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Research

Maternal Characteristics as Predictors of Immunization Status of Under-Five in Ebonyi State of Nigeria A Community Based Cross-Sectional Study

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ABSTRACT

Background: : Childhood immunization with the interacting factors has been a significant public health challenge especially in the sub-Saharan Africa. Nigeria has been presented as one the countries with the worst under-five mortality rates, and factors affecting childhood immunization are poorly understood. This study determined the influence of maternal characteristics as a predictor of immunization status of under-five in Ebonyi State of Nigeria.
Subjects and Method: The design in this study is cross-sectional survey. The population of the study was 572,955 under-five children in Ebonyi State from which 2865 was sampled. Data were analyzed using percentages and chi-square.
Results: The results revealed that 83.01% of under-5 children were fully immunized, suggesting a high immunization status in Ebonyi State. The chi-square analysis shows a significant influence of mothers' age ($p < 0.05$), mothers' location of residence ($p < 0.05$), mothers' educational level ($p < 0.05$) and immunization status of under-five children.
Conclusion: It was concluded that immunization status of under-five children in Ebonyi State was high and maternal characteristics had significant influence on immunization status of under-five children. Thus, it was recommended among others, that government at all levels should provide tangible incentives to mothers who fully immunized their children and promulgate a law to prevent children without immunization cards, also compel mothers, teachers to show full immunization of under-five children by registering in public and private primary schools.

Keywords: maternal characteristics, immunization status, under-five children

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BACKGROUND

Immunization of children is one of the most important public health interventions and cost-effective strategy to reduce the rate of childhood morbidity and mortality globally (Banerjee et al., 2021; Adenike et al., 2017). Child health immunization particularly among under-5 children has made enormous contributions to public health intervention and development across countries and continents globally (Duclos et al., 2014).

Immunization is a pre-requisite to social and economic development, and a crucial element that enables every child to grow, develop and reach his or her full physical, mental, social and intellectual potential. Immunization refers to the use of vaccine to prevent various child killer diseases such as tuberculosis (Bacillus Calmette Gurine [BCG]), tetanus, whooping cough, diphtheria, poliomyelitis, hepatitis B, yellow fever, and measles (Oyefara, 2014). Study have reported that immunization is a process that makes people or individual resistant to all these infection by the administration of a vaccine (Department of Health and Human Services, 2009).

However, United Nations Children's Fund have reported that globally 165 million children under the age-5 years are found to be stunted (low-height-for-age), 101 million children are underweight (low weight for age) and 52 million children are wasted (weight for height) (UNICEF 2013). WHO (2002) further estimated that in developing countries, 60% of the 10.9 million deaths that occurs annually among children aged less than 5 years are association with under nutrition (WHO 2002). It is however, estimated that between two and three million child deaths are averted annually through vaccination against diphtheria, tetanus, pertussis and measles and many more future deaths averted in older groups estimated to be 600,000 future deaths prevented annually through heaptitis B vaccination). Nevertheless, vaccine-preventable diseases are still responsible for about 25% of the 10 million deaths occurring annually among children under five years of age (Global Immunization Vision and Strategy [GIVS] (2006).

This is partly related to the fact that an increasing number of infectious diseases can now be classified as vaccine-preventable (Duclos et al., 2009). Although, about three quarters of the world's child popularion is reached with the required vaccines, only half of the children in Sub-Saharan Africa get access to basic immunization (Lee, 2005). Further, in poorer remote areas of developing countries, only one in twenty children have access to vaccination (UNICEF, 2009). Immunization against vaccination preventable diseases (VPDs) through the expanded programme of Immunization (EPI) is one of the most economical public health interventions available that contributes extensively to achieving the Millennium Development Goal to reduce the mortality rate of children under five by two thirds between 1990 and 2015 (World Bank 1993; United NC fund 2002).

Studies have reported that maternal characteristics are pivotal in childhood immunization, thus mothers can be instrumental in gaining access to vaccination services for their children (Luman et al., 2003). This is because most mothers play an important role in their children's vaccination, it is important to address maternal concerns and barriers when developing public health interventions for promoting childhood vaccinations. Encouraging eligible women and their children to participate in the WIC program and providing support and encouragement for immunization to mothers with multiple children may improve early childhood vaccination coverage (Luman et al., 2003).

Despite overwhelming benefits of childhood immunization, existing data in Nigeria reveal that there have been only small improvements in vaccination coverage in the country resulting to high neonatal and under-five morbidity and mortality (Osuala, 2015). For instance, in 2015, an estimated 19.4 million infants globally were not reached with routine immunization services and about 60% of these children live in Sub Sahara Africa (Immunization Coverage Fact Sheet, 2016). Nigeria has one of the worst mortality rates for under five children, (109 per 1000 live births) in the world and factors interacting with poor childhood immunization status are not well known (World Bank, 2015).

It is noteworthy that despite all efforts to improve the situation through expanded programme on immunezation, immunization coverage in Nigeria is still below the global target. Based on this backdrop, the researchers deemed it fit to determine the maternal characteristics on the immunization status of under-five children in Ebonyi State. The study focused on the age of the mother, mothers' location of residence, and mothers' educational level on immunization status of under-five children in Ebonyi State. Moreover, there was no empirical evidence known to the researchers that such a study has been conducted in Ebonyi State.

SUBJECTS AND METHOD

1. Study Design

We conducted a descriptive a cross-sectional survey research design between to examined maternal characteristics on the immunization status of under-five children in Ebonyi State of Nigeria. This survey research design was employed based on the suitability for the study of large-population with dispersed sub-units. Again, immunization study shows that a survey is the best technique of validating administrative records on immunization (He et al., 2012).

The study was conducted in Ebonyi state which was created from the old Enugu and Abia States on 1st October 1996. It is one of the states in the South- East Zone of the Federal Republic of Nigeria (Ebonyi State Ministry of Information, 2010). Ebonyi State occupies a land mass of 5,539 square kilometers, with a population of 2,864,776 (2016 State Population Projected from 2006), (See Appendix 4). Considering the pivotal roles of mothers in the immunization of their children and the large proportion of under-five children in Ebonyi State (572,955), (National Population Commission 2016 State Population Projected from 2006), it is important to undertake the present study in the State.

2. Population and Sample

The population of the study comprised all 572,955 under- five children in Ebonyi State. This information was sourced from the National population commission 2016 Ebonyi State Population Projected from 2006. The sample of the study was 2865. This was derived by using 0.5% of the population. Nwana (2008) suggested that 0.5% could be used for a large population. Multistage sampling procedure was employed in the study. In the first stage, purposive sampling technique was used to select 3 urban Local Government Areas (LGAs) from the 3 senatorial zones in the state. The selected LGAs were Abakaliki, Ezza South and Afikpo North.

These LGAs were the only gazetted urban LGAs in the state. In the second stage, random sampling of balloting without replacement was used to select 3 other LGAs namely Ohaukwu, Ikwo and Ohaozara making a total of 6 LGAs. This sampling method was adopted because the researcher made use of location of residence as a variable. In the third stage, random

sampling of balloting without replacement was used to pick 2 wards from each of the 6 selected LGAs which gave a total of 12 wards which was used to divide 2865 giving a total of 239 per ward. In the fifth stage, households with under-five children were selected alternately (1 in every 5) for the required number of under-five children.

3. Study Variables

The dependent variables in the study were maternal characteristics on immunization status of under-five children and independent variables were age of the mother, mothers' location of residence, and mothers' educational level.

4. Operational Definition of Variables

Immunization refers to the use of vaccine to prevent various child killer diseases among under-five children. Such killer diseases include tuberculosis (Bacillus Calmette Gurine [BCG]), tetanus, whooping cough, diphtheria, poliomyelitis, hepatitis B, yellow fever, and measles. This immunization makes children or individual resistant to all infectious diseases through the administration of a vaccine. Immunization against vaccination preventable diseases (VPDs) through the expanded programme of Immunization (EPI) is one of the most economical public health interventions available that contributes extensively to achieving the Millennium Development Goal to reduce the mortality rate of children under five.

Maternal characteristics was pertaining to those factors that may predict women participation in the immunization of their children. Such factors may include age of the mother, mothers' location of residence, and mothers' educational level on immunization status of under-five children. In the present study maternal characteristics were captured based on the number of children used in the study since every eligible child in a household was selected for the study.

5. Study Instruments

The instrument for data collection was an immunization checklist. The instrument was adapted from the routine immunization supportive checklist Nigeria. Child's immunization cards were utilized to extract information on the immunization status for all the vaccines prescribed in the immunization schedule.

This instrument was deemed necessary owing to the retrospecttive nature of the study. The checklist was used to extract data sighted from the children's immunization cards from where their immunization status was established. A child was ranked as fully immunized (FI) if he/she received all vaccines prescribed in the immunization schedule, partially immunized if started but not completed (PI) and not immunized if no vaccine was given (NI).

The immunization cards supplied the evidence of immunizations taken by a child and utilized in the collection of data for the study. Out of the 2865 copies of the checklist distributed, 2655 copies were returned showing a response rate of 92% of the sample which was deemed fit for the study. Number of the checklist not returned was 210 representing only 7% of the sample. From the 2655 returned copies 7 copies were rejected. The reason for not returning the checklists was due to inaccessibility of some parts of the LGAs especially as the data was collected in June/ July during the peak of the raining season. The rejected copies were due to ineligibility of the prints which were blurred by rain drops. The valid 2648 copies were used for data analysis.

6. Data analysis

Univariate Data were analyzed univariately using both descriptive and inferential statistics with the help of the SPSS version 23 application. Frequency and percentage were used to answer research questions while

chi-square (χ^2) was used to test the hypotheses at 0.05 level of significance.

RESULTS

1. Univariate analysis

Univariate analysis is used to explain the frequency distribution of study subject characteristics. The results of the analysis can be seen in Table 1.

Table 1 shows that 83.01% of under-5 children are fully immunized, 8.27% partially immunized and 8.72% not immunized suggesting a high immunization status of under-five children in Ebonyi State.

Table 1. Immunization Status of Under-five Children in Ebonyi State (n = 2648)

Immunization Status of Children	Responses
Fully Immunized	2198 (83.01%)
Partially Immunized	219 (8.27%)
Not Immunized	231 (8.72%)

Table 2 shows the result of analysis on the influence of mothers' age, mothers' location of residence, and mother education on immunization status of under-five children in Ebonyi State. Table 2 indicates that 83.47% of under-five children with mothers aged 15-35 years had full immunization, 9.37% of them were partially immunized while 7.16% received no immunization. For under-fives born to mothers aged 36-49 years, 81.92% had full immunization, 5.69% partial and 12.38% not immunized. The result shows that mothers aged 15- 35 years fully immunized their children more than mothers aged 36-49 years (83.47% and 81.92%) respectively.

Table 2. Influence of Mothers' age on Immunization Status of Under-five Children in Ebonyi State

Mothers' Age	Immunization Status of Children Responses			Total
	FI	PI	NI	
15 – 35 years	1550 (83.47%)	174 (9.37%)	133 (7.162%)	1,857
36-49 years	648 (81.92%)	45 (5.69%)	98 (12.38%)	791
Mothers' Location of Residence				
Urban	580 (75.23%)	69 (8.95%)	122 (15.82%)	771
Rural	1618 (86.20%)	150 (7.99%)	109 (5.81%)	1877
Mothers' Educational Level				
No formal education	245 (78.53%)	23 (7.37%)	44 (14.10%)	312
Primary education	762 (81.76%)	65 (7.04%)	105 (11.27%)	932
Secondary education and above	1,191 (84.83%)	131 (9.33%)	82 (5.84%)	1,404

FI = fully immunized, PI = partially immunized, NI = not immunized

Mothers' location of residence on immunization status of under-five children in Ebonyi State. The Table 3 shows that 75.23% of under-five children born of urban mothers had full immunization, 8.95% partial and 15.82% not immunized. The result reveals that 86.20% of under-fives from rural mothers had full immunization, 7.99% partial and 5.81% not immunized. The result implies that under-five children from rural mothers had higher number of full immunizations more than those from urban mothers (86.20% and 75.23%) accordingly.

The result of analysis shows that 78.53% of under-fives from mothers with no formal education got full immunization, 7.37% partial and 14.10% not immunized. Also, 81.76% of under-fives from mothers with primary education were fully immunized, 7.04% partially and 11.27% not immunized. Further, 84.83% of under-fives from mothers with secondary school and above had full immunization, 9.33% partial and 5.84% not immunized. The result implies that the highest children to be fully immunized were 84.83% from mothers with secondary education and above followed by 81.76% from mothers with secondary education. The least to be fully immunized was 78.53% of under-fives from mothers with no formal education.

Table 3 shows that OR= 26.62, is significant at p < 0.001. Therefore, the hypothesis of no significant influence of mothers' age and immunization status in Ebonyi State is rejected. Thus, there is a significant influence of mothers' age on immunization status of under- five children in Ebonyi State.

Table 3. Summary of chi-square Analysis of Mothers' age and Immunization Status of Under-five Children in Ebonyi State

Immunization Status	Mothers' Age		Total	OR	p
	15-35 years	36-49 years			
FI	1550 (1541.4)	648 (656.6)	2198 (2198.0)		
PI	174 (153.6)	45 (65.4)	219 (219.0)	26.62	<0.001
NI	133 (162.0)	93 (69.0)	231 (231.0)		

Table 4 shows that the OR = 71.39, is significant at p < 0.001. This means that the hypothesis stating that there is no significant influence of mothers' location of residence and immunization status of under-five children in Ebonyi State is rejected. Thus, there is a significant influence of mothers' location of residence and immunization status of under- five children in Ebonyi State.

Table 4. Summary of Chi-square Analysis of mothers' location of residence and Immunization Status of Under-five children in Ebonyi State

Variables	Mothers' Local of Residence		Total	OR	p
Immunization Status	Urban	Rural			
FI	580(640.0)	1618(1558.0)	2198(2198.0)		
PI	69(63.8)	150(155.2)	219(219.0)	71.39	<0.001
NI	122(67.3)	109(163.7)	231(231.0)		

Table 5. Summary of Chi-square Analysis of mothers' educational level and Immunization Status of Under-five children in Ebonyi State

Variables	Mother's Educational Level			Total	OR	p
	No Formal	Primary	Secondary and above			
FI	245 (259.0)	762 (773.6)	1191 (1165.4)	2198 (2198.0)		
PI	23 (25.8)	65 (77.1)	131 (116.1)	219 (219.0)	36.23	<0.001
NI	44 (272)	105 (81.3)	82 (122.5)	231 (231.0)		

Table 5 reveals that the OR= 36.229, is significant at p < 0.001. This means that the hypothesis which stated that there are no significant influence of mothers' education-

nal level and immunization status of under-five children is rejected. Therefore, there is a significant influence of mothers' educational level on immunization status of under-five children in Ebonyi State.

DISCUSSION

Results in Table 1 showed that 83.01% of under-five children were fully immunized, 8.27% partially immunized and 8.72% not immunized. The above finding indicates that the immunization status in Ebonyi State was high drawing from the 2015 Ebonyi state immunization coverage target of 85% and an expected national immunization coverage of 80% minimum (Ebonyi State ministry of health, EPI unit 2016 and Abdulraheem et al., 2011). The reason for the high rate may be due to the fact that immunization is free in addition to frequent immunization campaigns in the state.

Activities like house-to-house immunization, state immunization days may have helped to beef up Ebonyi State immunization status. Further, the submission of Vaccine Audit Report (2012) that funding for vaccine procurement has improved immunization uptake recently also may have been the reason for the high immunization status of under-five children in the State. The implication of the observed high immunization status of under-five children in Ebonyi State is that the federal government and donor agencies are to encourage the state government in her effort in controlling vaccine preventable diseases among the vulnerable group.

The finding of the present study shows that greater number of under- fives in Ebonyi State were fully immunized. This finding agrees with the observation of Tagbo et al. (2014) that carried out a study to assess vaccination coverage and its determinants in Children Aged 11 - 23 Months in Enugu Metropolis. The results of their study revealed that among the children surveyed, 84.9% completed all the vaccinations by card and recall, indicating a high immunization status among the study group.

The present finding also supports the findings of Adebayo et al. (2012) that carried out a study to assess routine immunization coverage and its determinants in a rural community in South Western Nigeria. The findings revealed relatively high immunization coverage among the study group. The finding of the present study that a greater number of under-five children were fully immunized in Ebonyi State supports the findings of Oyefora (2011) in Ojo Local Government Area, Lagos State which revealed an increased uptake (92 .5%) of immunization. The finding of high immunization status of under- five children in the present study is also in consonance with the findings of Chakraborty et al. (2014) that there was a high immunization status found among children less than one year (85.48%) in a study conducted in West Bengal. Further, the finding agrees with the findings of Onsomu et al. (2015) in their study which examined the association between maternal education and child immunization (12–23 months) in Kenya. They reported that majority of the children had full immunization.

However, the finding of the present study of high immunization status differs from the findings of Mosiur and Sarker (2010) who reported that only 61.7% children were fully immunized in rural Bangladesh which indicated a low immunization status. The present finding also varies from that of Abdulraheem et al. (2011) who observed that 62.8% representing two third of their study population were not fully immunized showing a low immunization status.

Further, the finding varied from the findings of Etana and Deressa (2011) who carried out a study in Addisaba to assess

immunization coverage and factors affecting immunization status of children aged 12-23 months. Their study reported a low immunization status of the study group. The finding of high immunization status differs from the findings of Mokogwu and Adeleye (2014) on full Immunization Status of Under-Five Children in an Urban Community in South-South Nigeria.

In their study, of the total of 259 caregivers interviewed, 111 (42.9%) reported full immunization of their 12-59-month-old children and 27 of 74 (36.5%) gave a similar report on their 12-23-month-old children, suggesting a low immunization status. Though the result of the present study is high and recommendable, it is not high enough to meet the global target of 90-95%.

1. Influence of maternal age on immunization status of under-five children

Results in Table 2 revealed that 83.47% of under-five children from mothers aged 15-35years were fully immunized more than 81.92% from mothers aged 36-49years. The finding suggests that younger mothers immunized their children more than older mothers implying that age of mothers influenced the immunization status of under-five children in Ebonyi State. This finding is rather a surprise because, older mothers are supposed to have more experience and knowledge of the benefits of childhood immunization. Be that as it may, it could be that with increased responsibility as mothers get older, they tend to pay less attention to their children's welfare including health care. The reason may also be that younger mothers are more exposed to media sources of immunization activities more than the older mothers.

On further analysis using chi-square, results in Table 8 revealed that there was a statistically significant influence of mothers' age on immunization with OR= 26.62 significant at $p < 0.001$. The result is agreement with the assertion of Mosiur and Sarker (2010) who observed that age was a strong factor associated with immunization status. Monsiur and Sarker (2010) also reported that younger mothers were more likely to immunize their children more than the older ones.

The finding also supports the study of Kamau and Essem (2001) who reported that younger mothers immunized their children more than older mothers in a study done in Kenya. In the same vein, the finding agrees the findings of Zimstat (2007), who observed that immunization status was lower with children born to older mothers in Zimbabwe. The finding of decrease in immunization of children as mothers' age increased is in consonance with the findings of Mokogwu and Adeleye (2014) who reported that childhood immunization dropped with increased mothers' age.

In contrast to the finding of the present study on better immunization of children by younger mothers, Elizabeth, Mary, Abigail and Sussan (2003) observed that children were less likely to be fully immunized if they were from younger mothers. The finding also varies from the findings of Ibnouf et al. (2007) who reported that children of older mothers had better immunization (82.6%) than children from younger mothers (68.6%). Further, this finding differs from the findings of Ettana and Deressa (2011) who observed that there was no significant association between maternal age and immunization status.

Again, the finding that age had a significant association with immunization status differs from the findings of Oyefara (2011) who reported that mothers' age had no significant association with childhood immunization. The reason of the variations in the findings of the various studies could be due to differences in the settings. The

differences could also be as a result of other factors such as level of education or living condition. The finding that children born of younger mothers were better immunized than those from older mothers has far reaching implications for health educators. This calls for health educators to focus more on age specific health intervention strategies which would encourage older mothers to immunize their children better.

2. Influence of maternal residence on immunization status of under-five children in Ebonyi State

Results in Table 3 revealed that 86.20% of under-five children from rural mothers were fully immunized more than 75.23% of those from urban mothers. This suggests that mothers' location of residence influenced immunization status of under-five children in Ebonyi State. Further, the summary of chi-square analysis in Table 6 showed that there was a statistically significant influence of mothers' location on immunization status of under- five children with OR = 71.39 significant $p < 0.001$.

The above result was surprising and unexpected. Mothers in the urban area are supposed to be more enlightened than their rural counterparts. All things being equal, it follows that they should know and value health care services including immunization for their children more than rural mothers. This finding has the implications of health educators carrying more of their health education intervention strategies more in the urban areas of Ebonyi State. The reason for the present finding might be that health educators created more awareness campaigns more in the rural areas than in the urban taking urban residency for granted. It could also be that urban mothers claim to be too busy to have time for immunization activities.

However, the findings agree with the findings of Ibnouf et al. (2007) who observed that full immunization was higher in the rural than urban areas, 56 (80%) against 25 (67.5%), p= 0.143. The finding also agrees with that of Mukungwa (2015) in Zimbabwe which revealed that rural Mashonaland West region had higher immunized children than those from Hararap which is urban. This same study in Zimbabwe equally revealed that other rural areas in the country were three times more likely than other urban areas to have more immunized children.

In contrast to the findings of the present study, most reviewed studies on immunization status reported that children from urban areas were more likely to get full immunization more than rural children. For instance, Kidane et al. (2008) reported that children from slum or rural areas were less likely to have complete immunization than those from urban. The same study revealed that children born of mothers from urban- slum or rural areas were less, likely to get full immunization. Further, the findings of Sarab et al. (2008), Mosuir and Sarker (2010), Munthal (2007), and Fermandez et al. (2011) all reported that children from urban areas were more immunized than rural children. In the present study, it might be that more health centers were located more in the rural more than in the urban areas of Ebonyi State. Living in rural areas makes immunization access more challenging. Where one lives can therefore be a considerable constraint in one's capacity to get to the services.

3. Influence of mothers' educational level on immunization status of under-five children in Ebonyi State

Table 4 revealed that the highest number of under- five children to be fully immunized were 84.83% from mothers with secondary education and above followed by 81.76% from mothers with primary education. The least to be fully immunized was 78.53% of

under-fives from mothers with no formal education. The data above imply that mothers' educational level had an influence on the immunization status of under-five children in Ebonyi State.

Analysis using chi-square on the influence of mothers' educational level and immunization status revealed in Table 12 that there was a significant influence of mothers' educational level and immunization status. The OR= 36.23 was significant at $p < 0.001$. The above findings were expected because; mothers who are more educated should be more knowledgeable on the benefits of good health practices including immunization. The finding also implied that the more mothers get education, the more empowered economically and socially to care for their children, all things being equal. This result shows that education is very important in adequate childhood immunization. These findings of educational level of mothers influencing immunization status of their children and being significantly associated has a serious implycation for health educators to be more pragmatic in educating mothers on the benefits of adequate immunization for their children.

The present finding is in line with Oyefara (2014) who observed that mothers with primary and secondary education had positive attitude towards full immunization of their children. This finding further agrees with several other reviewed studies such as Mutua et al. (2011) who noted that mothers with primary education were about 1.5 times more likely to immunize their children more than those with no form of education.

Again, Odinsanya et al. (2010) reported that there was a high immunization rate in most educated areas more than in the less educated areas of their study. Consistently, this finding is in line with the findings of other previous authors in their observations that education imparts skills and competence that are pivotal to human development and enhancement in the quality of life. Such authors as Ettana and Deressa (2011); Mukungwa (2015); Anup et al. (2014), Tagbo et al. (2014), Ettana and Deressa (2012), and Olumuyiwa et al. (2008), all reported that education of mothers had significant association with immunization status of under-five children as in the present study. Health educators should direct their health intervention strategies to meet the needs of various maternal characteristics such as ages, location of residence, and educational level of mothers of under- five children.

AUTHORS CONTRIBUTIONS

This work was carried out in collaboration among all authors. Authors ENA, CII and COA designed the study, and wrote the first draft of the manuscript. Authors LNOA, COA, JNN, REO, ETS, and BRE analyzes and interprets data, reviewed final summaries of selected studies and complete all incompatible data through discussion. All authors read and approved the final manuscript.

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CONFLICT OF INTEREST

Authors have declared that no competing interests exist

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