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# Level of disability in stroke survivors in the greater accra region of ghana: a cross-sectional study

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## Abstract

**Background** Many stroke survivors in low- and middle-income countries such as Ghana live with various degrees of disabilities. Insight into the level of disability and its determinants in stroke survivors has become very important. This study aimed to assess disability and determinants in stroke survivors in the Greater Accra Region of Ghana.

**Methods** One hundred and eight community-dwelling stroke survivors undergoing outpatient physiotherapy rehabilitation were sampled for the study. The World Health Organization disability assessment schedule (WHO-DAS) questionnaire was used to assess the level of disability in the participants. Sociodemographic and clinical data were gathered to help assess the determinants of disability. Association between sociodemographics and disability, and clinical characteristics and disability were determined using chi-square/Fisher's exact test. *p* values less than 0.005 were considered statistically significant.

**Results** Most of the study participants were reported to have moderate to severe disabilities in their bodily function. Age, gender, marital status, and employment status were found to be associated with the level of disability in stroke survivors.

**Conclusion** Disability and its determinants in stroke need to be given much attention as disability affects the ability of stroke survivors to function independently.

**Keywords** Stroke, Stroke survivors, Disability, Determinants of disability, Ghana

## Introduction

Stroke is still a major concern worldwide, as it is the leading cause of long-term disability in the adult population [1, 2]. About two-thirds of all stroke cases are now recorded in low-and-middle-income countries such as Sub-Saharan African countries, implying that

the burden of stroke-related disability is also high in these areas [3, 4]. The incidence and survival rate of stroke have been reported to be on the rise along with life expectancy, which has led to an increase in the rate of disability as disability is the primary outcome of stroke for those who are still living [5]. Thus, there will be an increase in the number of disabilities reported in low- and middle-income countries such as Ghana [6]. According to a review of stroke in Africa, the number of stroke cases will continue to rise in sub-Saharan Africa as a result of increased migration to urban centers, and this has been projected to get much worse in countries like Ghana [7]. Stroke is the main contributor to adult disability in Ghana, which confirms the projection [7]. This implies that if no action is taken to address the challenges of stroke, stroke-related

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disability in countries such as Ghana will substantially rise in the near future.

In stroke survivors, disability causes impairments, activity limitations, and participation restrictions [8]. As a result, the quality of life of stroke survivors is affected as they have to rely on others either partially or completely to perform their basic activities of daily living [9].

Understanding the level of disability as well as the determinants of disability can assist in paying more attention to stroke survivors and identifying those who are at higher risk of having long-term disability. Early prediction of disability helps with rehabilitation planning and thereby helps reduce the cost of stroke management by providing more specific and timely rehabilitation [10]. It could also aid in the development of assessments and interventions to help in the management of stroke-related disabilities. It will also help in stroke patients' discharge planning and anticipate the need for home and community support [10].

Once we have identified the level of disability in community-dwelling stroke survivors, as well as their determinants in the Ghanaian population, we will be able to identify many appropriate measures to put in place in terms of rehabilitating these groups of people and, as a result, reducing the number of disabled people in Ghana.

Although there are very few studies that have looked into the determinants of disability in community-dwelling stroke survivors, the few conducted were not in Ghana. Due to environmental factors, the results of those studies might not be contextually applicable to the Ghanaian population and therefore the need for this current study. Sociodemographic and clinical characteristics were used to assess the determinants of disability in stroke survivors.

This study therefore aimed to assess the level of disability and determinants of disability in stroke survivors in the Greater Accra Region of Ghana.

## Methods

### Study design

A cross-sectional study design was employed for this study. Ethical approval for this study was sought and received from the Ethical and Protocol Review Committee of the School of Healthcare Sciences, University of Pretoria (protocol number: 68/2020), Ghana Health Service Ethics Review Committee (protocol number: GHS-ERC 010/02/20) and Korle Bu Teaching Hospital Ethical and Protocol Review Committee (protocol number: KBTH-IRB/000165/2019). Voluntary written informed consent was also received from each participant through signing or thumbprinting.

### Setting

Stratified random sampling was used to stratify the hospitals in the Greater Accra Region of Ghana into the three levels of healthcare, which are the primary, secondary, and tertiary level hospitals. There was then the convenience sampling of one hospital from each stratum. Therefore, a total of three hospitals were selected for this study and these were the Korle Bu Teaching Hospital, Tema General Hospital, and Amasaman District Hospital. Korle Bu Teaching Hospital is a tertiary-level hospital, Tema General Hospital is a secondary-level hospital and Amasaman District Hospital is a primary-level hospital. All three selected hospitals are involved in both in-patient and out-patient stroke rehabilitation. This study was carried out at the physiotherapy outpatient departments of the selected hospitals.

### Participants and sampling strategy

This study sampled one hundred and eight first-time stroke survivors attending outpatient physiotherapy rehabilitation. The inclusion criteria were stroke patients (18 years and above) who had suffered stroke for the first time ever (to eliminate the effect of residual disability that characterizes recurrent stroke), living with stroke for at least 6 months, as well as attending outpatient physiotherapy rehabilitation at the selected hospitals. Stroke survivors with cognitive and communication deficits were excluded. The minimum number of study participants that were enrolled in this study was obtained using the Cochrane formula;  $n = Z^2 (P) (1 - P) / E^2$  [11]. At a confidence interval of 95% and a standard score ( $Z$ ) of 1.96, a population proportion ( $P$ ) of 0.5, and an allowable error ( $e$ ) of 0.094, a minimum of 108 stroke patients were recruited into this study. Based on the level of hospital and the patient number, 50 were recruited from Korle-Bu Teaching Hospital, 40 from Tema General Hospital, and 18 from Amasaman District Hospital.

### The instrument for data collection

The World Health Organization disability assessment schedule (WHODAS) questionnaire was administered to assess the level of disability in participants. A data-capturing form was also designed to gather information on the sociodemographic and clinical characteristics of the participants.

The WHODAS 2.0 (12 items) is a questionnaire with 12 items that assess the level of a disability taking into consideration the various components of the ICF. It assesses the level of disability in the past month. The questionnaire can be completed by a patient, clinician, or informant. In this study, the researcher (first author) administered the questionnaire. This version of

the questionnaire is in the English language. It assesses six aspects of adult tasks which are; understanding and communication, self-care, mobility, interpersonal relationships, work and household roles, and community and civic roles. The scores assigned to each item are as follows; “none” (0), “mild” (1), “moderate” (2), “severe” (3), and “extreme” (4). It takes not more than 10 min to complete. It is a reliable tool with Cronbach’s  $\alpha$ -coefficient of 0.92 [12].

**Procedure for data collection**

After having received consent from each participant, the aim and purpose of the study were also re-emphasized to each of the participants. The researcher (first author) administered the questionnaire and the data-capturing form to the participants. Data on the type of stroke were gathered from the patient folder by the researcher. All COVID-19 safety measures outlined by the Ghana Health Service were duly observed during the data collection process.

**Statistical analysis**

All data collected were entered into SPSS version 22.0 software for analysis. Descriptive statistics such as frequency and percentages were used to summarize the descriptive data. Chi-square/Fisher exact test was used to assess the association between the sociodemographic and clinical characteristics, and level of disability. A probability value less than 0.05 was considered statistically significant.

**Results**

**Sociodemographic characteristics**

This study recruited a total of one hundred and eight stroke survivors receiving out-patient physiotherapy rehabilitation from the primary (Amasaman District Hospital), secondary (Tema General Hospital), and tertiary (Korle Bu Teaching Hospital) level hospitals in the Greater Accra Region of Ghana. Of the 108 recruited participants, 18 (16.7%), 40 (37%), and 50 (46.3%) were recruited from primary, secondary, and tertiary-level hospitals respectively. The majority of the recruited study participants (46.7%) were between the ages of 48–63 years. Those aged 18–47 years accounted for about 22.4% of participation and participants who were 64 years and above accounted for 30.8%. The majority of the study participants were married, employed, and had secondary-level education. The majority of study participants were also found to neither consume alcohol nor smoke. Moreover, all the study participants were using Health Insurance, and the most used health insurance among the study participants was National Health Insurance (Table 1).

**Table 1** Sociodemographics of study participants

Sociodemographics	Frequency (n = 108) N (%)
Age	
18–47	24(22.2)
48–63	50(46.3)
64 and above	23(21.3)
Sex	
Male	55(50.9)
Female	53(49.1)
Marital status	
Single	12(11.1)
Married	83(76.9)
Divorced	2(1.9)
Widowed	11(10.1)
Level of education	
No education	7(6.5)
Primary	16(14.8)
Junior high	10(9.3)
Secondary	43(39.8)
Tertiary	32(29.6)
Type of employment	
Unemployed	10(9.3)
Self-employed	47(43.5)
Public sector	24(22.2)
Private sector	13(12.0)
Other	13(12.0)
Retired	1(1)
Type of health insurance	
NHIS	101(93.5)
Private	6(5.6)
Other	1(0.9)
Family history of stroke	
Yes	54(50)
No	54(50)
History of alcohol consumption	
Yes	23(21.3)
No	85(78.7)
History of smoking	
Yes	5(4.6)
No	103(95.4)

**Clinical characteristics**

The majority of the study participants (56.5%) were found to have infarctive stroke. All participants had at least one comorbidity, and hypertension was the highest recorded comorbidity (71.3%). Most participants (55.5%) also had right-sided affectation. Most of the participants had lived with stroke for at least 6 months and had also received rehabilitation for at least 6 months (Table 2).

**Table 2** Clinical characteristics of study participants

Clinical characteristics	Frequency (n = 108) N (%)
Comorbidities	
Diabetes	2(1.9)
Hypertension	77(71.3)
Other	4(3.7)
Diabetes, hypertension	25(23.1)
None	0(0.0)
Stroke type	
Infarctive	61(56.5)
Hemorrhagic	6(5.6)
Unclassified	41(37.9)
Side of stroke	
Left	46(42.6)
Right	60(55.5)
Both	2(1.9)
Duration of living with stroke	
6 to 12 months	97(89.9)
Greater than 12 months	11(10.1)
Management duration	
6 to 12 months	103(95.4)
Greater than 12 months	5(4.6)

**Level of disability**

A higher proportion of the study participants reported severe difficulty with standing for long periods (42.6%), taking care of household responsibilities (45.4%), learning new tasks (38.9%), joining community activities (38.0%), walking long distances (50.0%) and carrying out day-to-day work (37.0%). Also, a higher proportion of the study participants (35.2%) reported being severely affected emotionally. The majority of the study participants also

reported moderate difficulty with washing their whole bodies (31.5%) and getting dressed (36.3%). Moreover, for dealing with unknown persons, maintaining friendships, and concentrating on doing something, most of the study participants reported having mild difficulty (Table 3).

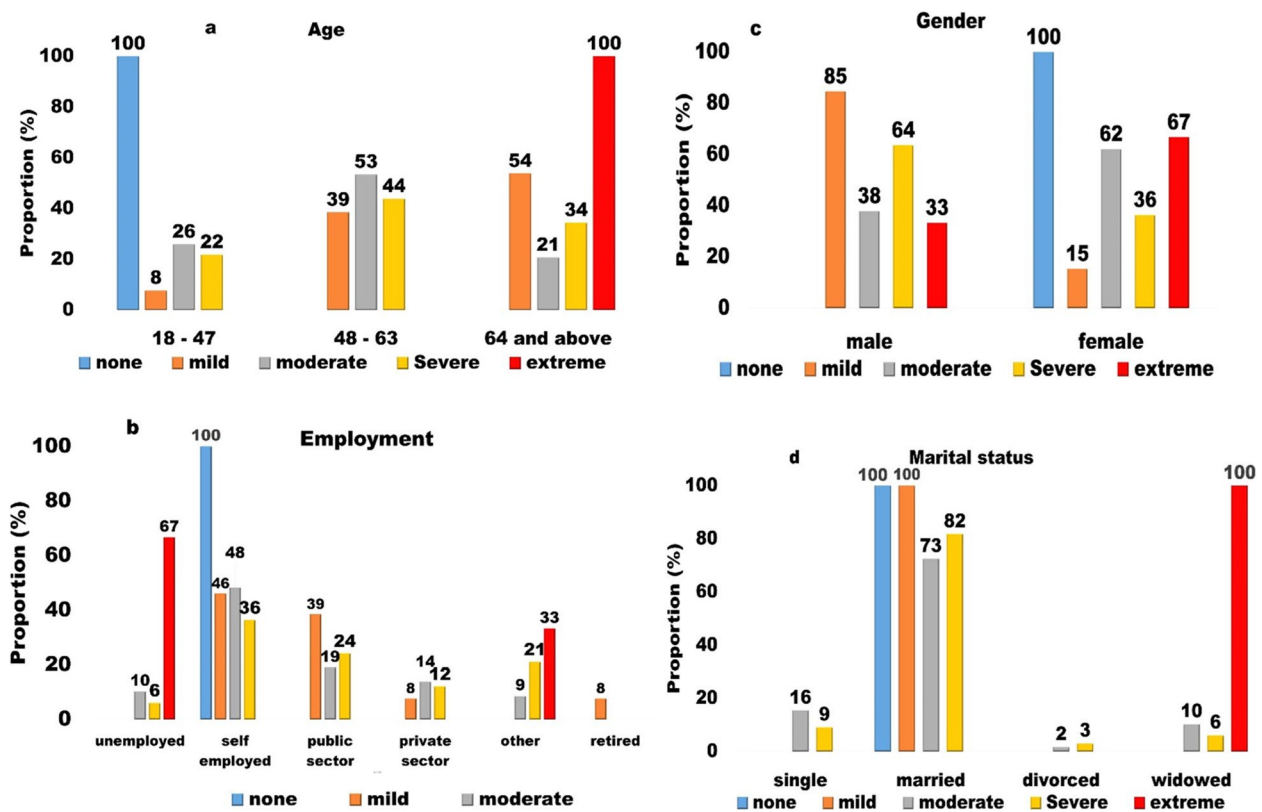
**Determinants of disability**

This study found a statistically significant association between age and level of disability ( $p=0.032$ ), gender and level of disability ( $p=0.010$ ), and marital status and level of disability ( $p=0.001$ ). For the association between age and disability level, it was found that most of the study participants who reported moderate (53.4%) to severe (43.8%) disabilities were those between the ages of 48–63 years. All participants (100%) who reported extreme disability were between the ages of 64 years and above. Also, for an association between gender and level of disability, the majority of those who reported severe (63.6%) disabilities were males while the majority of participants who reported extreme (66.7%) disability were females. For the association between marital status and level of disability, most of the study participants who reported moderate (72.5%) to severe (81.8%) disability were married whereas all participants who reported extreme (100%) disability were widowed. Although no statistically significant association ( $p=0.0046$ ) was found between the type of employment and disability level, most of the participants who reported moderate (48.3%) to severe (36.2%) disability were self-employed while the majority of those who reported extreme (66.7%) disability were unemployed (Fig. 1).

This study found no statistically significant association between hospital rehabilitation and level of disability ( $p=0.875$ ). Also, this study found the level of education not to be associated with the level of disability

**Table 3** Level of disability of study participants

Variable Difficulty level	None N (%)	Mild N (%)	Moderate N (%)	Severe N (%)	Extreme N (%)
Standing for long periods such as 30 min	5(4.6)	21(19.4)	26(24.1)	46(42.6)	10(9.3)
Taking care of household responsibilities	7(6.4)	10(9.2)	14(13.0)	49(45.4)	28(26.0)
Learning new task	8(7.4)	12(11.1)	26(24.1)	42(38.9)	20(18.5)
How much of a problem did you have joining community activities	4(3.7)	10(9.2)	23(21.3)	41(38.0)	30(27.8)
How much have you been emotionally affected	7(6.4)	28(26.0)	27(25.0)	38(35.2)	8(7.4)
Concentrating on doing something for 10 min	34(31.5)	37(34.2)	29(26.9)	4(3.7)	4(3.7)
Walking long distances such as a kilometer or equivalent	2(1.9)	8(7.4)	20(18.5)	50(46.2)	28(26.0)
Washing your whole body	9(8.3)	33(30.6)	34(31.5)	20(18.5)	12(11.1)
Getting dressed	7(6.4)	32(29.6)	39(36.3)	20(18.5)	10(9.2)
Dealing with people you do not know	16(14.8)	42(39.0)	36(33.3)	9(8.3)	5(4.6)
Maintaining friendship	16(14.8)	45(41.7)	34(31.5)	8(7.4)	5(4.6)
Your day-to-day work	1(0.9)	5(4.6)	20(18.5)	37(34.3)	45(41.7)



**Fig. 1** The figure shows the determinants of disability. Age ( $p=0.032$ ), gender ( $p=0.010$ ), marital status ( $p=0.001$ ), and employment status ( $p=0.0046$ ) were found as determinants of disability

of patients ( $p=0.745$ ). Moreover, family history of stroke ( $p=0.713$ ), comorbidities ( $p=0.868$ ), alcohol consumption ( $p=0.736$ ), smoking ( $p=0.938$ ), type of stroke ( $p=0.470$ ), and side of stroke ( $p=0.117$ ) were also found not to be statistically significantly associated with disability level in participants.

### Discussion

Stroke is a condition that leaves most of its survivors with residual disability which affects their ability to carry out their normal activities of daily living, thereby affecting their quality of life. To help reduce stroke-related disability, it is important to understand the level of disability as well as factors that determine disability levels in stroke survivors. This study, therefore, assessed the level of disability in community-dwelling stroke survivors as well as the determinants of disability.

This study found that most of the stroke survivors were between 48 and 63 years and this age group is within the working population. Currently, stroke has been found to affect much younger persons less than 65 years as also recorded in this current study especially in Africa [13–15]. Infarctive stroke was found in this study as the most common type of stroke also recorded in the literature

that the most common type of stroke is infarctive stroke which accounts for about 80% of stroke cases [16]. Also, the majority of the participants in this study were found to be hypertensive and hypertension is recorded to be the major risk factor associated with stroke [17].

Disability has been found in this study to affect the daily life activities of stroke survivors. Most of the study participants reported having severe difficulty with standing for long periods, taking care of household responsibilities, learning new tasks, joining community activities, walking long distances, and carrying out day-to-day work. Most of them also reported being severely affected emotionally. This means stroke affected the mobility, participation, and psychological well-being of participants. Most of the participants also reported moderate difficulty with self-care activities such as bathing and grooming. This will therefore make the stroke survivor become more dependent on others for performing their day-to-day activities and thereby have a poor quality of life. These findings have also been reported in similar studies around Africa where stroke patients have also been reported to have difficulty with mobility, activities of daily living, leisure, and social activities despite undergoing rehabilitation [18–20]. This means that a lot

of attention needs to be given to stroke rehabilitation to help deal with the stroke-related disability, thereby getting stroke survivors to become more functional and independent. This will help reduce the burden of stroke on individuals and the nation at large.

The results of this study found age, gender, marital status, and type of employment as possible determinants of disability levels in community-dwelling stroke survivors. However, hospital rehabilitation, level of education, family history of stroke, comorbidities, type and side of stroke, smoking, and alcohol intake were found not to influence disability level in stroke survivors.

This study found age as a determinant of disability as also reported in previous studies that age is a predictor of disability among stroke survivors [14, 18, 21]. In this study, stroke patients aged 64 years and above were found to have severe disability as compared to those younger. This could be attributed to the fact that old age is significantly associated with poor functional outcomes as functional capacity decreases with age and therefore leads to more severe disability as also reported in a previous study [1].

This study found gender as a determinant of disability as also recorded in other studies [17, 22]. Females were reported in this study to have extreme disability as compared to males. Previous studies have also reported similar results where females were found to be more disabled than males [1, 18]. The reason for the poor outcome in females translating to extreme disability as compared to males could be because females have been reported to experience higher severity of stroke as compared to males. Females have been found to experience higher severity of stroke because females experience poor health status with old age and stroke also affects older persons [23]. The other possible reason for extreme disability in females than males could be the socioeconomic status of women which is usually poor as compared to males. This could affect their rehabilitation and therefore influence their level of disability.

This study also found marital status as a determinant of disability and this is in contrast to a previous study that found marital status not to influence disability levels in stroke survivors [1]. In this study participants who reported extreme disability were widowed. The possible reasons for the extreme disability in persons who were widowed could be isolation and depression which they might experience. Isolation and depression have been found to be positively correlated with poor functional outcomes following and therefore extreme disability [24].

This study also found that stroke patients who were unemployed had extreme disability as compared to those who were working before the stroke episode as also reported in another study [25]. This could be attributed

to the fact that those who were employed prior to the stroke episode might be able to afford rehabilitation or have private insurance which might cover the cost of rehabilitation as compared to those unemployed as discussed in another study [25]. In Ghana, most stroke rehabilitation services are paid out of pocket [26]. Therefore, participants who cannot afford, it will not be very religious with their rehabilitation schedules due to financial issues. As such, they will continually be burdened with disability.

## Conclusion

This study found that most stroke survivors in the Greater Accra region of Ghana were still battling with disability. Most of them have moderate to severe disabilities after 6 months of undergoing rehabilitation. This shows that a bit more attention needs to be given to stroke rehabilitation to help deal with stroke-related disability and thereby improve the outcome of stroke survivors and this will help improve their quality of life making them more independent. Understanding the determinants of disability in stroke survivors will help guide stroke rehabilitation and thereby help in setting more individualized and realistic rehabilitation programs for stroke survivors.

## Limitation

The study is limited by the COVID-19 pandemic at the time of conducting the study which affected the recruitment of more stroke survivors. In addition, the study mainly considered one hospital only at each level of the health care system in Ghana.

## Abbreviations

WHODAS World Health Organization's disability schedule  
ICF International classification of functioning, disability, and health

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## Authors' contributions

This study was conceptualized by Tawagidu Mohammed under the supervision of Diphale Joyce Mothabeng and Gifty Gyamah Nyante. Diphale Joyce Mothabeng and Gifty Gyamah Nyante also guided Tawagidu Mohammed in collecting data and writing the manuscript. Mubarak Abdul-Rahman was involved in data analysis and assisted in results writing. All authors contributed to the final write-up and editing of the manuscript.

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## Availability of data and materials

All data and materials for this study are available on request.

## Declarations

### Ethics approval and consent to participate

Ethical approval was sought and obtained from the Ethical and Protocol Review Committee of the School of Healthcare Sciences, University of Pretoria (protocol number: 68/2020), Ghana Health Service Ethics Review Committee (protocol number: GHS-ERC 010/02/20) and Korle Bu Teaching Hospital Ethical and Protocol Review Committee (protocol number: KBTH-IRB/000165/2019). Permission was sought from the heads of the hospitals and the heads of the physiotherapy outpatient departments. The aim and purpose of the study were well explained to each of the participants. Voluntary written informed consent was sought from each of the participants through signing and thumb-printing.

### Competing interests

The authors declare that they have no competing interests.

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## References

- Lv Y, Sun Q, Li J, Zhang W, He Y, Zhou Y. Disability status and its influencing factors among stroke patients in northeast china: a 3-year follow-up study. *Neuropsychiatr Dis Treat*. 2021;17:2567–73.
- Feigin VL, Stark BA, Johnson CO, Roth GA, Bisignano C, Abady GG, et al. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Neurol*. 2021;20(10):1–26.
- Akinyemi RO, Ovbiagele B, Adeniji OA, Sarfo FS, Abd-Allah F, Adoukonou T, et al. Stroke in Africa: profile, progress, prospects and priorities. *Nat Rev Neurol*. 2021;17(10):634–56. <https://doi.org/10.1038/s41582-021-00542-4>.
- Katan M, Luft A. Global burden of stroke. *Semin Neurol*. 2018;38(2):208–11.
- do Carmo JF, Oliveira ERA, Morelato RL. Functional disability and associated factors in elderly stroke survivors in Vitória, Brazil. *Rev Bras Geriatr Gerontol*. 2016;19(5):809–18.
- Agyemang C, Attah-Adjepong G, Owusu-Dabo E, De-Graft Aikins A, Addo J, Edusei AK, et al. Stroke in Ashanti region of Ghana. *Ghana Med J*. 2012;46(2 Suppl):12–7.
- Sanuade AO, Dodoo FN, Koram K, De-Graft Aikins A. Prevalence and correlates of stroke among older adults in Ghana : evidence from the study on lobar AGEing and adult health. *PLoS One*. 2019;14(3):1–17. <https://doi.org/10.1371/journal.pone.0212623>.
- Oyewole OO, Ogunlana MO, Gbiri CAO, Oritogun KS, Osalusi BS. Impact of post-stroke disability and disability-perception on health-related quality of life of stroke survivors: the moderating effect of disability-severity. *Neurol Res*. 2020;42(10):835–43. <https://doi.org/10.1080/01616412.2020.1785744>.
- Carod-Artal FJ, Stieven Trizotto D, Ferreira Coral L, Menezes Moreira C. Determinants of quality of life in Brazilian stroke survivors. *J Neurol Sci*. 2009;284(1–2):63–8. <https://doi.org/10.1016/j.jns.2009.04.008>.
- Yang Y, Shi YZ, Zhang N, Wang S, Ungvari GS, Ng CH, et al. The disability rate of 5-year post-stroke and its correlation factors: a national survey in China. *PLoS ONE*. 2016;11(11):1–9.
- Cochran WF. *Sampling Techniques: Chapter 5*. 3rd editio. John Wiley and Sons. New York; 1977. 10 p. Available from: [https://scholar.google.com/tr/scholar?q=sampling+techniques&btnG=&hl=en&as\\_sdt=0,5#0](https://scholar.google.com/tr/scholar?q=sampling+techniques&btnG=&hl=en&as_sdt=0,5#0).
- Ćwirlej-Sozańska A, Sozański B, Kotarski H, Wilmowska-Pietruszyńska A, Wiśniowska-Szurlej A. Psychometric properties and validation of the polish version of the 12-item WHODAS 2.0. *BMC Public Health*. 2020;20(1):1–10.
- Krishnamurthi RV, Moran AE, Feigin VL, Barker-Collo S, Norrving B, Mensah GA, et al. Stroke prevalence, mortality and disability-adjusted life years in adults aged 20–64 years in 1990–2013: data from the global burden of disease 2013 study. *Neuroepidemiology*. 2015;45(3):190–202.
- Owolabi MO, Akarolo-anthony S, Akinyemi R, Arnett D, Gebregziabher M, Jenkins C, et al. Review The burden of stroke in Africa : a glance at the present and a glimpse into the future. *Cardiovasc J Afr*. 2015;26(3):123–34.
- Johnson W, Onuma O, Owolabi M, Sachdev S. Stroke: a global response is needed. *Bull World Health Organ*. 2016;94:634–634A.
- Alrabghi L, Alnemari R, Alotteebi R, Alshammari H, Ayyad M, Al Ibrahim M, et al. Stroke types and management. *Int J Community Med Public Heal*. 2018;5(9):3715.
- Qawasmeh MAI, Aldabbour B, Momani A, Obiedat D, Alhayek K, Kofahi R, et al. Epidemiology, risk factors, and predictors of disability in a cohort of Jordanian patients with the first ischemic stroke. *Stroke Res Treat*. 2020;2020:1–9.
- Oyewole OO, Ogunlana MO, Oritogun KS, Gbiri CA. Post-stroke disability and its predictors among Nigerian stroke survivors. *Disabil Health J*. 2016;9(4):616–23. <https://doi.org/10.1016/j.dhjo.2016.05.011>.
- Cawood J, Visagie S, Mji G. Impact of post-stroke impairments on activities and participation as experienced by stroke survivors in a Western Cape setting. *South African J Occup Ther*. 2016;46(2):10–5.
- Rhoda A, Mpofu R, De Weerd W. Activity limitations of patients with stroke attending out-patient facilities in the Western Cape. *South Africa South African J Physiother*. 2011;7(2):16–22.
- Farzadfard MT, Sheikh Andalibi MS, Thrift AG, Morovatdar N, Stranges S, Amiri A, et al. Long-term disability after stroke in Iran: evidence from the Mashhad stroke incidence study. *Int J Stroke*. 2019;14(1):44–7.
- do Carmo JF, Morelato RL, Pinto HP, de Oliveira ERA. Disability after stroke: a systematic review. *Fisioter Mov*. 2015;28(2):407–18.
- Rexrode KM, Madsen TE, Yu AYX, Carcel C, Lichtman JH, Miller EC. The impact of sex and gender on stroke. *Circ Res*. 2022;130(4):512–28.
- Butsing N, Tipayamongkholgul M, Ratanakorn D, Suwannapong N, Bundhamcharoen K. Social support, functional outcome and quality of life among stroke survivors in an urban area. *J Pacific Rim Psychol*. 2019;13(4):1–8.
- Bettger JP, Zhao X, Bushnell C, Zimmer L, Pan W, Williams LS, et al. The association between socioeconomic status and disability after stroke: findings from the Adherence eValuation After Ischemic stroke Longitudinal (AAVAL) registry. *BMC Public Health*. 2014;14(281):1–8.
- Baatiema L, De-Graft Aikins A, Sav A, Mnatzaganian G, Chan CKY, Somerset S. Barriers to evidence-based acute stroke care in Ghana: a qualitative study on the perspectives of stroke care professionals. *BMJ Open*. 2017;7(4):1–11.

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