.0157***
			(0.00181)			(0.00180)			(0.00185)			(0.00183)
Marital status:												
Married/co-habitating			0			0			0			0

Single	0.285**	0.292**	0.373***	0.428**
	(0.107)	(0.102)	(0.102)	(0.133)
Divorce/separated	0.0995**	0.0125	0.0865*	0.00637
	(0.0381)	(0.0393)	(0.0372)	(0.0444)
Ethnicity:				
Akan	0	0	0	0
Ewe	−0.137*	−0.0606	−0.0958	−0.291***
	(0.0630)	(0.0731)	(0.0700)	(0.0750)
Ga-Adangbe	−0.0816	−0.100	−0.204**	−0.280***
	(0.0706)	(0.0738)	(0.0738)	(0.0707)
Northern languages	−0.0855	−0.0714	−0.0926	−0.129
	(0.0603)	(0.0704)	(0.0660)	(0.0778)
Other	0.0135	0.00128	−0.00526	−0.0446
	(0.0829)	(0.0773)	(0.0755)	(0.0741)
Religion:				
None	0	0	0	0
Christian	0.0607	0.107	0.0833	0.148
	(0.0827)	(0.0903)	(0.0773)	(0.0833)
Islam	0.0238	0.121	0.0309	0.116
	(0.110)	(0.117)	(0.106)	(0.113)
Traditional	0.0779	0.134	0.139	0.229*
	(0.134)	(0.122)	(0.117)	(0.103)
Other	0.0832	0.228	0.194	0.199
	(0.174)	(0.166)	(0.147)	(0.186)

(*Continued*)

Table 5. (*Continued.*)

	Changing and maintaining body position			Carrying, moving and handling objects			Walking and moving			Self-care		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Place of residence:												
Rural			0			0			0			0
Urban			−0.0999			−0.0384			−0.0796			−0.0371
			(0.0569)			(0.0664)			(0.0597)			(0.0693)
Constant	0.468***	0.427***	−0.748***	0.311***	0.326***	−0.664***	0.127**	0.183***	−0.360	0.127**	0.183***	−0.360
	(0.0405)	(0.0438)	(0.181)	(0.0373)	(0.0410)	(0.184)	(0.0399)	(0.0434)	(0.200)	(0.0399)	(0.0434)	(0.200)
N	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210
r^2	0.0277	0.0492	0.361	0.0327	0.0961	0.301	0.0357	0.140	0.260	0.0357	0.140	0.260

Note: Standard errors are in parentheses.
Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 6. Multivariate analysis of participation restrictions among people with non-communicable diseases (NCDs) in Ghana

	Interpersonal relationships			Community, civic and social life			Informal relationships		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
NCD conditions:									
Hypertension:									
No	0	0	0	0	0	0	0	0	0
Yes	0.221***	0.111*	0.0326	−0.131***	−0.0624	−0.000333	0.235***	0.167***	0.149***
	(0.0500)	(0.0432)	(0.0348)	(0.0388)	(0.0352)	(0.0329)	(0.0410)	(0.0316)	(0.0288)
Diabetes:									
No	0	0	0	0	0	0	0	0	0
Yes	0.357**	0.265*	0.239*	−0.147	−0.0896	−0.000500	−0.0749	−0.0705	0.0268
	(0.125)	(0.113)	(0.104)	(0.0845)	(0.0788)	(0.0759)	(0.0880)	(0.0852)	(0.0767)
Stroke:									
No	0	0	0	0	0	0	0	0	0
Yes	0.602***	0.664***	0.396**	−0.473***	−0.508***	−0.311***	−0.434**	−0.383**	−0.224
	(0.171)	(0.156)	(0.143)	(0.100)	(0.105)	(0.0928)	(0.152)	(0.144)	(0.123)
Structural factors:									
Health services:									
Person-centred		−0.387***	−0.404***		0.293***	0.268***		0.0672*	0.0464
		(0.0274)	(0.0249)		(0.0240)	(0.0233)		(0.0332)	(0.0259)
Comprehensiveness		−0.133***	−0.131***		0.0730*	0.0683**		−0.320***	−0.237***
		(0.0359)	(0.0339)		(0.0284)	(0.0257)		(0.0288)	(0.0280)

(*Continued*)

Table 6. (*Continued.*)

	Interpersonal relationships			Community, civic and social life			Informal relationships		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Quality		0.162***	0.152***		−0.0597*	−0.0750**		0.223***	0.160***
		(0.0278)	(0.0245)		(0.0251)	(0.0245)		(0.0272)	(0.0241)
Insurance:									
No		0	0		0	0		0	0
Yes		0.0301	−0.0408		0.00132	0.0602		−0.100**	−0.0622
		(0.0476)	(0.0432)		(0.0356)	(0.0331)		(0.0376)	(0.0401)
Individual factors:									
Lifestyle factors:									
Body Mass Index:									
Underweight			0			0			0
Normal			−0.129*			−0.00487			0.0547
			(0.0599)			(0.0447)			(0.0407)
Overweight			−0.123			0.0421			0.0894
			(0.0717)			(0.0586)			(0.0521)
Obese			0.0167			−0.0470			−0.0111
			(0.0794)			(0.0622)			(0.0633)
Vigorous work:									
No			0			0			0
Yes			0.221***			−0.0152			0.347***
			(0.0621)			(0.0464)			(0.0434)

Walk or bike:			
No	0	0	0
Yes	−0.0808	0.121*	0.385***
	(0.0697)	(0.0580)	(0.0553)
Tobacco use:			
No	0	0	0
Yes	0.0162	−0.0637	0.0259
	(0.0490)	(0.0378)	(0.0378)
Alcohol consumption:			
No	0	0	0
Yes	−0.0141	0.00467	−0.0720*
	(0.0456)	(0.0407)	(0.0361)
Socio-economic factors:			
Education level:			
No education	0	0	0
Primary	−0.140**	0.150***	0.0538
	(0.0473)	(0.0450)	(0.0433)
Secondary/tertiary	−0.289***	0.180***	0.0887
	(0.0577)	(0.0519)	(0.0459)
Employment status:			
No	0	0	0

(*Continued*)

Table 6. (*Continued.*)

	Interpersonal relationships			Community, civic and social life			Informal relationships		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Yes			−0.579***			0.461***			0.229***
			(0.0566)			(0.0422)			(0.0420)
Wealth status:									
Poorest			0			0			0
Poorer			−0.0793			0.158**			0.185***
			(0.0615)			(0.0539)			(0.0522)
Middle			−0.0539			0.208***			0.308***
			(0.0695)			(0.0581)			(0.0481)
Richer			−0.166*			0.188**			0.270***
			(0.0688)			(0.0579)			(0.0552)
Richest			−0.153*			0.208***			0.108
			(0.0747)			(0.0618)			(0.0579)
Socio-demographic factors:									
Gender:									
Male			0			0			0
Female			0.147**			−0.236***			−0.00205
			(0.0473)			(0.0395)			(0.0414)
Age			0.0230***			−0.00621***			0.000245
			(0.00187)			(0.00137)			(0.00132)

Marital status:			
Married/co-habitating	0	0	0
Single	0.386**	−0.197*	−0.00710
	(0.126)	(0.0949)	(0.107)
Divorce/separated	0.0286	−0.0970*	0.0126
	(0.0469)	(0.0379)	(0.0396)
Ethnicity:			
Akan	0	0	0
Ewe	−0.00108	0.508***	−0.165*
	(0.0691)	(0.0995)	(0.0644)
Ga-Adangbe	0.00748	0.249**	−0.217**
	(0.0721)	(0.0814)	(0.0660)
Northern languages	−0.0412	−0.00540	−0.146*
	(0.0718)	(0.0719)	(0.0672)
Other	0.0495	−0.0948	−0.326***
	(0.102)	(0.0743)	(0.0632)
Religion:			
None	0	0	0
Christian	−0.107	0.371***	0.185*
	(0.120)	(0.0940)	(0.0730)
Islam	−0.216	0.481***	0.415***
	(0.153)	(0.122)	(0.0866)

(*Continued*)

Table 6. (*Continued.*)

	Interpersonal relationships			Community, civic and social life			Informal relationships		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Traditional			−0.177			0.621***			−0.0479
			(0.183)			(0.118)			(0.0963)
Other			−0.0409			0.0771			0.198
			(0.186)			(0.190)			(0.131)
Place of residence:									
Rural			0			0			0
Urban			−0.150*			−0.145*			−0.0510
			(0.0645)			(0.0612)			(0.0603)
Constant	0.262***	0.329***	−0.197	−0.0369	−0.0910*	−0.648***	−0.133**	−0.0845*	−1.021***
	(0.0444)	(0.0488)	(0.204)	(0.0362)	(0.0399)	(0.155)	(0.0425)	(0.0395)	(0.141)
N	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210	4,210
r^2	0.0165	0.141	0.331	0.00983	0.100	0.248	0.0158	0.153	0.281

Note: Standard errors are in parentheses.
Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

body position and walking and moving. Compared to those without education and the unemployed, those with a secondary/higher level of education and the employed reported lower activity limitations and lower participation restrictions in their interpersonal relationships. In contrast, those with higher education and the employed had higher participation in their community, civic and social life or in their informal relationships. Females had higher activity limitations and participation restrictions than males.

Discussion

We used the ICF model to examine how NCDs contribute to disability in Ghana. The ICF model provides a common language to understand disability worldwide (WHO, 2002; Resnik and Plow, 2009). It serves as a framework to conceptualise how human functioning related to body structures, functions and activities (at the level of the person) and participation (at the level of society) interact with the structural and individual-level factors.

The sudden onset of such NCDs as hypertension, diabetes and stroke could disrupt a person's life, but most interventions focus on organ damage (impairment), with little attention to other aspects of human functioning (Algurén *et al.*, 2009). In this study, stroke emerged as a major contributor to disability; it limited people's functioning and participation in daily activities and in society as a whole. Research in Western countries notes that about 90 per cent of stroke survivors have some disability, with compromised neurological functions (motor, sensory, visual) and/or limited ability to perform daily activities (Glässel *et al.*, 2010; Sumathipala *et al.*, 2011; Silva *et al.*, 2015; Carvalho-Pinto and Faria, 2016). Research conducted in sub-Saharan Africa finds stroke survivors have decreased social interactions with neighbours and other relatives and experience difficulty participating in social gatherings (Algurén *et al.*, 2009; Vincent-Onabajo, 2013; Urimubenshi, 2015). In our study, individuals living with diabetes and hypertension did not report severe disability, but such conditions are usually asymptomatic. Participants may not have detected these conditions because of inadequate education, limited access to health care or delayed diagnosis (Aikins, 2003; Lins *et al.*, 2010).

Studies in Western countries have demonstrated that individuals with higher education are able to delay the onset of disability or postpone disability to a greater extent than those with less education (Jones and Latreille, 2009; Montez *et al.*, 2017; Chatzitheochari and Platt, 2019). However, educational level may have less effect once a disability is present. Our results suggest socio-economic factors have a significant effect. For instance, in our sample, those with a higher level of education and the employed were less likely to report disability than those without education and the unemployed. This finding is partly explained by the fact that education enhances knowledge, and those with adequate health knowledge are likely to seek out healthy lifestyle behaviours and health care (Zühlke and Engel, 2013; Checkley *et al.*, 2014; Schulz *et al.*, 2016; Lee *et al.*, 2018).

In the ICF model, certain structural-level factors are considered to be contextual factors affecting the functioning of an individual. For instance, in this study health systems had an impact on disability. We found that those who received good person-centred and comprehensive health services were less likely to report

disability. Previous research demonstrates that those with disability are more likely to utilise health-care and rehabilitative services to address their functional level (Jones *et al.*, 2016; Reichard *et al.*, 2019).

Finally, we found some individual-level variables affected disability. For instance, women reported more disability than men; this may be related to women's primary responsibility for the household and their more limited participation in social life (WHO, 2011). We also found that older people were more likely to report activity limitations and participation restrictions. This has been documented elsewhere; research in Western countries has established a strong association between ageing and disability, with decreased functioning in cognitive, physical and sensory domains having a major impact on older adults (Freedman *et al.*, 2002). The findings further indicate that lifestyle factors affect disability among NCD patients in Ghana. Analyses revealed significant differences between respondents who engaged in physical activity and those who did not. For instance, respondents who engaged in physical activity reported lower activity limitations in changing and maintaining body position and carrying and handling objects, and higher participation in interpersonal relationships and community, civic and social life. Respondents who were obese reported higher activity limitations (in changing and maintaining body position and walking and moving). Our results are consistent with some studies in Western countries that established that engaging in risky lifestyle behaviours increases the likelihood of living with a disability, while adopting healthy behaviours such as physical activity reduces the burden of disability (Jacob *et al.*, 2016; Raina *et al.*, 2021).

Conclusion

In this research, we investigated the prevalence of activity limitations and participation restrictions among Ghanaians living with NCDs including hypertension, diabetes and stroke. The results clearly show stroke is the largest contributor to disability in the Ghanaian population. We also found those with higher socio-economic status, particularly those with higher education, reported no/moderate disability. Our findings have policy implications. For example, interventions to reduce the burden of disability in the Ghanaian population should include the provision of accessible public spaces for those with activity limitations and participation restrictions.

Despite the interesting findings, it is important to acknowledge the limitations of the study. First, the use of self-reported data may have introduced subjective interpretations of the survey items by respondents, biased by their experiences and culture. Second, we did not examine the issue of reverse causality, even though it could affect the interpretation of the results. We do not know, for instance, whether disability causes NCDs or NCDs cause disability, and future research should certainly address this issue. Unfortunately, the cross-sectional nature of the SAGE data did not allow us to make causal inferences. Third, due to data limitations, we were unable to examine other elements of the ICF including body functions and body structures. Despite the limitations, this study is one of the few in Ghana and sub-Saharan Africa to have developed a comprehensive operationalisation of disability in exploring its relationship with NCDs.

Note

1 No significant association was observed for diabetes.

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