Journal of Family Medicine and Health Care
2021; 7(4): 83-89
http://www.sciencepublishinggroup.com/j/jfmhc
doi: 10.11648/j.jfmhc.20210704.11
ISSN: 2469-8326 (Print); ISSN: 2469-8342 (Online)

Risk Factors of Diabetes Mellitus in Zambezi Region, Namibia

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To cite this article:
Erica Libuku, Lischen Haoses-Gorases. Risk Factors of Diabetes Mellitus in Zambezi Region, Namibia. *Journal of Family Medicine and Health Care*. Vol. 7, No. 4, 2021, pp. 83-89. doi: 10.11648/j.jfmhc.20210704.11

Received: March 26, 2021; **Accepted**: June 8, 2021; **Published**: November 17, 2021

Abstract: Zambezi region was reported to have the highest number of diabetes cases in 2012 (health information system) HIS of the MOHSS. No study, has considered to identify the risk factors of diabetes mellitus in Zambezi region. The *Objectives of the study was t*o identify demographic, socio-economic, knowledge, anthropometric, familial and behavioural factors that are independently associated with diabetes among a sample of the general population in Zambezi region. The study used analytical cross-sectional design to investigate the etiology of the disease as it is manifested in Zambezi region. Data was collected from a sample of 646 respondents specifically from 4 constituencies of Zambezi region in Namibia. Quantitative data was collected using structured questionnaire and analyzed with SPSS Version 22. Results were presented in frequencies and percentages in Tables as well as Figures. The study found that physical inactivity and lack of knowledge regarding risk were two risk factors for diabetes in Zambezi region. Summary of demographical findings indicated that 12 participants (1.9% of the sample), were in the age group between 15 and 19 years, while 151 respondents (23.4%) were between the ages of 30 and 34. Of 646 participants (100%), 51.7% (334) were female and 48.3% (312) were male. Relationship status, revealed that 43.2% (279) of the respondents had never been married, 37% (239) are married and 7.1% (46) are divorced whereas five percent (5%, 32) were cohabitate with their partners but are not married. Furthermore, 1.4% (9) of those unmarried couples are currently separated. The main conclusion that can be drawn is that physical inactivity and lack of knowledge regarding risk were the main factors contributing to the high number of diabetes mellitus cases in Zambezi region.

Keywords: Risk Factors, Diabetes Mellitus, Zambezi Region, and Exposed and Non-exposed

1. Introduction

Diabetes has emerged as one of the greatest threats to health in Namibia. In fact, data captured through the Health Information System (HIS) from various public-health facilities in the country indicated that diabetes is increasing at an alarming rate. In 2008 alone, 3883 new cases of diabetes were reported by health facilities in the country. In 2010 this number increased to 4729 cases which nearly doubled in 2012 to 6439 [14]. However, segregating these statistics per region, Zambezi ranked the highest for the incidence of diabetes cases.

Diabetes has been referred to as a disease of urbanisation and industrialisation, a disease that has been relatively rare in Africa. However, over the past decade, diabetes has emerged as an important medical problem in developing regions, such as on the African continent [13], [15], explained that "diabetes used to be the disease of the affluent community but due to the westernisation of the rural community it becomes prevalent in the rural community".

In the literature, the term 'risk' tends to refer to characteristics or exposure that increases the possibilities that a person will develop a disease or suffer an injury at a given point in time. In this study, the term 'risk factor' will be used in its broadest sense to refer to all factors that may contribute to the development of diabetes in Zambezi region.

Onset of diabetes is influenced by a number of factors which are divided into two categories. Non-modifiable

factors are old age (over 45 years) and heredity, while modifiable factors are obesity, physical inactivity, smoking and excessive alcohol consumption [16]. Modifiable have been shown to be independently associated with the incidences of diabetes. Overweight/obesity and physical inactivity appear to be the two major factors" [16]. Additionally, diabetes is associated with factors such as advanced age, an overweight condition or obesity, physical inactivity, marital status, smoking, lower education and low income [5].

Furthermore, studies conducted in Nigeria and in the Free States by [11, 2] indicated that development of diabetes is influenced by a number of risk factors such as the demographies of life style, socioeconomic status and family history. This study was conducted to assess whether similar risk factors would be associated with the development of diabetes in Zambezi region.

2. Research Objectives

The objective of this study was to:

Identify demographic, socio-economic, knowledge, anthropometric, familial and behavioural factors that are independently associated with diabetes among a sample of the general population in Zambezi region.

3. Methods

Research design

A quantitative approach with a descriptive and analytical Cross-sectional designs were used to identify demographic, socio-economic, knowledge, anthropometric, familial and behavioural factors that are independently associated with diabetes among a sample of the general population in Zambezi region. Structured interviewer-administered questionnaires, anthropometrics and biochemical measurements, were used to collect data from the proportion of general population in Zambezi region.

The targeted populations of the study were from the constituencies of Katima urban, Kabbe North, Kabbe South and Sibbinda in the Zambezi region. The total number of 646 participants, males and females over the age of 18, from 33 different households were sampled from the general population of Zambezi region. Zambezi region was purposively selected for this study because in 2012 it had the highest number of reported cases of diabetes among all regions in Namibia.

The researcher adapted the WHO STEP-wise surveillance instrument in the form of a structured questionnaire to identify demographic, socio-economic, familial, anthropometric, knowledge-based, and behavioural risk factors that are independently associated with diabetes in Zambezi region. Trained interviewers conducted face-to-face interviews with selected participants regarding risk factors of diabetes. The anthropometric measurements used were weight, height and hip circumference whereas Biochemical was blood glucose. Levels of glucose were measured to determine the existence of diabetes among those participants exposed to risk factor for diabetes. The researcher opted to capture raw data using Epi Info, because the questionnaire had been adapted from the standard WHO Step-Wise tool for non-communicable chronic diseases survey. After the entry of data, computer files, or data sets, were created which were subsequently imported into the Statistical Package for the Social Sciences (SPSS). Tables, cross-tabulation, custom tables, correlation analysis on both bi-variate and multi-variate analyses, using Pearson correlation and exploratory factor analysis respectively were descriptively produced.

Ethics were observed during data collection, analysis of the data, interpretation of results and during the presentation of results. All these steps were closely monitored by UNAM's Ethics research committee and an external examiner to guarantee that sound knowledge of practise was adhered to.

4. Results

In the first place, segregation of age indicated that 12 participants (1.9% of the sample) were in the age group between 15 and 19 years, while 151 respondents, the largest age group of the sample (23.4%) were between the ages of 30 and 34. The population sample was 646 participants (100%), of which 51.7% (334) were female and 48.3% (312) were male. In response to relationship status, results are depicted in figure 1 which illustrate that 43.2% (279) of the respondents had never been married, 37% (239) are married and 7.1% (46) are divorced. Five percent (5%, 32) of the participants cohabitate with their partners but are not married, and a small percentage, 1.4% (9) of those unmarried couples are currently separated.

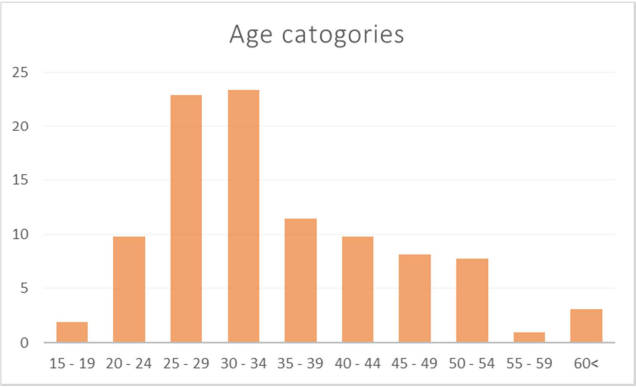

Figure 1. *Age distribution of the participants.*

Identification of risk factors of diabetes was made by comparing various demographic and socioeconomic data with status of diabetes to determine their influence on the development of the disease. Secondly, cross-sectional analysis was used to identifying risk factors of diabetes among the participants of the population.

A slight difference between males and females without diabetes was observed. About 237 (50.7%) females and 230 (49.3%) males did not have diabetes, whereas 95 (54%)

females and 81 (46%) males were diabetic. No significant difference between the two groups was evident (0.465).

Correlating age and diabetes revealed that none of the participants between the ages of 15 and 19 had diabetes, while 36 (20.5%) in the age group 30 to 34 were diabetic. On the other hand the highest number of participants, 121 (25.9%), without diabetes belonged to the age group 25 to 29 years and the lowest number, seven (1.5%), were in the group 55 to 59 years. There was a significant, positive correlation between age and diabetes status with a value of p-0.000*.

Surprisingly, fewer participants from urban areas, 55 (31.3%), and more than half from rural areas, 121 (68.8%), had diabetes. However, among participants who did not have diabetes, 135 (28.9%) were from urban and 25 (5.4%) were from rural areas. There was no statistically significant relationship between residential area and diabetes status, by a value of p-0.313.

Table 1. *Demographical data and diabetes status in Zambezi region.*

Variables		Non-diabetic	Diabetic	P=value
Family history	Yes	151 (32.4%)	57 (32.4%)	0.990
	No	316 (67.7%)	119 (67.6%)	
Sex	Female	237 (50.7%)	95 (54.0%)	0.465
	Male	230 (49.3%)	81 (46.0%)	
Age categories	15 - 19	12 (2.6%)	0 (0.0%)	0.000*
	20 - 24	47 (10.1%)	16 (9.1%)	
	25 - 29	121 (25.9%)	27 (15.3%)	
	30 - 34	112 (24%)	36 (20.5%)	
	35 - 39	56 (12%)	18 (10.2%)	
	40 - 44	36 (7.7%)	27 (15.3%)	
	45 - 49	35 (7.5%)	18 (10.2%)	
	50 - 54	32 (6.9%)	18 (10.2%)	
	55 - 59	7 (1.5%)	5 (2.8%)	
	60<	9 (1.9%)	11 (6.3%)	
Residential area	Urban	135 (28.9%)	55 (31.3%)	0.313
	Rural	332 (71.1%)	121 (68.8%)	
Educational level	None	25 (5.4%)	12 (6.8%)	0.235
	Primary	96 (20.6%)	48 (27.3%)	
	Secondary	250 (53.5%)	83 (47.2)	
	Post-secondary	96 (20.6%)	33 (18.8%)	
Marital status	Never married	210 (45%)	66 (37.5%)	0.217
	Currently married	174 (37.3%)	65 (36.9%)	
	Separated	5 (1.1%)	4 (2.3%)	
	Divorced	28 (6. %)	18 (10.2%)	
	Widowed	29 (6.2%)	12 (6.8%)	
	Cohabiting/stay together	21 (4.5%)	11 (6.3%)	

Furthermore, the number of participants in the sample who had diabetes was investigated according to different levels of education. The extraction of this statistic was carried out to establish whether educational attainment had any influence on the likelihood of developing diabetes. The results revealed that the number of participants with a secondary education (83, 47.2%) had a higher incidence of the disease than those without any formal education (12, 6.8%). On the other hand, the following figures reflect how many participants of different educational backgrounds don't have diabetes: no formal education, 25 (5.4%), primary education, 96 (20.6%), secondary education, 250 (53.5%), and post-secondary education, 96 (20.6%). The survey revealed that there was no significant relationship between the level of education and the incidence of diabetes (p-0.235).

Additionally, participants were distinguished according to their marital status to establish whether that had an influence on their diabetes status. The highest incidence of diabetes was observed among participants who had never married (66, 37.5%), and the lowest was among married people who lived in separation, four (2.3%). The following marital statistics apply to participants who do not have diabetes: never married, 210 (45%), currently married 174 (37.3%), separated 5 (1.1%), divorced, 28 (6 %) and widowed, 29 (6.2%). The results concluded that there is no significant relationship between marital status and diabetes (p-0217).

Fifty seven subjects 32.4% (57) in the population sample with a positive diabetes history and 67.7% (119) without a family history suffered from diabetes. However, 32.4% (151) of the participants with a positive family history and 67.7% (316) without, had no diabetes. There was no significant difference in the likelihood of developing diabetes between those with and without family histories, at a p-value of 0.990.

Again, identifying risk factors of diabetes among the participants of the population sample was carried out via cross-sectional analysis. Odds ratios were used to compare the relative odds of the occurrence of the outcome of the topic of concern, namely diabetes, given exposure to the risk factors of diabetes.

About 50.7% (237) of females did not have diabetes while 54% (95) did. On the other hand 49.3% (230) of males had no diabetes and 46% (81) did. This study revealed that the odds ratio for developing diabetes among both males and females as 0.879. There is no statistical difference between males and females for the occurrence of diabetes.

Table 2. *Prevalence and estimation of diabetes risks among exposed and non-exposed.*

Factors		Diabetes Status		Odds Ratio	95% Confidence Interval	
		No Diabetes	Diabetes Present		Lower	Upper
Family history of diabetes	Yes	32.3% (151)	32.4% (57)	0.998	.689	1.445
	No	67.7% (316)	67.6% (119)			
Do moderate-intensity sport?	Yes	7.3% (34)	10 (5.7%)	1.303	.630	2.697
	No	433 (92.7%)	166 (94.3%)			
Do vigorous-intensity sports	Yes	64 (13.7%)	19 (10.8%)	1.312	.761	2.261
	No	403 (86.3%)	157 (89.2%)			
Walk or use bicycle for least 10 minutes	Yes	206 (44.1%)	80 (45.5%)	.947	.668	1.342
	No	261(55.9%)	96 (54.5%)			
Work that involve vigorous-intensity activity	Yes	47 (10.1%)	23 (13.1%)	.744	.437	1.267
	No	420 (89.9%)	153 (86.9%)			
Use smokeless tobacco products	Yes	1 (0.2%)	1 (0.6%)	.376	.023	6.037
	No	466 (99.8%)	175 (99.4%)			
Sex	Female	237 (50.7%)	95 (54.0%)	.879	.621	1.244
	Male	230 (49.3%)	81 (46.0%)			
Level of knowledge	Poor knowledge	359 (76.9%)	132(75.0%)	1.108	.740	1.658
	Good knowledge	108 (23.1%)	44 (25.0%)			
Smoke any tobacco product	Yes	28 (6.0%)	23 (13.1%)	.424	.237	.759
	Never	439 (94.0%)	153 (86.9%)			
Alcohol consumption	Yes	81 (17.3%)	40 (22.7%)	.713	.466	1.093
	No	386 (82.7%)	136 (77.3%)			
Attitudes towards the risk factors of diabetes	Bad attitudes	337 (72.2%)	140 (79.5%)	.667	.439	1.013
	Good attitudes	130 (27.8%)	36 (20.5%)			

Among participants exposed to a family history of diabetes, 32.4% (57) had diabetes and 32.3% (151) did not. On the other hand, among participants who were not exposed to a family history of diabetes, 67.7% (316) did not have diabetes while 67.6% (119) did. The odds ratio for exposure and the outcome was 0.998, meaning there was no difference in the occurrence of the outcome among the exposed and non-exposed participants to family history of diabetes.

Among those who engage in moderately intense sports 7.3% (34) did not have diabetes and 5.7% (10) did. Whereas, among those who do not engage in sport on this level, 92.7% (433) had no diabetes and 94.3% (166) did. The odds ratio for exposed and non-exposed participants and the outcome was 1.303. There is a difference in the occurrence of the outcome among those who do and do not involve in moderately intense sports activity.

Among those who do vigorous-intensity activity 13.7% (64) do not have diabetes and 10.8% (19) have diabetes. Among the majority of those who do not engage in vigorous physical activity, 86.3% (403) did not have diabetes and 89.2% did. The odds ratio for exposed and the outcome is 1.312, which means there is a significant difference in the occurrence of the outcome among exposed and non-exposed to the risk factors of diabetes.

About 44.1% (206) of those that walk or ride a bicycle for least 10 minutes did not have diabetes and 45.5% (80) did. Whereas 55.5% (261) of those that do not walk or ride a bicycle for least 10 minutes did not have diabetes and 54.5% (96) did. The relative odds of the occurrence of the outcome of diabetes among those who walk or ride a bicycle for at least 10 minutes continuously and those who do not is 0.947. This means there is no significant difference in the occurrence of diabetes.

Of those that reported that their work involves vigorous physical activity, 10.1% (47) did not have diabetes and 13.1% (23) did. The majority who reported their work does not involve vigorous activity, 89.9% (420) did not have diabetes and 86.9% (153) did. The results indicated an odds ratio of 0.744. There is no difference in the occurrence of the outcome among those whose work involves vigorous-intensity activity. Therefore this study found that work involving vigorous activity is not a protective factor.

Among those who indicated they used smokeless tobacco products, one (0.2%) did not have diabetes and one (0.6%) did. The majority of those who indicated they did not use smokeless tobacco products (466, 99.8%) did not have diabetes and 99.4% (175) did. Furthermore, the item compared the relative odds of the occurrence of the outcome of diabetes among those who are exposed and not exposed to smokeless tobacco product. The results revealed the odds ratio of 0.376, and being lower than one, means there is no difference in the occurrence of the outcome among the two groups. Therefore, according to this study, smokeless tobacco is not risk factors for diabetes.

Of the few participants that smoke a tobacco product 6% (28) did not have diabetes and 13.1% (23) did. The majority of those that never smoked a tobacco product (94%, 439) did not have diabetes and 85.9% (153) did. The results indicated an odds ratio of 0.424 for the occurrence of diabetes among smokers and non-smokers, which number, being lower than one, means there is no difference in the occurrence of diabetes among smokers and non-smokers.

A high percentage of diabetes cases (75%, 132 participants) were observed among participants with poor knowledge about the risks of diabetes, while 76.9% (359) did not have diabetes. Among the participants who have good

knowledge, 23.1% (108) did not have diabetes and 25% (44) did. This item further established the odds ratio for the occurrence of diabetes between the participants with poor and good knowledge towards risk factors of diabetes. The results portrayed an odds ratio of 1.108. There is a significant difference in the occurrence of diabetes among those with and without good knowledge of diabetes. Therefore, the study showed that a low level of knowledge is definitely one of the risk factors of diabetes.

Among those who were observed to have bad attitudes towards the risk factors of diabetes, 72.2% (337) did not have diabetes and 79.5% (140) did. Of the few participants who had good attitudes towards risk factors, 27.8% did not have diabetes and 20.5% (36) did. This item determined the odds ratio of diabetes occurrence among participants with bad attitudes and good attitudes towards risk factors of diabetes. The results shown in the table depicted an odds ratio of 0.667. This means that there is no significant difference in the occurrence of diabetes among participants with bad attitudes and good attitudes. Both with bad and good attitudes had the same chance of developing diabetes.

Of the small number of participants who consume alcohol, 17.3% (81) did not have diabetes while 22.7% (40) did. Of the majority of the participants who do not consume alcohol, 82.7% (386) did not have diabetes and 77.3% (136) did. The odds ratio of diabetes occurrence between alcohol consumers and non-alcohol consumer was determined. The results indicated an odds ratio of 0.713 among the two groups. Therefore this study found no significant difference in the occurrence of diabetes among alcohol consumers and non-alcohol consumers.

5. Discussion

This study's first objective was to identify the risk factors for diabetes in Zambezi region. Zambezi region was reported to have the highest number of diabetes cases in 2012 (health information system) HIS of the MOHSS. No detailed investigation of the factors behind the statistics had ever been conducted. Not surprisingly then, a review of the literature, produced no data on the risk factors of diabetes in Namibia, let alone Zambezi region. From the short review above, physical inactivity and lack of knowledge regarding risk factors for diabetes were two key findings emerge from this study.

5.1. Physical Inactivity

The first risk that was identified in this study was physical inactivity. In the literature, the term physical activity tends to be used to refer to any bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above a base level. Furthermore, physical activities are classified on the basis of intensity of the activity: moderate and vigorous activity [6]. "Physical inactivity is now ranked as the fourth leading risk factor for global mortality. Again, physical inactivity levels are rising in many countries with major implications for the prevalence of non-communicable diseases (NCDs) and the general health of the population worldwide"[4].

This study identified a lack of activity, of both moderate and vigorous intensity, as risk factors for diabetes in Zambezi region. Despite the fact that the population of Zambezi region uses walking as a means of moving from place to place, moderate and vigorous activity emerged as a preventative measure for avoidance of diabetes in the region. The study showed that the population of the Zambezi region does not meet the WHO recommendation that an individual should carry out moderate activity for at least 150 minutes per week depending on an individual's relative level of fitness. According to WHO, moderate-intensity activities include brisk walking, dancing or household chores [17]. Thus, high levels of physical inactivity increase the risk of developing diabetes [10]. The most important clinically relevant finding was that those participants that are not engaged in moderate activity are exposed to a relative risk of 1.303 chance higher of developing diabetes than those involved in moderate activity.

Another significant finding that emerged from the study was: a lack of engaging in vigorous activity for the purpose of mitigating the chance of developing diabetes exists in Zambezi region. The study indicated that participants did not meet the WHO recommended level of 75 minutes per week. Vigorous physical activity would include running or swimming fast, cycling or moving heavy loads [17]. Furthermore, the analysis revealed that the chance of developing diabetes among those who avoid vigorous activity is 1.312. Meeting the goal of either 150 minutes of moderate activity, or 75 minutes of vigorous activity, per week, can be achieved in multiple, shorter sessions distributed throughout the week, i.e. 150 minutes weekly can be achieved with 30 minutes of moderate physical activity five times per week [16].

The odds ratio of this study was found to be higher than that of previously reported levels by the study conducted in Australia. That study compared inactivity with participation in moderate-intensity physical activity, in which the results indicated a relative risk of 0.69 for development of diabetes. In the same survey, the role of walking was investigated, regular walking (usually $\geq$ 2.5 hours per week brisk walking) has a relative risk of 0.70 when compare with practically no walking [8]. The results of this investigation revealed that the general population of Zambezi region are physically inactive in categories of moderate to vigorous physical activity. Taken together, these findings suggest an intervention of promoting physical activity in order to reduce the chances of developing diabetes among the general population of Zambezi region.

5.2. Poor Knowledge of the Risk Factors of Diabetes

The second most important risk factor of diabetes identified in this study which influences the onset of diabetes was poor knowledge about the risk factors of diabetes in Zambezi region. Knowledge may be regarded as understanding, one's capacity for imagining and way of perceiving. However, merely knowing what healthy behaviour is, does not mean that this behaviour will be

practiced [7]. The degree of knowledge among the sample population was assessed in this study, which helped to identify areas where dispensing information and education efforts would be beneficial.

Although the demographic health survey (DHS) for 2013 was carried out on diabetes by MOHSS, its investigation did not specifically address the level of knowledge among the general population of Zambezi region on the risk factors of diabetes. This study was designed to remedy that weakness by assessing the levels of knowledge among the general population in Zambezi region. However, the data is somewhat discouraging, though at the same time, interesting. One-hundred-thirty-two participants in the survey (75%) demonstrating poor knowledge of the risk factors of diabetes were offset by 44 (25%) participants who have good knowledge towards risk factors. A further analysis was done on this variable to measure the risk of exposed versus unexposed. Moreover, participants exposed to poor knowledge have relative risk of developing diabetes, greater than 1. There is a difference in the occurrence of diabetes among those with and without good knowledge of its risk factors. Therefore, what is meant in this study by "level of knowledge" is knowledge of the risk factors of the disease.

These results are not unlike those which have been reported in earlier studies. For example, a survey conducted on "knowledge and perceptions of diabetes in a semi-urban Omani population", was unable to provide even a rudimentary definition of diabetes. In addition, two thirds of the subjects of that survey were unable to identify obesity as a risk factor [3]. The study's extract was the most surprising correlation and interesting match to the current study.

The increasing prevalence of diabetes in Zambezi region poses a real threat to the capacity of existing health services. Awareness of the risk factors can assist in early recognition and reduction of incidence of the disease [9].

6. Recommendations

Evidence suggests that assessing levels of knowledge is among the most important factors for the development of an intervention. There are several possible explanations for this conclusion. The development of an education programme to improve knowledge of the people and in the community in general, can improve attitudes towards diabetes and in the long run influence people's practices to adopt healthier lifestyles [12]. Thus, this combination of findings provides some support for the conceptual premise that the population of Zambezi region needs an education programme that will raise levels of knowledge among the general population.

7. Conclusion

The findings of this study can be understood as, surrendering to physical inactivity and suffering from a lack of knowledge on the risk factors of diabetes, were identified to be relative risk factors of the disease. The occurrence of diabetes among the participants who are exposed to said factors are equal to or greater than one, compared to unexposed individuals. Future investigations are necessary to validate the kinds of conclusions that can be drawn from this study. It is believed that apart from looking for the risk factors of diabetes in Zambezi region, future research should look for the similar cause in other regions.

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