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

Emmanuel Banchani1*, Eric Y. Tenkorang1 and William Midodzi2

1Department of Sociology, Memorial University, St. John’s, Canada and 2Faculty of Medicine, Division of Community Health and Humanities, Memorial University, St. John’s, Canada

*Corresponding author. Email: eb1043@mun.ca

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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.

Keywords: disability; non-communicable diseases (NCDs); activity limitations; participation restriction; Ghana

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 functions¹ | Body structures² | Activities and participation³ | Environmental factors⁴ |
|-----------------|-----------------|------------------------------|------------------------|
| 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 |
| Functions of the digestive, metabolic and endocrine systems | Structures related to the digestive, metabolic and endocrine systems | Self-care: |

(Continued)
| Body functions                     | Body structures                                   | Activities and participation          | Environmental factors       |
|-----------------------------------|---------------------------------------------------|---------------------------------------|-----------------------------|
| 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                      |                             |

Notes: 1. Code letter is ‘b’. 2. Code letter is ‘s’. 3. Code letter is ‘d’. 4. Code letter is ‘e’. 
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, 2010a; Ghana Health Service (GHS) (nd)). The SAGE data
Table 2. Operationalisation of scalar and categorical variables

| Description                                                                 | Details                                                                                     |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| **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 0.817. 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 | Measurement |
|-------------|-------------|
| 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)
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 hyperten-
sion. 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 pre-
vious research examining the validity of hypertension measures (Duda et al., 2007;
Friedman-Gerlicz and Lilly, 2009; Tenkorang et al., 2015). For the diabetes and

| 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 |
| **Tobacco use** | Ever smoked tobacco or used smokeless tobacco |
| **Alcohol consumption** | Have you consumed alcohol in the last 30 days |
| **Body Mass Index (BMI)** | BMI variable was created from anthropometric measures (height and weight of respondents) |
| Socio-demographic variables: |  |
| **Gender** | Whether participant is female or male |
| **Age** | Age of participants in years |
| **Marital status** | Current marital status of study participants |
| **Ethnicity** | What is your background or ethnic group? |
| **Religion** | Religious denomination of participants |
| **Place of residence** | Current residential place of participants |

Table 2. (Continued.)
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 lifestyle 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, 2010b: 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 \(j\); \(\alpha_0\) is the intercept; \(\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \ldots \beta_6\) 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
| Independent variables: | %   | Mean | SD  | Minimum | Maximum |
|------------------------|-----|------|-----|---------|---------|
| 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 |      |     |         |         |
| Individual factors:    |     |      |     |         |         |
| Lifestyle factors:     |     |      |     |         |         |
| Body Mass Index:       |     |      |     |         |         |
| Underweight            | 13.80 |      |     |         |         |
| Normal                 | 55.87 |      |     |         |         |
| Overweight             | 18.84 |      |     |         |         |

(Continued)
Table 3. (Continued.)

|                                    | %     | Mean   | SD    | Minimum | 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)
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
| 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)  |
Table 4. (Continued.)

| Activity limitations | Participation restrictions |
|----------------------|---------------------------|
| Changing and         |       | Interpersonal relationships | Community, civic and social life | Informal relationships |
| 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                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Tobacco use:         |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Alcohol consumption: |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Socio-economic factors: |     |                            |                               |                       |
| Education level:     |       |                            |                               |                       |
| No education         |       |                            |                               |                       |
| Primary              |       |                            |                               |                       |

| Walk or bike:        |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Tobacco use:         |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Alcohol consumption: |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Socio-economic factors: |     |                            |                               |                       |
| Education level:     |       |                            |                               |                       |
| No education         |       |                            |                               |                       |
| Primary              |       |                            |                               |                       |

| Tobacco use:         |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Alcohol consumption: |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Socio-economic factors: |     |                            |                               |                       |
| Education level:     |       |                            |                               |                       |
| No education         |       |                            |                               |                       |
| Primary              |       |                            |                               |                       |

| Walk or bike:        |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Tobacco use:         |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Alcohol consumption: |       |                            |                               |                       |
| No                   |       |                            |                               |                       |
| Yes                  |       |                            |                               |                       |
|                      |       |                            |                               |                       |
| Socio-economic factors: |     |                            |                               |                       |
| Education level:     |       |                            |                               |                       |
| No education         |       |                            |                               |                       |
| Primary              |       |                            |                               |                       |
| 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) |
| Marital status:       | Activity limitations | Participation restrictions |
|----------------------|----------------------|---------------------------|
|                      | Changing and       | Carrying, moving and     | Walking and moving | Self-care | Interpersonal relationships | Community, civic and social life | Informal relationships |
|                      | maintaining body   | handling objects         |                   |          |                           |                           |                       |
| body position        | 0                    | 0                         | 0                  | 0         | 0                           | 0                           | 0                       |
| Marital/co-habitating|                      |                           |                     |           |                             |                             |                         |
|                      | 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      | Christian | Islam    | Traditional | Other     |
|-------------------------------|-----------|-----------|----------|-------------|-----------|
|                               | 0         | 0.00140   | 0.0656   | 0.136       | 0.123     |
|                               |           | (0.107)   | (0.135)  | (0.159)     | (0.209)   |
|                               |           | 0.0314    | 0.0323   | 0.0704      | 0.272     |
|                               |           | (0.123)   | (0.146)  | (0.152)     | (0.200)   |
|                               |           | 0.0305    | −0.0557  | 0.165       | 0.187     |
|                               |           | (0.0940)  | (0.119)  | (0.126)     | (0.209)   |
|                               |           | 0.0936    | 0.0192   | 0.0931      | 0.219     |
|                               |           | (0.0918)  | (0.117)  | (0.114)     | (0.229)   |
|                               |           | −0.203    | −0.305   | −0.255      | 0.0200    |
|                               |           | (0.196)   | (0.220)  | (0.247)     | (0.0269)  |
|                               |           | 0.333*    | 0.396**  | 0.642***    | 0.0163    |
|                               |           | (0.133)   | (0.152)  | (0.155)     | (0.217)   |
|                               |           | 0.159     | 0.385*** | −0.333**    | 0.154     |
|                               |           | (0.0842)  | (0.101)  | (0.120)     | (0.176)   |

| Place of residence:         | Rural     | Urban     |
|------------------------------|-----------|-----------|
|                               | 0         | −0.0313   |
|                               |           | (0.0637)  |
|                               | 0         | 0.000874  |
|                               |           | (0.0728)  |
|                               | 0         | 0.0243    |
|                               |           | (0.0638)  |
|                               | 0         | 0.00517   |
|                               |           | (0.0856)  |
|                               | 0         | −0.150    |
|                               |           | (0.0824)  |
|                               | 0         | −0.187**  |
|                               |           | (0.0653)  |
|                               | 0         | −0.173*   |
|                               |           | (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: $\beta = 1.390, p < 0.001$), 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 |
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|                                | Changes 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:                     | 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:            | 0.246**  | 0.0498  | 0.259*** | 0.138    |
|                                | (0.0738) | (0.0735) | (0.0766) | (0.0838) |
| Vigorous work:                 | 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) |
### 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       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |
| Poorer              | −0.00714| 0.0293  | 0.0973* | 0.0752  | 0.0538  | 0.0558  | 0.0471  | 0.0588  | 0.0558  | 0.0471  | 0.0588  | 0.0558  |
| Middle              | 0.0303  | 0.0936  | 0.162** | 0.215** | 0.0632  | 0.0632  | 0.0576  | 0.0678  | 0.0632  | 0.0576  | 0.0678  | 0.0632  |
| Richer              | −0.0570 | −0.00699| 0.0659  | 0.0640  | 0.0627  | 0.0631  | 0.0572  | 0.0691  | 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  | 0.0682  | 0.0721  | 0.0667  | 0.0812  |
| **Socio-demographic factors:** |         |         |         |         |         |         |         |         |         |         |         |         |
| Gender:             |         |         |         |         |         |         |         |         |         |         |         |         |
| Male                | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |
| Female              | 0.168***| 0.0575  | 0.145***| 0.0188  | 0.0425  | 0.0424  | 0.0406  | 0.0438  | 0.0425  | 0.0424  | 0.0406  | 0.0438  |
| Age                 | 0.029***| 0.0255***| 0.0280***| 0.0157***| 0.00181 | 0.00180 | 0.00185 | 0.00183 | 0.00181 | 0.00180 | 0.00185 | 0.00183 |
| Marital status:     |         |         |         |         |         |         |         |         |         |         |         |         |
| Married/co-habitating | 0      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |
|                        | Single  | Divorce/separated | Ethnicity: | Religion: |
|------------------------|---------|-------------------|------------|----------|
|                        | 0.285** | 0.0995**          |            |          |
|                        | 0.292** | 0.0125            |            |          |
|                        | 0.373***| 0.0865*           |            |          |
|                        | 0.428** | 0.00637           |            |          |
| (0.107)                | (0.102) | (0.102)           | (0.0381)   |          |
| (0.102)                | (0.0393)| (0.0372)          | (0.0372)   |          |
| (0.133)                | (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        |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| Urban                | −0.0999  | −0.0384  | −0.0796  | −0.0371             |                      |                      |                      |                      |                      |                      |                      |                      |
|                      | (0.0569) | (0.0664) | (0.0597) |                      |                      |                      |                      |                      |                      |                      |                      |                      |
| 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    |
| r²                   | 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       | 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       | 0       | 0       | 0       | 0       | 0       | 0       |
| Normal                  | −0.129* | 0.00487 | −0.00487 | 0.0547 | (0.0599) | (0.0447) | (0.0407) |
|                         | (0.0717) | 0.0421 | (0.0586) | (0.0521) | (0.0794) | (0.0622) | (0.0633) |
| Overweight              | −0.123  | 0.0421  | 0.0421  | 0.0894 | (0.0599) | (0.0447) | (0.0407) |
|                         | (0.0717) | 0.0421 | (0.0586) | (0.0521) | (0.0794) | (0.0622) | (0.0633) |
| Obese                   | 0.0167  | −0.0470 | −0.0470 | −0.1111 | (0.0599) | (0.0447) | (0.0407) |
|                         | (0.0717) | 0.0421 | (0.0586) | (0.0521) | (0.0794) | (0.0622) | (0.0633) |
| Vigorous work:          |         |         |         |         |         |         |         |         |         |
| No                      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |
| Yes                     | 0.221*** | −0.0152 | 0.347*** |
|                         | (0.0621) | (0.0464) | (0.0434) |
|                          | No       | Yes       | \( \text{coeff} \) |
|--------------------------|----------|-----------|-------------------|
| Walk or bike:            |          |           |                   |
| No                       | 0        | 0         | 0                 |
| Yes                      | \(-0.0808\) | \(0.121^*\) | \(0.385^{***}\)  |
| Tobacco use:             |          |           |                   |
| No                       | 0        | 0         | 0                 |
| Yes                      | \(0.0162\) | \(-0.0637\) | \(0.0259\)       |
| Alcohol consumption:     |          |           |                   |
| No                       | 0        | 0         | 0                 |
| Yes                      | \(-0.0141\) | \(0.00467\) | \(-0.0720^*\)    |
| Socio-economic factors:  |          |           |                   |
| Education level:         |          |           |                   |
| No education             | 0        | 0         | 0                 |
| Primary                  | \(-0.140^{**}\) | \(0.150^{***}\) | \(0.0538\)       |
| Secondary/tertiary       | \(-0.289^{***}\) | \(0.180^{***}\) | \(0.0887\)       |
| Employment status:       |          |           |                   |
| No                       | 0        | 0         | 0                 |
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) |
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             |         |         |         | 0.621*** |         |         | −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 par-
ticipation 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 dis-
rupt 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 disabil-
ity, 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; Urimubensi, 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 sig-
nificant 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.
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Conflict of interest. The authors declare no conflicts of interest.

Note
1 No significant association was observed for diabetes.

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