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The Prevalence of Female Genital Mutilation among Women in Osun State Using Non Parametric Test-Wil-coxon Signed Rank Test and Spearman Correlation Test

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Abstract: ***The need for health care professionals to be aware of application of non-parametric methods in numerous health issues associated with Female Genital Mutilation (FGM) is addressed in this research work using data gathered from Multiple Indicator Cluster Survey collected by the National Bureau of statistics between 2016 and 2017. The purpose of this study is to study the prevalence and associated factors of female genital mutilation among women (15-49 years) and children (0-14 years) in Osun state using non parametric methods (Wil-coxon signed rank test and Spearman correlation test). The Wil-coxon signed rank test was used to ascertain that the prevalence and associated factors of female genital mutilation among women (15-49 years) and children (0-14 years) in Osun state is statistically significant while the finding from a spearman rank non-parametric test shows that there is a very strong evidence to believe that there is a significant monotonic relationship between female genital mutilation of women (15- 49 years) and children (0 – 14 years). The research later concludes that the Nigerian Government has an obligation to eliminate female genital mutilation as a harmful traditional practice that affects women while a greater understanding of nonparametric application on Female Genital Mutilation will help health professionals to improve the health care research and findings.***

1. Introduction

Female genital mutilation/cutting (FGM/C) is a traditional practice that includes all procedures that intentionally alter female genital organs for non-medical reasons, and is internationally recognized as a violation of the human rights of children and women (WHO 2014; UN 2012). The practice affects more than 125 million girls and woman living predominantly in 28 African countries, Yemen, and Iraq (Andro et al. 2009; Farina 2010; UNICEF 2013). The prevalence of FGM/C in practicing countries has been measured using a standard survey method developed by the Demographic Health Survey (DHS) (Yoder and Shanxiao 2013). However, the prevalence in immigrant countries is substantially unknown, as no standardized methods have existed until now. Violence against women remains a significant problem in all societies. Female Genital Mutilation is one of the most severe and widely embraced manifestations. Female genital mutilation refers to the practice of traditionally removing all or some of the external genitalia of girls and young women for non-medical reasons. It is also known as female circumcision. It is internationally recognized as a violation of the human right of girls and women which is believed to be rooted from the inequality of the sexes. It is mostly carried out when the girl child is below the age of five. It is a widely practiced act but more prevalent in Somalia (98%), Guinea (97%), Djibouti (93%), Sierra Leone (90%). Mali (89%).Female genital mutilation is practiced in many parts of the world. The World Health Organization estimates that some 140 million girls and women now alive have undergone this mutilation, with around 3 million more experiencing it every year. United Nations Population Fund, 2016 declared Osun state to have the highest prevalence of female genital mutilation in Nigeria. This research will study the current prevalence and associated factors among women and children using non-parametric methods (Wil-coxon signed rank test and Spearman correlation test).

2. Materials and Methods

a) Wil-coxon signed-rank test

This test makes use of both the direction and magnitude of the differences between matched sample pairs. The absolute values of the difference are then obtained and sign of each difference is assigned to the corresponding rank without considering zero differences. The sum of the ranks having less frequently appearing sign (S) is obtained and used as Wil-coxon statistic.

The mean of S is $\mu_S = \frac{n(n+1)}{4}$ (1)

The standard deviation is $\delta_s = \sqrt{\frac{n(n+1)(2n+1)}{24}}$ (2)

The z-score corresponding to S is $z = \frac{S-\mu_S}{\delta_s}$ (3)

$$\mu = \frac{n(n+1)}{4} \qquad \sigma^2 = \frac{n(n+1)(2n+1)}{24} \quad (4)$$

Proof: To show that the mean and variance of *T*+ are as described above. The proof for *T*-is the same and since *T* = min(*T*+, *T*-) it is clear that all *T* have the mean and variance described above. The approximation comes from the Central Limit Theorem. We now show that the mean and variance are as indicated.

Let $x_i = 1$ if the sign of the data element in the sample with rank i is positive and $= 0$ if it is negative. Thus, under the assumption of the null hypothesis, each x_i has a Bernoulli distribution and so $\mu_i = E[x_i] = 1/2$ and $\sigma_i^2 = var(x_i) = 1/2 \text{ x } 1/2 = 1/4$.

By Property 3a and 4a of Expectation it follows that

$$\mu = E[T^+] = E\left[\sum_{i=1}^{n} ix_i\right] = \sum_{i=1}^{n} E[ix_i] = \sum_{i=1}^{n} iE[$$

(5)

Since the x_i are independent it follows by Property 3b and 4b of Expectation that

$$\sigma^2 = var[T^+] = var\left[\sum_{i=1}^{n} ix_i\right] = \sum_{i=1}^{n} var[ix_i] = \sum$$

$$= \frac{1}{4} \cdot \frac{n(n+1)(2n+1)}{6} = \frac{n(n+1)(2n+1)}{24} \qquad (6)$$

This is compared with the z critical value at α level of significance.

b) Spearman's Rank Correlation Coefficient

Spearman's correlation coefficient is a statistical measure of the strength of a monotonic relationship between paired data. In a sample, it is denoted by r_s design constrained as follows $-1 \le r \le 1$

This is given as:

$$r_s = 1 - \frac{6\sum d^2}{n(n^2-1)} \qquad (7)$$

Where d is the difference between pairs of ranked values and n is the number of observations. It gives a measure of the association between two sets of ranked or ordered data. Its values range from -1 to +1

$$\rho = \frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_i (x_i - \bar{x})^2 \sum_i (y_i - \bar{y})^2}} \qquad (8)$$

Since there are no ties, the xx's and yy's both consist of the integers from 11 to nn inclusive. Hence we can rewrite the denominator:

$$\frac{\sum_i (x_i - \bar{x})(y_i - \bar{y})}{\sum_i (x_i - \bar{x})^2} \qquad (9)$$

But the denominator is just a function of nn:

$$\sum_i (x_i - \bar{x})^2 = \sum_i x_i^2 - n\bar{x}^2$$
$$= \frac{n(n+1)(2n+1)}{6} - n\left(\frac{(n+1)}{2}\right)^2$$
$$= n(n+1)\left(\frac{(2n+1)}{6} - \frac{(n+1)}{4}\right)$$
$$= n(n+1)\left(\frac{(8n+4-6n-6)}{24}\right)$$
$$= n(n+1)\left(\frac{(n-1)}{12}\right)$$
$$= \frac{n(n^2-1)}{12}$$

Now let's look at the numerator:

$$\sum_i (x_i - \bar{x})(y_i - \bar{y})$$
$$= \sum_i x_i(y_i - \bar{y}) - \sum_i \bar{x}(y_i - \bar{y})$$
$$= \sum_i x_i y_i - \bar{y}\sum_i x_i - \bar{x}\sum_i y_i + n\bar{x}\bar{y}$$
$$= \sum_i x_i y_i - n\bar{x}\bar{y}$$
$$= \sum_i x_i y_i - n\left(\frac{n+1}{2}\right)^2$$
$$= \sum_i x_i y_i - \frac{n(n+1)}{12} 3(n+1)$$
$$= \frac{n(n+1)}{12}.(-3(n+1)) + \sum_i x_i y_i$$
$$= \frac{n(n+1)}{12}.[(n-1) - (4n+2)] + \sum_i x_i y_i$$
$$= \frac{n(n+1)(n-1)}{12} - n(n+1)(2n+1)/6 + \sum_i x_i y_i$$
$$= \frac{n(n+1)(n-1)}{12} - \sum_i x_i^2 + \sum_i x_i y_i$$
$$= \frac{n(n+1)(n-1)}{12} - \sum_i (x_i^2 + y_i^2)/2 + \sum_i x_i y_i$$
$$= \frac{n(n+1)(n-1)}{12} - \sum_i (x_i^2 - 2x_i y_i + y_i^2)/2$$
$$= \frac{n(n+1)(n-1)}{12} - \sum_i (x_i - y_i)^2/2$$
$$= \frac{n(n^2-1)}{12} - \sum d_i^2/2$$

Numerator/Denominator

$$= \frac{n(n+1)(n-1)/12 - \sum d_i^2/2}{n(n^2-1)/12}$$
$$= \frac{n(n^2-1)/12 - \sum d_i^2/2}{n(n^2-1)/12}$$
$$= 1 - \frac{6\sum d_i^2}{n(n^2-1)}$$

Hence

$$\rho = 1 - \frac{6\sum d_i^2}{n(n^2-1)}.$$

3. Analysis

This involves the presentation and analysis of sample data obtained from the fifth global round of the multiple cluster survey (MICS) which was headlined by the National bureau of statistics (NBS) in collaboration with the National Primary Health Care Development Agency (NPHCDA) and National agency for the control of aids (NACA). This research focuses on the female genital mutilation in Osun State. Therefore, informations regarding Osun state are extracted from the overall data in other to draw out conclusion that is particular to female genital mutilation in Osun state. The data collected were tested using Wilcoxon signed-rank test and Spearman Rank Correlation test with the help of statistical package for social sciences (SPSS v.23).

Table 1: Presentation of Personal Data of Respondents (Osun State)

	0-14 years (Female)	15- 49 years (Female)
Female Genital Mutilation (Yes)	162	432
Female Genital Mutilation (No)	307	206
Total	469	638

The above table 4.1 gives an overview of the findings on female genital mutilations in Osun state. The table reveals that female children within the ages of 0-14 years on whose female genital mutilation were conducted is 162 which is far lower than those female children that did not experience female genital mutilation (307). Unlike the female fifteen years above, where there is less awareness of campaign against female child mutilation where 432 of 638 female genders were mutilated.

Research Objectives: Prevalence and associated factors of female genital mutilation among women (15-49 years) and children (0-14 years) in Osun state

H_0: The median of difference between female genital mutilation (0-14 years) and female genital mutilation (15-49) is not equal to zero

H_1: The median of difference between female genital mutilation (0-14 years) and female genital mutilation (15-49) is equal to zero

Decision Rule: Reject the null hypothesis if p-value.<= 0.05

Table 2: Ranks

		N	Mean Rank	Sum of Ranks
15-49 Years Old 0-14 Years old	Negative Ranks	10[a]	16.00	160.00
	Positive Ranks	23[b]	17.43	401.00
	Ties	4[c]		
	Total	37		

a. 15-49 Years Old < 0-14 Years old
b. 15-49 Years Old > 0-14 Years old
c. 15-49 Years Old = 0-14 Years old

The **Rank's** table above provides some interesting data on the comparison of age brackets of participants' 0–14 years female and 15–49 years women. We can see from the table above that 10 clusters of respondents covers 15- 49 years age bracket while 23 clusters make up with 0-14 years bracket. The table below shows the statistical analysis.

Table 3: Hypothesis Test Summary

Null Hypothesis	Test	Sig.	Decision
The median of difference between 0-14 years old and 15-49 years old equals 0.	Related samples Wilcoxon signed rank test	0.31	Reject the null hypothesis

Asymptotic significances are displayed. The significance level is .05

Since (p-value = 0.031 < 0.05), we reject the null hypothesis and conclude that the median of difference between 0-14 years old female Genital mutilation and 15-49years old female genital mutilation is statistically equal to zero. This means there is currently a significant difference between prevalence of female genital mutilation among women (15-49 years) and children (0-14 years) in Osun state them.

Table 4: Spearman Rho Correlation

			0- 14 Years old	15- 49 Years Old
Spearman's rho	0- 14 Years old	Correlation Coefficient	1.000	.907**
		Sig. (2-tailed)	.	.000
		N	37	37
	15- 49 Years Old	Correlation Coefficient	.907**	1.000
		Sig. (2-tailed)	.000	.
		N	37	37

**. Correlation is significant at the 0.01 level (2-tailed).

Since the SPSS reports that the p-value for the spearman's rho test as being 0.000 we can therefore conclude that there is a very strong evidence to believe that there is a significant monotonic relationship between female genital mutilation of women (15- 49 years) and children (0 – 14 years). The result above revealed that there was a strong, positive monotonic correlation between them (= 0.91, $p < .001$).

4. Discussion

This study focuses on the appraisal of the statistical analysis on prevalence of female genital mutilation in Osun state comparing female genital mutilation of Women between (15- 60 years) and daughters of age (0- 14 years). A cross tabulation analysis revealed that female children within the ages of 0-14 years on whose female genital mutilation were conducted is far lower than those female's children it was conducted on. Unlike the female fifteen years above, wherethere is less awareness of campaign against female child mutilation where 432(638) female gender were mutilated.

A non-parametric test using Wil-coxon signed rank test was used to ascertain that the prevalence and associated factors of female genital mutilation among women (15-49 years) and children (0-14 years) in Osun state is statistically significant. Although there is still a relatively large percent of young children who still undergoes female genital mutilation secretly.

Our final finding from a spearman rho non-parametric test also shows that there is a very strong evidence to believe that there is a significant monotonic relationship between female genital mutilation of women (15- 49 years) and children (0 – 14 years).

5. Conclusion

This study demonstrated a relatively high prevalence of Female Genital Mutilation among Women in Osun State Using Non Parametric Test (Wil-coxon signed rank test and Spearman correlation test).The problem of female genital mutilation itself and its causes remain a matter of many theories whose relationships are not fully understood, forcing many interventions to focus on symptoms rather than the root causes of the problem. As a result, systems and structures that support the perpetuation of the practice unfortunately remain in place. In addition, the exact dynamics of the shift towards less orthodox and severe types of circumcision are unknown; we therefore feel that there is a need for more research to be done to determine these dynamics.

6. Conflict of Interests

The authors declare that they have no competing interests

7. Author's Contributions

All authors participated in writing the scientific proposal, data collection and writing of the manuscript. All authors read and approved the final manuscript.

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