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Knowledge of, Attitudes Towards and Access to Genetic Testing and Counselling for Disability in Zambia

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Abstract

Genetically transmitted disorders, which lead to disability, make a larger percentage as those caused by environmental factors. However, knowledge and awareness of the genes that cause such disorders can help reduce on the prevalence of genetically transmitted disorders. This requires availability of genetic testing and counselling services in hospitals. In Zambia, there is scarcity of information on the available services and even knowledge of genetic testing and counselling. This study was conducted to establish knowledge of, attitudes towards and access to genetic testing and counselling for disability in Zambia. A mixed methods approach was used. One hundred and sixty nine respondents were recruited to provide data on the study. The results of the study indicate that students in higher learning institutions are aware about genetic testing and counselling and where the service can be sought. However, traces of negative attitudes were concluded from students' failure to indicate their willingness to visit hospitals for genetic testing and counselling. Further, results showed that there was scarcity of sources of information about genetic testing and counselling. The services were also not available in the main hospitals except for sickle cell anaemia testing which is normally done when one is pregnant. We recommend for knowledge generation and dissemination in the science of genetic testing and counselling to help the Zambian population know the relevance of the service and where it can be sought so that a reduction in genetically transmitted disorders that cause disabilities is drastically reduced.

Keywords: genetic testing, counselling, disability, Zambia

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INTRODUCTION

This study was conducted to establish knowledge of, attitudes towards and access to genetic testing and counselling for disability among students in seven selected universities and colleges of education in Zambia. Genetic testing involves screening for genetic diseases or disorders that are transmitted through chromosomes and genes. Medical doctors carry such tests to identify genes that may transmit diseases and disorders to unborn children. Genetic counselling provides information about the significance of testing and prepares the person tested to accept the results of the tests..

LITERATURE REVIEW

Zambia is located in Southern Africa with a population of 13.4 million people of which 52.5% are children and 36.7 % are youths. Of the whole Zambian population, 2.0 % are persons with disabilities (Central Statistical Office, 2012). The categories of disabilities captured in the last census are 32.7 % physical disabilities, 24.8 % partially sighted, 4.6% blind, 9.2% hard of hearing, 2.5% deaf, 1.9 % dumb, 2.5 % deaf and dumb, 1.1% intellectual, 12.6% other disabilities, and 3.8% have speech impairments (Central Statistical Office, 2012). However, the 2011 World Health Organisation (WHO) World Report on Disability pegs the prevalence of disability at not less than 10% in every population. The latter is supported by the findings of the 2005 – 2006 National Survey of Living Conditions among people with activity limitation in Zambia which revealed that the prevalence of disability in Zambia is at least 17 % of the national population (Elde & Loeb, 2006). According to Roy and Shengelia (2016), about 2-3% of all live births suffer from congenital abnormalities globally and 70% of those are preventable through community genetic services.

The causes of disability in Zambia have been grouped into congenital, diseases, injury, spousal violence and other unknown causes (CSO, 2012). According to CSO (2012), congenital causes of disability in Zambia account for 14.2%, second to disease at 35.2%. It is clear that Zambia is not spared from congenital and inheritable disorders that bring about disability. There is no doubt that some of the causes of disability are more related to genetic transmission than other courses. Knowledge of genetic diseases and the services that can help abate or reduce the prevalence of disability is crucial to people that are planning to marry and have children.

We cannot stop disabilities but we can prevent a number of them and reduce the higher prevalence of disabilities and stress that comes with birth of a child with a disability in a home. Genetically transmitted disorders that cause disabilities can be prevented if couples take measures to know their genetic compositions before they get married or before they decide to have a child. It is possible that most parents with children with disabilities do not take pretesting or screening of their genetic composition. Genetic counselling and testing is quite significant in helping prospective couples, and couples in making decisions about the children they are likely to have. Oyedele, Emmanuel, Gaji and Do'om (2015:17), explain that, "premarital genotype screening presents an opportunity for individuals to become informed about their genetic predisposition to diseases and for couples to be aware of the possible genetic characteristics of their unborn children". According to Hann et al, (2017) genetic testing can help patients of hereditary cancer to make important decisions about prevention or early detection. Genetic testing or premarital screening is quite common when couples want to get married (Oyedele, Emmanuel, Gaji, & Ahure Do'om, 2015).

Further, literature also shows that there are several disabilities that result from genetic disorders or are caused by the passing on of genes with certain disorders from parents to the developing foetus. Many disabilities are caused by different diseases, some acquired and others genetic. For instance, sickle cell disease, cystic fibrosis and Tay-Sach's disease are inherited (Oyedele, Emmanuel, Gaji, & Ahure Do'om, 2015).

In special education, these are health impairments that call for constant management through medication. Other inherited health problems include asthma, and diabetes, So many syndromes or disorders that cause disabilities are associated with genetics. For instance, albinism is an inherited disorder of the skin but has implications on vision as well. Muscular dystrophy is a genetic degenerative disorder that progressively weakens one's body strength. Learning disabilities of reading, writing and arithmetic, hyperactivity and emotional disorders have research evidence associated with heredity. Disabilities of vision such as strabismus, astigmatism, colour blindness, blindness have genetic associations. There is also some prevalence of hereditary cancer in some patients which can be prevented (Hann, Freeman, Fraser, Waller, Sanderson, Rahman, Side, Gessler, & Lanceley, 2017). Roy and Shengeile (2016) report that the prevalence of congenital defects in Bangladesh is 2-4%, placing Down syndrome, a chromosomal abnormality at 71%.

Oyedele, Emmanuel, Gaji and Do'om, (2017) in a study of premarital awareness and acceptance of premarital genotype screening among youths in a Nigerian community found that 50.7% were aware of premarital genotype screening and 52.7% of the respondents had ever been screened. Further, the study indicated positive attitude towards premarital genotype screening (77.3%) and the relationship between awareness and acceptance of premarital genotype screening was statistically significant.

A study by (Boadu & Addoah, 2018) on student awareness of sickle cell disease revealed that almost all students were aware (98.6%) of their source of information being the school (84.6%) and the media (12.6%). However, students generally had limited understanding and inadequate knowledge of sickle cell as an inherited disease. Further literature appears to show that despite availability of genetic services as was the case of a study of Hereditary Breast and Ovarian related cancers, services remained underutilised in clinical settings (Allen, Roberts, & Guan, 2019), attributing the low uptake to low awareness by the general population.

According to Roy and Shangelia (2016), the key factors that are associated with high prevalence of congenital disorders in Bangladesh are consanguineous marriage, inadequate antenatal check-ups, unskilled home deliveries and lack of home community services. This study has more interest in awareness of genetic disorders, attitude towards genetic testing and counselling and availability of services.

From the above analysis of literature, different studies show different experiences. Some studies show a lack of awareness and understanding of genetic diseases and testing services while others show such awareness but a lack of access to genetic services. Since studies on genetic testing and counselling in Zambia are scarce yet significant, it was relevant to undertake this study.

Statement of the problem

The Zambian 2010 census reports that by 2010, 53% of the people above 15 years were married and the median marriage age was 20.7 years with males median marriage age at 24.2 years while females were at 18.8 years (CSO, 2012). One of the major reasons for marriage is procreation and if such is the case, then consideration of genetic compatibility and avoidance of genetic inheritance that causes grave effects on family functioning needs serious consideration (Oyedele E. , Emmanuel, Gaji, & Ahure Do'om, 2017). Visiting genetic counsellors becomes crucial in making decisions about marriage and procreation. (Ciarleglio, Bennett, Williamson, Mandell, & Marks, 2003) explain the role of genetic counsellors as service providers for patients across the lifespan who assess family and environmental history to determine risk diseases and that they assist in genetic testing, diagnosis, and disease prevention and management; and offering psychosocial and ethical guidance to help patients make informed, autonomous health care and reproductive decisions. However, in Zambia, what is not known is the knowledge of, attitudes towards and access to genetic testing and counselling services for disability. The assumption is that as students in higher learning institutions, they are expected to have adequate knowledge of genetic testing and counselling as well as positive attitudes towards the practice. This should provide a litmus picture of whether

Zambians take the practice seriously in order to reduce disability in families. The understanding of genetic diseases or disorders that bring about disabilities would help couples make decisions. Knowledge of genetic diseases, disorders that bring about disabilities can help reduce on the prevalence of disabilities once intending couples are advised about their compatibilities and the likelihood of having a child with an inherited disability.

Objectives of the study

The objectives of this study were;

1. To determine the level of awareness about genetic testing and counselling for disability among students in selected higher learning institutions in Zambia.
2. To establish the sources of awareness about genetic testing and counselling services by students in selected higher learning institutions in Zambia.
3. To establish the attitudes of students towards genetic testing and counselling services in selected higher learning institutions in Zambia.
4. To examine barriers to access to genetic testing and counselling services among students in selected higher learning institutions in Zambia.

Hypotheses

1. University students have adequate knowledge of genetic diseases that cause disabilities
2. University students have positive attitudes towards genetic testing and counselling for genetic diseases.

Theoretical underpinning

There are two main models for understanding the causes of disability. These are the social and the medical models. The social model posits that disability is a social construction, created by society's inability to meet the needs of persons with disability. The needs include social, emotional and physical needs. Thus, the lack of a caring environment creates disability. The medical model posits that disability is caused by intrinsic factors; factors within the individual causing disability. Once these factors are identified through assessment and or screening, treatment should stop the disability. This study is anchored on the medical model because genetic testing is about discovering the causes of disability so that appropriate interventions are initiated. From the perspective of this study, the prevalence of disabilities that are genetically related can be abated once access to genetic testing and counselling services are provided in hospitals.

METHODS

Research design

The study adopted a mixed methods approach in which both quantitative and qualitative data was collected. Data on awareness, knowledge of genetic diseases attitudes toward genetic testing and counselling, and availability of genetic testing and counselling services in Zambia was collected by means of a survey design and purposefully selected hospitals. Thus, a parallel convergence mixed methods design was applied in this study. It was expected that some quantitative data from students would be better qualified by the involvement of medical personnel in the study to tell about the availability of services, a variable that could influence student's attitudes towards accessing genetic testing and counselling services.

Sample and sampling procedure

A mixed method approach comprising two sampling methods, namely, simple random and purposive extreme case sampling used to select respondents. The sample size was 169 respondents and participants. One hundred sixty five (165) answered questionnaires and 4 medical personnel were interviewed. The 165 respondents were students from higher learning institutions. The four (4) medical personnel were purposefully sampled from selected public hospitals in Lusaka.

Description of instruments

We used questionnaires on students in higher learning institutions and an interview guide on the medical personnel responsible for genetic testing and counselling. The interview guide was used to collect views on whether genetic testing and counselling services are offered, the nature of genetic counselling services offered and whether clients access such services or not, and the factors that may inhibit access to such services. Two hospitals were visited in Lusaka. Two participants at each hospital were enrolled to participate in the study.

The questionnaire collected information on whether the respondents were aware about the genetic testing and counselling services, where to access the services and whether they were able to access such services or not. The reasons for failure to access the services were also sought. The interview guided an inquiry into the availability of genetic services at hospitals in Zambia and whether clients manage to afford such services. The barriers to access to such services were also established.

Data analysis

Data was analysed in two phases; quantitative data was analysed separately by use of the statistical package for social sciences (SPSS). Specific tools from SPSS that were used are descriptive statistics, frequencies and chi-square. These helped to obtain frequencies, percentages, cross tabulation of data for comparisons and possible relationships and differences in data. Qualitative data was analysed in themes. The quantitative and qualitative data was later converged to see similarities in what respondents and medical personnel reported about the genetic testing and counselling services in Zambia.

Ethics

We obtained ethical clearance from the University of Zambia, School Of Humanities Ethics Committee. Respondents were provided with an information sheet. All respondents were assured of the confidentiality and their participation was basically voluntary. Respondents were reminded of their right to withdraw from the study at any point during the data collection process

RESULTS AND DISCUSSION

Awareness about genetic testing and counselling

This study sought to establish awareness about genetic testing and counselling services for disorders that cause disabilities and whether prospective couples take advantage of such services before making decisions about having a child or not.

The first objective of this study was to determine awareness by respondents about the genetic testing and counselling. Table 1 shows the results:.

Table 1. Awareness about genetic testing and counselling questions

	Characteristic	Yes	%	No	%	Total
1	Awareness about genetic testing and Counselling (p= .235)	98	59	67	41	165
2	Know whether fertile or sterile	30	18	135	82	165
3	Know the composition of our genes (p = .001)	108	65	57	35	165
3	Know our HIV status (p = .000)	34	21	130	79	164

The results show that majority respondents 98 (59%) were aware about the genetic testing and counselling while 67 (41%) were not aware. There were no significant differences in awareness about genetic testing and counselling among students in different learning institutions at ($\chi2$ (5, n = 165) = 6.8, p >.05). There were equally no significant differences on the other variables in table 1, all of which showed whether students were aware about genetic testing and counselling or not. It was worth noting that although the number of students that were aware appeared higher than those that were not aware, a percentage of 41 not being aware was worrying. From the results of the study, although most students disagreed that genetic testing and counselling was meant to establish one's HIV status (see 4 in table 1), a significant differences were recorded at chi-square computation value of (x2 (5, n = 164) = 25.6, p <.05. The significant variation was more amplified by Mufulira College of Education students where 23 (14%) believed that genetic testing was meant for determining ones HIV status and 36 (22%) did not agree to the proposition. Likewise, significant differences were noted on the variable that genetic testing and counselling was for determining the composition of genes. Overall, majority respondents were affirmed in response 108 (65%) but a considerable number 57 (35%) did not believe that was the purpose of genetic testing and counselling. This shows that there is still a large percentage of respondents who are not aware of the purpose of genetic testing and counselling although the majority are aware.

From the results, hypotheses 1 and 2 are therefore accepted. The results of this study suggest that although students were aware of genetic testing and counselling services, they would not visit the hospital to access the services. This is different from the results of a study by Allen, Roberts, & Guan, (2019), where clients appeared not to be aware that genetic testing and counselling services existed at clinics. But, from the qualitative data, it seems hospitals in Zambia do not have genetic testing and counselling services for clients to access, assuming this could be the reason for the respondents not visiting hospitals to access the said services. Interviews with medical personnel at two hospitals revealed that the general public appeared not to be aware about genetic testing and counselling and the services involved. In most cases, one would be found to have sickle cell anaemia when they were already pregnant and visiting the hospital for antenatal clinics only.

> I cannot really say 'yes' because they are very few that we come across here in the labor, for instance can be 2 out of 10 women in the labor would come when they are already advanced in pregnancy and you discover that they also have anaemia. So we just counsel them and give them painkillers (Medical personnel 1; Female, January 2020).

The results appear consistent with those of Muzata, Walubita, Muzata, Sefotho, Mofu, & Chakulimba, (2020) who discovered that most genetic testing and counselling related services in Zambia involved cases such as sickle cell anaemia and HIV/AIDs diseases rather than the many genetic disorders that cause disabilities. Qualitative findings also indicate that for sickle cell anaemia patients, they are told about their condition and the consequences of having another pregnancy. One of the medical personnel reports:

> Sickle cell patients are aware and know their condition and they are often told when they have their first child not to have another child. They are also told when they are getting married of the consequences of both partners being carriers of sickle cell as there exists a high chance of giving birth to a child who will have suckle cell (Medical personnel 1; Female, January 2020).

When asked about other genetic conditions that medical personnel at the selected hospitals dealt with, they (medical personnel) said they were limited to certain conditions related to what the hospital was able to handle and that there was generally limited awareness among clients seeking guidance on genetically transmitted diseases that cause disabilities.

> That is the hindrance, we may want to test but the tests are not available and when they available, most of them are not available in government health institutions. We end up going to private labs which tend to be expensive and the lack of such makes doctors to overlook the important aspects of such tests (Medical personnel 2; Female, January 2020).

Further results show that despite this knowledge, respondents seem to be negative about the service at hospitals. Table 2 below shows respondents expressing plans to visit the hospital more than actually visiting the hospital for genetic testing and counselling before deciding to have their next or first child.

Table 2. Questions on attitudes towards genetic and counselling

	Characteristic	**Yes**	**%**	**No**	**%**	**Total**
1	Visited hospital for genetic Counselling with partner?	13	8	151	92	164
2	Planning to visit hospital for genetic counselling and testing before having first child?	103	62	62	38	165

The results show some form of negative attitude towards seeking genetic testing and counselling services before deciding to have a child. From table 2, characteristic 1, it is clear that despite knowing the service and its purpose, respondents, 151 (92%) did not visit the hospital for testing and counselling, although they promised to do so 103 (62) when asked in characteristic 2. The results are similar to the study by Muzata et al (2020) who discovered that there appeared to be negative attitudes towards genetic testing and counselling among students in Zambia. Thus, despite being aware about the service, many respondents did not bother to visit the hospital for genetic testing and counselling. However, this study went further to investigate why such negative attitudes could prevail.

What are the sources of information about genetic testing and counselling among students in higher education institutions in Zambia?

We further asked the respondents on their sources of information about genetic testing and counselling and related services. We inquired whether they acquired information about genetic testing and counselling through self-reading, the courses of study, medical doctor, friends, social media or through radio or television programmes. Table 3 below shows the results:

Table 3. sources of information about genetic testing and counselling among students in higher education institutions in Zambia

	Characteristic	YES	%	NO	%	Total frequency
1	Through reading	42	25	123	75	165
2	Through my course	25	15	140	85	165
3	Through a medical doctor	28	17	137	83	165
4	Through a friend	25	15	140	85	165
5	Through Social media	44	27	121	73	165
6	Through the radio and TV programme	34	21	131	79	165

From the results, it appears there is scarcity on the sources of information on genetic testing and counselling in Zambia; thereby giving a connotation that the practice is not considered for consumption among the population. The results show that majority of respondents on each characteristic asked about did not agree on the sources of information mentioned with percentages ranging from 73 – 85%. What is more worrying about the results is the revelation that even medical doctors could not make up the highest percentage of the sources of information on genetic testing and counselling. This was also confirmed from the qualitative data we collected, where medical personnel themselves confirmed that there was no sensitisation on the subject matter. One of the medical doctors narrated:

> No, there is not much awareness and I feel sensitization should start with us health practitioners (Medical doctor 2; Male - 13.01.2021)
>
> There is need for sensitisation about genetic testing and counselling in Zambia. Genetic Testing is affected by cultural beliefs that stop people from discussing genetic disorders such as Sickle Cell Anaemia (Medical doctor 3; Male - 13.01.2021)

From the explanations by medical personnel, there is emphasis on sickle cell anaemia, ignoring all other conditions that may cause disabilities when a child is born. The results show alarmingly that even the school and higher education syllabus does not play a serious role in educating students about the disabling disorders that are inheritable. The results still show that only 25 (15%) out of the 165 respondents accessed information about genetic testing and counselling through their courses of study. With the advancement in technology and the utilisation of social media, significance placed on sensitising people about the dangers of consanguineous marriages and other causes of genetically transmitted disorders should reach out to most of the youths, especially those in higher education institutions such as the respondents in this study.

People are supposed to be educated about genetic disorders such as Muscular dystrophy, Gragile X syndrome, Klinefelter syndrome, Down syndrome, Colour blindness, Cridu chat syndrome, Haemophilia, Huntington disease, Sickle Cell anaemia and many others (Muzata, Walubita, Muzata, Sefotho, Mofu, & Chakulimba, 2020), so that they take precautions when deciding to marry or to have children. Kachong'u and Muzata (2020) reported that many learning disabilities have been known to run in families. These include dyslexia, dysgraphia, dyscalculia, emotional imbalances, and hyperactivity among many (Kachong'u & Muzata, 2020). Many disabilities result from ignorance and the decisions made without planning for the birth of a child. The general populace maybe ignorant that consanguineous marriages bring about disabilities because it involves persons sharing the same genes. In Bangladeshi, 71% of congenital disabilities result from consanguineous marriages, inadequate anti natal check-ups, unskilled home deliveries and lack of community services (Roy & Shengelia, 2016).

We then went further to find out from the respondents what factors may affect their willingness to seek medical guidance on genetic testing and counselling. From literature, factors such as education, religion, culture have influence on the attitudes to genetic testing and counselling (Jonassaint, et al., 2010). We asked respondents on factors that may affect their willingness to seek medical counsel regarding genetic testing and counselling before deciding to marry and or have a child. Table 4 below shows the results:

Table 4. factors likely to inhibit access to genetic testing and counselling

Characteristic	**Yes**		**No**		**Total**
My religion does not permit	5	3	160	97	165
My culture does not permit	4	2	161	98	165
Fear of breaking up	33	20	132	80	165

The results show that neither religious beliefs nor culture and fear for breaking up constrained respondents' willingness to seek genetic testing and counselling services at hospitals. We deliberately left out the aspect of education since the respondents we engaged in this study were in tertiary level education ranging from undergraduate to post graduate. It appears the attitude is more rooted in the scarcity of such services and the lack of awareness that such services actually existed.

When respondents were asked about where to access genetic testing and counselling in Zambia, table 5 below shows that respondents are aware of where to access the services.

Table 5. Awareness of where to access services

	Characteristic	**Yes**	**%**	**No**	**%**	**Total**
1	The medical personnel	133	81	31	19	164
2	The church pastor	10	6	154	94	164
3	Specialised marriage counsellors	19	12	146	88	165

From the results therefore, we conclude that while respondents are aware of the significance of the service and where to access it, the service is not readily available in the Zambian hospitals. This is confirmed by the interviews we conducted with medical personnel as well.

> We are constrained in terms of testing but we deal more with counselling, although not detailed counselling, just general counselling to make them prepared of what to expect in the event that for example a couple decides to have a child where both partners are sickle cell carriers (Medical personnel 2, Male, 13.01.2014).
>
> No specific testing and counselling is provided to patients that come for gynaecology issues. We lack equipment and trained Human Resources. Since there is no equipment Doctors not well trained to handle issues of counselling patients with Genetic disorders just like the lack training in counselling in general (Medical personnel 3, Male, 14.01.2014).

The common tests conducted at the hospitals relate more to sickle cell. According the medical personnel interviewed, sickle cell is the most common genetic disorder they do tests on.

> Sickle cell is the one which is common among our population especially the ones which are carriers. But we also do tests for down syndrome which mainly looks at the aspect of age and this must be done in all women. However, the tests are not available and have to be done from private labs (Medical personnel 2, Male, 13.01.2014).

CONCLUSION

From the results, we conclude that students in higher learning institutions in Zambia are aware about the importance of genetic testing and counselling for disabilities and other disorders; and where to access the services. However, Genetic testing and counselling services are limited to tests related to sickle cell anaemia. The limitation is largely as a result of lack of equipment and specialised personnel to conduct such tests.

From the results, we recommend the following:

- There is need to broaden access to genetic testing and counselling information through various formal avenues such as medical talk shows on television, radio and websites. This study established that various available avenues were not used as sources of genetic testing and counselling services and awareness.
- There is need to broaden genetic testing and counselling services in Zambian hospitals. This study established that Zambian hospitals had limited genetic testing and counselling to sickle cell anaemia
- There is need to support hospitals with specialised and modern equipment in order for doctors to perform genetic testing and counselling on clients and provide reliable results
- There is need to capacity build health personnel in the field of genetic testing and counselling in order to provide the needed services to clients.

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REFERENCES

Allen, C., Roberts, M., & Guan, Y. (2019). Exploring Predictors of Genetic Counseling andTesting for Hereditary Breast and Ovarian Cancer:Findings from the 2015 U.S. National HealthInterview Survey. *Journal of Personalized Medicine, 9*(26), 1-13.

Boadu, I., & Addoah, T. (2018). Knowledge, Beliefs and Attitude towards Sickle Cell Disease among University Students. *Journal of Community Medicine & Health Education, 8*(1).

Central Statistical Office. (2012). Zambia . *2010 Census of Population and Housing National Analytical Report*. Lusaka, Zambia: Central Statistical Office.

Ciarleglio, L., Bennett, R., Williamson, J., Mandell, J., & Marks, J. (2003). Genetic counseling throughout the life cycle. *The Journal of Clinical Investigation, 112*(9), 1280–1286.

Hann, K. E., Freeman, M., Fraser, L., Waller, J., Sanderson, S., Rahman, S., et al. (2017). Awareness, knowledge, perceptions, and attitudes towards genetic testing for cancer risk among ethnic minority groups: a systematic review. *BMC Public Health, 17*(503).

Jonassaint, C., Santos, E., Glover, C., Payne, W., Fasaye, G., Oji_Njideka, N., et al. (2010). Jonassaint, C.R., Santos, E.U, Glover, CRegional differences in awareness and attitudes regarding genetic testing for disease risk and anscentry. *Hum Genet, 128*, 249-260.

Kachong'u, Z., & Muzata, K. (2020). Understanding Dyslexia in the Mainstream Classroom: Voices of 8th Grade Learners at Sihole Combined School in Kalabo District. *Journal of Lexicography and Terminology, 4* (1), 87-104.

Muzata, K.K., Walubita, G., Muzata, D., Sefotho, M.M., Mofu, M., & Chakulimba, O. (2020). Gender differences in the knowledge of genetic disabilities and attitudes towards genetic counselling and testing in Zambia. *Journal of Educational Research on Children, Parents and Teachers,*1 (2), 90-103.

Oyedele, E. A., Emmanuel, A., Gaji, L. D., & Ahure Do'om, E. (2015). Awareness and acceptance of premarital genotype screening among youths in a Nigerian community. *International Journal of Medical and Health Research, 1*(1), 17-21.

Roy, A., & Shengelia, L. (2016). A Review on situation of congenital disorders and access to community genetic services in Bangladesh. *Annals of clinical and laboratory research, 4*(2), 1-4.