LOG LIKELIHOOD RATIO TEST OF ELDERLY CRISIS IN NIGERIA

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Abstract: This paper highlighted some of the problems facing our elderly population which includes: poverty, unemployment, non-payment of pension and gratuity, cultural decay, homelessness, non-institutionalized policy for the elderly, poor medical facilities and poor educational background. Investigation on the educational background of elderly and health services utilization and reasons for using the center using surveyed data revealed the following: majority of Nigeria's elderly population have little or no formal education; two major health centres attended by our elderly population are government hospitals because of their equipments and qualified staff and then patient medical stores because of moderate amount of money they charge. Elders that are on regular medical examination prefer government hospital to other health service centres.

Keywords: Aging, educational background, Log likelihood ratio test, poverty, unemployment

Introduction

Aging is often seen as a period of decline and depletion, a time of edging, ever close to death. The natural instinct is to want to grow old even for those who have little prospect of comfort at old age. The onset of old age varies from society to society and from community to community. In the United States, people are generally considered as being old when they reach the age of 65 year, whether single or married, poets or plumbers, robust or feeble primarily because the initial requirement of the social security system set eligibility at that age (Fry, 1985; Keith, 1990). Some societies connect aging to role change that accompany generational event in the life cycle. In India, for example, a person crosses the threshold into old age when his or her children marry (Vatuk, 1980). The Masia mark old age by social role promoting an age set into retirement, so that a man may be as young as 60 or as old as 75 when he retires (Van den Berghe, 1983). Hamed (1990) stated that to be regarded as old, social scientists postulated that a person must be 65 and above. Aribiah (1999) stated that the general method of defining old age by both demographers and sociologists is usually in terms of chronology. That is, how long a person has lived. From his perspective therefore, people from 65 and above are regarded as old; 65-74 as the young old, that is, just getting old;75-84 as softly old; while 85 and above as the oldest old or real old.

In contemporary Nigeria, civil service commission regarded a person as being old and due for retirement when he reaches the age of 60. In some societies in Nigeria like the Igbo society, a person is regarded as old person when he looks old. A world Bank policy research titled "Averting the old age crisis" revealed that half a billion people, slightly more than nine percent of the world's population are over 60 years old and above. If further stated that by 2030 the number will triple to 1.4 billion, and that most of this growth will take place in developing countries; also the report also stated that due to improved medical technology, health facilities and decline fertility, the pace at which people are getting older in the developing countries is faster than that of industrialized countries (Hamed, 1999). Idris (2017) stated that by official projection the number of persons who would be aged 60 years and above is expected to increase to two billion in 2050. According to him by that time the older persons will undoubtedly out-number the children or the younger population. According to World Population Project there is an annual increase in elderly population in Nigeria; male elderly population (60 years and older) constituted 3.28 percent of the total population in 1990 and female elderly 4.25. By population projection elderly population will constitute about 8.06 percent by the year 2035 and female

elderly 9.5 (National Population Commission, 1990).Since elderly population do normally have health challenges this paper aimed at finding the particular health service centre our elderly population usually patronize and their reason(s) for patronizing such centres. Educational level of the elderly population will also be critically studied as a means of finding lasting solution to their crises.

Care of elderly

In Nigeria elders are expected to be provided for by the young ones of the families, immediate families and the community while they (the elders) in reciprocal act as custodians of societal values and knowledge for the younger generation. According to Aduge-ani (2016), under the African culture, tradition and set up, the parent is expected to train the child to maturity. Then when the child grows up, he or she in turn takes care of the parent. Omokaro (2015) reported that the research conducted by the HelpAge International showed that Nigeria had dropped in the rankings of countries that care for their aged population. It was quite unusual in Nigeria, in the olden days to see an old man or woman moving about begging while there are younger ones in his family and immediate families especially among the Igbo race. In 1980's and early 90's it was a crime for a young person to sit down in any gathering while an older person around him is standing. Now the prevailing economic hardship in the country has, however, affected this traditional practices coupled with the effect of urbanization and societal changes which have also negatively affected the kind of care the elderly receive from the families and immediate families. Children who are culturally expected to stand in as life insurance to parents at old age, who invested on them are equally handicapped as most of them are unemployed or underemployed and those employed are struggling to cope with mounting economic pressure. Consequently the senior citizens are being left with no option than to fend for themselves through various means which may be less dignifying. Our people do not abandon our elderly people. Any policy aimed at alleviating the problems of elderly population should first and foremost address the issues of poverty, unemployment, ignorance, homelessness, etc. Where these do not pose any serious threat people will be able to take care of their aged parents and relations. Establishment of old people homes is alien to our culture. People do not support it. According to Hamed (1999) in Igbo speaking area an attempt by the government in 1980's to establish old people's home in the area was met with unfavourable reaction from the people which led to its abandonment. In some areas where such homes have been established, there are cases of people abandoning the aged relation at the homes. The co-coordinator of old people home

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at 1 Lancaster road, Yaba Lagos disclosed that one of their inmate, a father of six who was brought under their care by a community chief because his children abandoned him as they could not provide his needs died in the home without his children visiting him even for once. Even when he died, they had to look for the children to come and bury him.

Problems of Elderly Population in Nigeria
Poverty
One of the major problems facing our elderly population is poverty. The aged population as one of the dependant populations is supposed to be provided for by the working population. But our question is this "how many percentage of this class can fend for themselves before thinking of others". Large percentage of Nigerians today is living below the poverty level. Very many percentage of our working class are jobless, still depending on their aged parents for feeding, clothing, education, etc. Due to this economic hardship a lot of youths are recruited to criminal activities, prostitution, and war activities everyday thus causing a lot of havoc to the life of elderly population. Some of these youths that are supposed to be providing for their aged ones loss their life during the process; very few youths that are into the labour force are struggling to cope with mounting economic pressure surrounding them like catering for their children, unemployed brothers and sisters. All these, most of the times, reduce the attention that will be given to the elderly population in our country. According to Chibueze (2016), 20 US states laws requires family members, for the most part adult children, to support their financially needy relatives, which can include elderly parents who no longer have income or disabled adult children who are unable to support themselves. Most of these statuses he said are among the original laws of the states that have not been active since the great depression.

Unemployment
The continued increase of unemployment rate in Nigeria makes it difficult for people to see the health and social needs of our elderly population. The funniest aspect of our situation is that now the proportion of unemployed men, who according to our tradition are expected to support the family is higher than that of women among the working class. This was revealed by the data in the Tables 1 and 2 below; Federal Office of Statistics (1995).

Table 1: Percentage age distribution of unemployment person by age group and sex (urban area)

Age group	Male	Female
15-19	33.3	29.7
20-24	34.4	34.4
25-44	27.7	12.4
45-54	1.5	13.3
55-59	3.1	4.8
Total	100	100

Table 2: Percentage age distribution of unemployment person by age group and sex (rural area)

Age group	Male	Female
15-19	25.6	32.7
20-24	28.0	40.0
25-44	31.5	15.5
45-54	4.9	4.5
55-59	2.9	7.0
Total	100	100

The Tables revealed evenly distribution of unemployment rate among rural and urban dwellers, which goes to show that elderly people at both areas suffer neglect.

Non-payment of pension and gratuity
Beside "change" the next permanent thing in life is "retirement" said Ore (2003). According to him retirement needs not to be a traumatic experience but should rather present new challenges and fulfillment. In Nigeria retirement is always a matter which many workers never love to hear about. Non-payment of pension and gratuity has made our retirees unable to build home but limited to rented house whereas they need a confined place to live in and wait for the end limit of the life span. The hope of our elderly ones getting houses in this our present government that is finding it difficult to pay their workers at the end of the month is faithless. The provision of essential commodities like food, clothing, drug etc to the elderly population is not even in the plan of our government not to talk of housing them. It is a thing of shame that a country like Nigeria, so richly blessed with rich mineral and national resources cannot fend for the elderly population which a country like Ghana do with ease. Ghana has in their proposed plan and arrangement provided money to their aged ones to enable them build their houses (Solanke and Madu, 1999)

Non-institutionalized policy for the elderly
The problem in Nigeria is that a lot of people who make policy for the aged think that old age may not come their ways. To the best of our knowledge there is no existing active policy that favours elderly people at large in Nigeria. In Nigeria old people are seen as hopeless and problem to the nation while in Ghana the reverse is the case, their government have embarked on drafting of the National Aging policy (Solanke and Madu, 1999). The proposed policy is stated to have come into effect in the mid 1999. The policy has it that all aged person are supposed to benefit from free medical services at public health centres throughout the country, they are exempted from paying VAT on the items they purchase; special transport rebate is being proposed by the government in conjunction with commercial bus/taxi owners association. Also government are to make available special designed public transport vehicle for them and under the free medical services scheme, drugs supply and health care delivery are being improved to ensure that essential drugs required for illness related to old age are easily available and affordable to elders. In China, a new law that went effect recently requires children to provide for the emotional and Physical needs of their parents, which includes visiting them often or face fines and potential jail (Chibueze, 2016). He added that one woman who was found negligent in visiting her 77-year-old mother has already been charged under the Law on Protection of the Rights and Interests of the Elderly and was ordered to visit her mother at least once every two months, and on at least two national holidays a year. This type of policy is worthy of copying by our government. There is strong need for our policy makers to involve the beneficiaries in their policy formulation to enhance its implementation so that the major problem of the beneficiaries will be tackled.

Medical facilities
Previous studies and write-up revealed an association between the elderly and chronic sicknesses. Arthritis, high blood pressure and chronic heart condition were revealed as the chronic illness of the elderly population (Rosenberg and Moore, 1997). Other related chronic sicknesses revealed are ocular morbidity (Sign *et al.,* 1997), visual impairment and difficulty in hearing (Al-Shammar and Bemgboye, 2000), anemia, hemorrhagic disorder and pulmonary heart disease (Schwarz 1975), Oral cancer (Yellowitz, 1999), hypertension, diabetes and heart diseases (Borges and Gomez, 1998). With all these diseases of elderly population mentioned, one cannot believe that there is nothing like free medical services scheme for our elderly population. The essential drugs required for

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illness related to old age are not easily available and affordable to our elders.

Poor educational background

One of the most serious problem of our elderly people is poor educational background, majority of our elderly population do not have formal education and for this cannot read and write. Because of this poor educational background some find it difficult to express their opinion when discussing matters that affects them. This leads to non-inclusion of their welfare in the national policy. Sometimes when government wants to pass information to them they do not find it easy since majority of them cannot communicate with them. It is difficult sometimes to administer drug to the elderly people if they do not have any assistant.

3.0 Data and its presentation

The data used for this paper were secondary, extracted from an unpublished research survey conducted by Ilomagolu (2002). The data is on the elderly population and their health need, a case study of Oji Local Government Area of Enugu State. Information on the age group versus educational level of the elderly population and reasons for utilizing a particular health service centre by the elderly population were selected for analysis.

Table 3: Distribution of Educational level of the Elderly Population According to age group in Oji L.G.A

Age group	No formal education	Below standard six	Standard six	School cert	Above school cert.	Don't know	Total
60-64	128	41	50	18	7	0	252
65-69	49	51	12	4	1	0	119
70-74	5	0	2	4	2	9	22
75-79	3	3	3	0	2	4	15
80-84	3	0	0	2	0	1	6
Total	**188**	**95**	**67**	**28**	**22**	**14**	**414**

Table 4: Aggregate table for the cross tabulation of reasons for utilizing health service centre by elderly population in Oji LGA

Health Service Centre	Reason for Health Centre Utilization								Total
	A	B	C	D	E	F	G	H	
Govt. hospital	110	55	10	73	71	63	49	1	462
Private physician	77	92	57	72	56	59	26	1	440
Herbal homes	7	71	43	96	2	69	97	6	391
Patient medical store	1	103	91	67	0	38	42	2	344
Others	0	82	31	26	0	12	56	10	217
Total	**195**		**262**	**334**	**129**	**271**	**270**	**20**	**1884**

A - Having equipment and qualified staff: B – Proximity; C – Moderate price; D – No other centre around; E – On regular medical checkup; F – Advice from children and relation; G- others; H – Don't know

Analytical tool

The statistical test statistic we are going to employ on this work is log-likelihood test statistic for two-way contingency table.

Log-likelihood ratio test

In statistics, a likelihood ratio test is a statistical test used for comparing the goodness of fit of two models, one of which (the null model) is a special of the other (the alternative model). The test is based on the likelihood ratio, which expresses how many times more likely the data are under one model than the other. To discuss the likelihood ratio test further let us introduce the likelihood ratio, perhaps such will help us to understand the test better.

The likelihood ratio

If we are interest in carrying out a test where the adopted probability model involves several unknown parameters, we may denote an element of the parameter space by $\theta = \theta_1, \theta_2, \ldots, \theta_k$.

To carry out the test we use likelihood ratio, $\lambda(x)$, defined as

$$\lambda(x) = \frac{sup\{L(\theta; x : \theta \in \Theta_0)\}}{sup\{\theta; x : \theta \in \Theta\}}, \quad x \in R_X^n \quad\quad 1$$

The argument behind this though informal is as follows. For the observation x, determine its best probability of occurring under H_0 and also it probability overall. The ratio of these two probabilities can never exceed unity, but, if small, would constitute evidence for rejection of the null hypothesis.

A likelihood ratio test for testing $H_0: \theta \in \Theta_0$ against $H_0: \theta \in \Theta_1$ is a test with critical region of the form

$$K = \{x: \lambda(x) \leq c\},$$

where c is a real number between 0 and 1.

Clearly the test will be at significance level α if c can be chosen to satisfy

$$sup\{P(\lambda(X) \leq c; \theta \in \Theta_0)\} = \alpha$$

If H_0 is a simple hypothesis with $\Theta_0 = \{\theta_0\}$, we have the simpler form

$$P(\lambda(X) \leq c; \theta_0) = \alpha.$$

To determine c, we must look at the c.d.f of the random variable $\lambda(x)$, where the random sample x has joint p.d.f $f_x(x; \theta_0)$.

For general contingency table we can write the log-likelihood ratio statistic as

$$-2\log\lambda(x) = \sum_i \sum_j n_{ij} \log \frac{n_{ij}n}{n_{i.}n_{j.}} \quad\quad 2$$

Since the function $-2\log\lambda(x)$ is a decreasing function, it follows that the critical region of the likelihood ratio test can also be expressed in the form

$$K_1 = \{x: -2\log\lambda(x) \geq k \}$$

Writing

$$\Lambda(x) = -2\log\lambda(x) = 2[l(\hat{\theta}: x) - l(\theta_0: x)] \quad\quad 3$$

the critical region may be written as

$$K_1 = \{x: \Lambda(x) \geq k \}$$

and $\Lambda(x)$ is called the likelihood raType equation here.tio statistics.

We have been using the idea that values of θ close to $\hat{\theta}$ are well supported by the data so, if θ_0 is a possible value of θ, then it turns out that, for large samples,

$$\Lambda(x) \xrightarrow{D} \chi_p^2$$

where $p = \dim(\theta)$

Likelihood ratio test for goodness-of-fit for discrete distribution

Suppose we have k groups with n_i in the ith group. Thus;

Group	1	2	3	4	…	k
Number	n_1 n_2		n_3 n_4	…		n_k

where $\sum_i n_i = n$

Suppose also that we have a probability model such that $p_i(\theta)$, $i = 1, 2, \ldots, k$, is the probability of being in the ith group. Clearly $\sum_i p_i(\theta) = 1$.

The likelihood is

$$L(\theta) = n! \prod_{i=1}^k \frac{p_i(\theta)^{n_i}}{n_i!} \quad\quad 4$$

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Log Likelihood Ratio of Elderly Crisis

And the log-likelihood is

$$l(\theta) = \sum_{i=1}^{k} n_i \log p_i(\theta) + \log n! - \sum_{i=1}^{k} \log n_i! \quad g(p)$$

$$= \sum_i p_i = 1 \quad 5$$

Using Lagrange multiplier γ we obtain the set of k equations

$$\frac{\partial l}{\partial p_i} - \gamma \frac{\partial g}{\partial p_i} = 0, \qquad 1 \le i \le k,$$

or

$$\frac{n_i}{p_i} - \gamma = 0 \quad 1 \le i \le k$$

Writing this as

$$n_i - \gamma p_i = 0$$

and summing over i we find that $\gamma = n$ and

$$\hat{p}_i = \frac{n_i}{n} \qquad 6$$

The likelihood ratio statistic is

$$\Lambda = 2 \left[\sum_{i=1}^{k} n_i \log \frac{n_i}{n} - \sum_{i=1}^{k} n_i \log p_i(\hat{\theta}) \right]$$

$$= 2 \sum_{i=1}^{k} n_i \log \left(\frac{n_i}{n p_i(\hat{\theta})} \right) \qquad 7$$

Likelihood ratio test of Two-way contingency table
In a two-way contingency table a fixed number of individuals are cross-classified according to two criteria. They are therefore displayed as n_{ij} in a table with r rows and c columns as follows;

Row	Column		Row Totals ↓
	n_{11} ... n_{1c}		$n_{1.}$
	⋮ ⋱ ⋮		⋮
Column Total→	n_{r1} ... n_{rc}		$n_{r.}$
	$n_{.1} n_{.c}$		n

The aim of this test is to investigate the independence of the two classifications. Suppose the kth individual goes into cell (i,j) and that individuals are independent. Let

$$P(i,j) = \theta_{ij}, \qquad i = 1,2, \dots r \quad j = 1,2, \dots, c$$

where $\sum_{ij} \theta_{ij} = 1$. The null hypothesis of independence of classifiers can be written $H_0: \theta_{ij} = \emptyset_i \rho_j$

The likelihood function is

$$L(\theta) = n! \prod_{ij} \frac{\theta_{ij}^{n_{ij}}}{n_{ij}!} \qquad 8$$

So the log-likelihood is

$$l(\theta) = \sum_{ij} n_{ij} \log \theta_{ij} + \log n! - \sum_{ij} \log n_{ij}! \quad 9$$

Under H_0, put $\theta_{ij} = \emptyset_i \rho_j$ and maximize with respect to $\emptyset_i$ and ρ_j subject to $\sum_i \emptyset_i = \sum_i \rho_j = 1$. You will obtain

$$\hat{\emptyset}_i = \frac{n_{i.}}{n}, \qquad \hat{\rho}_{.j} = \frac{n_{.j}}{n} \qquad 10$$

Under H_1, if we maximize with respect to θ_{ij} subject to $\sum_{ij} \theta_{ij} = 1$, we obtain that

$$\hat{\theta}_{ij} = \frac{n_{ij}}{n} \qquad 11$$

And, finally

$$\Lambda = 2 \sum_{i=1}^{r} \sum_{j=1}^{c} n_{ij} \log \frac{n_{ij} n}{n_{i.} n_{.j}} \qquad 12$$

When testing contingency tables, the number of degree of freedom of the resulting χ^2-distribution is given, in general, by

$$p = rc - 1 - (r-1) - (c-1)$$
$$= rc - r - c + 1$$
$$= (r-1)(c-1)$$

Standardized residual
The likelihood ratio test statistic is used for independence of factors of classification while the standardized residual R helps us to check the discrepancy between the expected value and observes value. This tells the amount of information each cell contributed toward the rejection or acceptance of the null hypothesis. It's a measure of how significant your cells are to the chi-square or Λ value. When you compare the cells, the standardized residual makes it easy to see which cells are contributing the most to the value, and which are contributing the least.
The Person residuals for goodness-of-fit test are defined as

$$r_i = \frac{n_i - n_i \hat{p}_i}{\sqrt{n_i \hat{p}_i (1 - \hat{p}_i)}} \qquad 13$$

The adjusted residual for two-way contingency table is

$$R = \frac{n_{ij} - n_{i.} n_{.j}}{\sqrt{n_{i.} n_{.j} (1 - \hat{\emptyset}_i)(1 - \hat{p}_{.j})}} \qquad 14$$

Result
The result of Table3 showed that there exist association between age and educational level of elderly population. There are large positive residuals for elderly population of 65-69 at educational level of standard six and below; elderly population of 60-64 years that have no formal education; and elderly population of 80-84 with school certificate. Large negative residual are recorded for elderly population of 70-74 years at below and at standard six; elderly population of 65-69 with school certificate; and elderly population of 70-74 years with no education. Considering the probability of elderly population at different educational level, counted data and residual values at different cells we conclude that elderly population Oji-river local government area.
The result of Table 4 showed large positive residual for elderly population attending government hospital because of their equipment and qualified staff; patients' medical store because of its moderate price; and government hospital for elders on regular medical examination. Large negative residual are observed for elderly population attending government hospital because of the moderate price; patients' medical store because of their good equipment and qualified staff; and herbal homes because of good equipment they have. These result indicate that majority of the elderly population attending government hospital are doing so because of the good equipment and qualified staff they have and not because they charge less. Also majority of elderly population are patronizing patients' medical store because they are charging them less. Some elderly populations that are attending herbal homes are not doing so because of their equipment and qualified staff but for other reasons best known to them.

Conclusion
Since majority of the elderly population are not learned government should create alternative means of communicating with them and finding out their needs and problems. Their welfare should be properly addressed at both state and national level. Government and individuals should provide free medical care and attention to elderly population at public hospital and community medical centres in order to enable them maintain and regain the optimum level of

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physical, mental and emotional well being and to prevent or delay the onset of sickness.

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