PREVALENCE AND DETERMINANTS OF STUNTING AMONG PRIMARY SCHOOL CHILDREN IN RURAL AND URBAN COMMUNITIES IN OBAFEMI OWODE LOCAL GOVERNMENT AREA, SOUTHWESTERN NIGERIA

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ABSTRACT

Background: Studies on stunting in children have largely focused on the under-five, establishing it as a strong predictor of mortality in these children. Few studies have documented the prevalence or determinants of stunting among school children in southwestern Nigeria. The aim of the study was to determine the prevalence and predictors of stunting among selected primary school children in rural and urban communities of Obafemi Owode Local Government Area, Ogun State.

Methods: A cross-sectional study of rural and urban primary school children was conducted. An interviewer-administered questionnaire was used to collect information on respondents’ and parents’ socio-demographic characteristics. Stunting was defined as height-for-age less than two standard deviations from the median height-for-age of the standard World Health Organization reference population. Using EPI-INFO version 6.03, children were classified as stunted if z-scores of height-for-age were less than 2 standard deviations below the National Centre for Health statistics (NCHS)/WHO median. Height and weight were taken using a stadiometer and weighing scale respectively. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 16.0 while predictors were determined using logistic regression at 95% level of significance.

Results: A total of 1,160 primary school children were studied with 52.2% from rural schools. Males constituted 57.1% and 51.8% in the rural and urban school respectively. Prevalence of stunting among rural school children was 46.2%, and was significantly higher (p<0.001) than among urban children at 33.8%. Younger children <10 years (OR: 0.088; 95CI: 0.052 - 0.150) and children between 11-12 years (OR: 0.534; 95CI: 0.322 - 0.886) were at a significantly lower risk of stunting both in rural schools compared to children >13 years.

Conclusion: The prevalence of stunting was high especially among pupils from schools in the rural communities. This underscores the need for urgent feasible and effective nutrition programs for primary school children especially those in rural schools within the study area.

Keywords: Stunting, School children, Undernutrition, Millennium development goals, Sustainable development goals

BACKGROUND

Malnutrition has continued to persist in both developed and developing countries.1,2 Stunting is an indicator of chronic malnutrition which may lead to poor mental development later in life.3 Stunting typically represents a cumulative process of reduced growth that predominantly occurs before three years of age and persists into school age.4

Globally, prevalence of stunting amongst school age children typically varies from place to place ranging from 9.3-24.0% in Latin America and Caribbean to as high as 20.2-48.1% in Africa.5 In South Africa the prevalence for stunting is 18.0%, whereas it is as high as 42.0% and 50.0% in mid and Eastern Africa respectively.6 Nationally, prevalence of stunting among primary school children ranges from 11.5% in Anambra, 11.8% in Onitsha to as high as 60% in Kebbi State.7,8 In Nigeria, the progress towards halving the proportion of people suffering from hunger under the Millennium Development Goals (MDGs)9 has hitherto been slow and daunting.

Stunting has profound effects on the health of children. It predisposes to heightened risks of severe infections as a result of immune-compromised responses.10 Stunting has also been implicated in increased

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morbidity and mortality, reduced physical, neurodevelopmental and economic capacity and an elevated risk of metabolic disease into adulthood.\textsuperscript{11} Under-nutrition significantly interferes with a number of bodily functions such as immunity (cell-mediated immune responses)\textsuperscript{12} antibody responses and cytokine production\textsuperscript{13}, that as a result provoke poor health outcomes in early infancy and childhood.\textsuperscript{14,15} Most importantly, the high prevalence of bacterial and parasitic diseases in poor and developing countries have continued to exacerbate the effect of stunting in children.\textsuperscript{16} 

Risks of stunting are high in children as a result of heightened vulnerabilities to “low dietary intake, inaccessibility to food, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos and infectious diseases”\textsuperscript{17}. Significant associations have been established between early childhood stunting and late onset adulthood depression with elevated self-reported conduct problems.\textsuperscript{17} The consequences of stunting iterated above demonstrate the need to investigate and implement interventions to address the problem amongst school children. Furthermore, the ‘double burden of malnutrition’, (in which households have a stunted child and an overweight mother) makes stunting as a form of under-nutrition quite worrisome.\textsuperscript{18-20} 

Numerous studies have investigated and provided broader national estimates of stunting\textsuperscript{8}, even though key health-related targets in the Millennium Development Goals and the Sustainable Development Goals supports concerted calls to eradicate poverty and hunger whilst also bridging inequities in health.\textsuperscript{21} Bearing this in mind, there is a dire need for comparative statistics across wealth quintiles and vulnerable populations that can inform formulation and adoption of feasible policies at the strategic and operational levels of government in order to curtail the effects of stunting in Nigeria and sub-Saharan Africa. The objective of this study was to document the prevalence of stunting and its determinants amongst rural and urban students in selected primary school pupils of South-Western Nigeria.

METHODS
This cross-sectional study was conducted in selected public primary schools in Obafemi-Owode Local Government Area (LGA) in Ogun Central Senatorial District. The LGA is predominantly rural with a total of 161 public primary schools and 63 private primary schools. In addition there are 41 health facilities owned by the LGA and these are made up of 3 comprehensive health centres, 22 health centres, 8 health clinics and 8 health posts.\textsuperscript{22} The study was carried out in the third term of the 2007/2008 academic year. Data collection was between May and July 2008.

The target population consisted of children from public primary schools in Obafemi-Owode Local Government Area. Sample size for comparison of two independent groups\textsuperscript{23} was used to deduce a minimum sample size of 400 participants per group. A multi-stage sampling technique was utilized to recruit a total of 1,160 grade 4 pupils across the study sites. This class was purposively chosen because most of the pupils were old enough to answer the questions correctly and were not preparing for national examinations at the time of data collection (as those in grades 5 and 6). Pupils with chronic ailments were excluded from the study.

List of all primary schools was obtained from Obafemi-Owode Local Government Education Authority and were stratified into urban and rural categories. Based on the population of primary four (4) pupils in all the schools, a total of 62 rural and urban were selected using proportionate allocation. In each school that was selected, grade 4 pupils were considered as a cluster and all eligible students that met inclusion criteria were interviewed. Out of 1,400 consent forms given out, 1,160 forms were returned resulting in a response rate of 82.9%. Six hundred and six (606) and 554 pupils were selected from the rural and urban schools respectively. A semi-structured pretested interviewer-administered questionnaire was used to obtain information on socio-demographic characteristics. Anthropometric measurements (weight and height) were both used to compute nutritional status which was done with the help of trained community health workers. Before weights and height measurements were taken, pupils were requested to come dressed in lightweight clothing while the scale was returned to zero before every subsequent measurement was taken. The weight and height of each child were measured using a standard balanced beam scale with attached measuring rods according to World Health Organization standards.\textsuperscript{24} All weight and height measurements were taken twice to ensure accuracy. Independent variables for the study included both socio-demographic characteristics of respondents and anthropometric measurements of respondents. Dependent variable used in this study was presence or absence of stunting. Stunting was assessed by measuring Height-for-age (stunting) Z-scores calculated using Centre for Disease Control (National Centre for Health Statistics)/World Health Organization reference values\textsuperscript{25} with EPI-INFO software package version 6.03. Children were classified as stunted if the Z-scores

\textsuperscript{4.03. Children were classified as stunted if the Z-scores...}
were < -2 standard deviations below the median values of the international reference.25,26

Data were analysed using the Statistical Package for the Social Sciences (SPSS) Version 16. Frequency distributions of the quantitative variables were obtained. Differences in proportions were tested using the chi-square test for categorical variables. The Fisher’s Exact test was used to compare proportions in tables with >20% of the cells having expected counts less than 5. Statistical significance level was set at P < 0.05.

Multivariate logistic regression analysis was carried out to identify predictors for stunting in the study population.

Prior to data collection, ethical approval was obtained from the Health Research Committee of Federal Medical Centre, Abeokuta and the Ogun State Universal Basic Education Board respectively. Informed consent was obtained from parents while assent was obtained from pupils above the age of 12. Only the children who gave assent and parents that

| Variable          | Rural N=606 (%) | Urban N=554 (%) | Total N=1160 (%) | X²  | p-value  |
|-------------------|-----------------|-----------------|------------------|-----|----------|
| Age (years)       |                 |                 |                  |     |          |
| ≤ 10              | 259 (42.8)      | 231 (41.7)      | 490 (42.2)       | 2.449| 0.294    |
| 11 - 12           | 236 (38.9)      | 237 (42.8)      | 473 (40.8)       |     |          |
| ≥ 13              | 111 (18.3)      | 86 (15.5)       | 197 (17.0)       |     |          |
| Sex               |                 |                 |                  |     |          |
| Male              | 346 (57.1)      | 287 (51.8)      | 633 (54.6)       | 3.268| 0.071    |
| Female            | 260 (42.9)      | 267 (48.2)      | 527 (45.4)       |     |          |
| Birth Order       |                 |                 |                  |     |          |
| 1 – 4             | 383 (63.2)      | 386 (69.7)      | 769 (66.3)       | 5.428| 0.020*   |
| ≥ 5               | 223 (36.8)      | 168 (30.3)      | 391 (33.7)       |     |          |
| Caregiver         |                 |                 |                  |     |          |
| Both parents      | 460 (75.9)      | 458 (82.7)      | 918 (79.1)       | 10.42| 0.005*   |
| Grandparents      | 91 (15.0)       | 50 (9.0)        | 141 (12.2)       |     |          |
| ** Others         | 55 (9.1)        | 46 (8.3)        | 101 (8.7)        |     |          |
| Stunting          |                 |                 |                  |     |          |
| Yes               | 280 (46.2)      | 187 (33.8)      | 467 (40.3)       | 18.652| <0.001*  |
| No                | 326 (53.8)      | 367 (66.2)      | 693 (59.7)       |     |          |
| Clinical Characteristics |       |                 |                  |     |          |
| Weight (kg) Mean ± SD | 25.9 ± 4.9 | 28.1 ± 5.2 | 27.0 ± 5.2 | t = -7.287 | <0.001*  |
| Height (cm) Mean ± SD | 131.8±7.5 | 133.5±8.1 | 132.6±7.9 | t = -3.539 | <0.001*  |

Table 1: Association between socio-demographic characteristics by location only

Mothers’ Family Characteristics by location

| Educational status | Rural N=606 (%) | Urban N=554 (%) | Total N=1160 (%) | X²  | p-value  |
|--------------------|-----------------|-----------------|------------------|-----|----------|
| No formal          | 150 (24.8)      | 112 (20.2)      | 262 (22.6)       | 38.960† | <0.001*  |
| Primary            | 341 (56.3)      | 252 (45.5)      | 593 (51.1)       |     |          |
| Secondary          | 110 (18.2)      | 169 (30.5)      | 279 (24.1)       |     |          |
| Post-secondary     | 4 (0.7)         | 16 (2.9)        | 20 (1.7)         |     |          |
| Tertiary           | 1 (0.2)         | 5 (0.4)         | 6 (0.5)          |     |          |

Occupation

| Civil servant      | 10 (1.7)        | 34 (6.1)        | 44 (3.8)         | 15.968| <0.001*  |
| Traders/artisans/farmers | 596 (98.3) | 520 (93.8) | 1116 (96.2) |

Fathers’ socio-demographic characteristics by location

| Educational status | Rural N=606 (%) | Urban N=554 (%) | Total N=1160 (%) | X²  | p-value  |
|--------------------|-----------------|-----------------|------------------|-----|----------|
| No formal          | 115 (19.0)      | 88 (15.9)       | 203 (17.5)       | 55.210† | <0.001*  |
| Primary            | 344 (56.8)      | 232 (41.9)      | 576 (49.7)       |     |          |
| Secondary          | 142 (23.4)      | 199 (35.9)      | 341 (29.4)       |     |          |
| Post-secondary     | 4 (0.7)         | 26 (4.7)        | 30 (2.6)         |     |          |
| Tertiary           | 1 (0.1)         | 9 (1.6)         | 10 (0.9)         |     |          |

Occupation

| Civil servant      | 33 (5.4)        | 69 (12.5)       | 102 (8.8)        | 17.730| <0.001*  |
| Traders/Artisans/Farmers | 573 (94.6) | 485 (87.5) | 1058 (91.2) |

* - Statistically significant  **Others – Uncles and Aunts  † - Fisher’s Exact Test
gave their informed consent were enrolled into the study. All information and findings were treated with strict confidentiality.

RESULTS

Socio-demographic Characteristics of Respondents

Mean age of respondents was 11.1 ± 1.6 years with majority of participants less than 10 years (42.2%). There was a male preponderance (54.6%) with a greater number of respondents within the first four children in the family (66.3%). More respondents lived with both parents (79.1%). A greater proportion of mothers (96.2%) and fathers (91.2%) of participants were either traders, artisans or farmers. Highest educational status attained was primary education for both mothers (51.1%) and fathers (49.7%) (Table 1).

| Socio-demographic Characteristics | Rural | | | Urban | | | X² | p-value | | Stunted n (%) | | Not Stunted n (%) | | X² | p-value |
|----------------------------------|-------|----|----|-------|----|----|---|---|----|----|---|---|
| **Age (years)**                  |       |    |    |       |    |    |   |   |     |    |   |   |
| <10                              | 54(19.3)| 205(62.9)| 122.01| 0.001*| 31(16.6)| 200(54.5)| 92.477| 0.001*|
| 11-12                            | 144(51.4)| 92(28.2)| 98(52.4)| 139(37.9)| | | | | |
| ≥13                              | 82(29.3)| 29(8.9)| 58(31.0)| 28(7.6)| | | | | |
| **Sex**                          |       |    |    |       |    |    |   |   |     |    |   |   |
| Male                             | 167(59.6)| 179(54.9)| 1.379| 0.240| 96(51.3)| 191(52.0)| 0.025| 0.875|
| Female                           | 113(40.4)| 147(45.1)| 91(48.7)| 176(48.0)| | | | | |
| **Birth order**                  |       |    |    |       |    |    |   |   |     |    |   |   |
| 1-4                              | 178(63.6)| 205(62.9)| 0.031| 0.861| 129(69.0)| 257(70.0)| 0.064| 0.801|
| ≥5                               | 102(36.4)| 121(37.1)| 58(31.0)| 110(30.0)| | | | | |
| **Caregiver**                    |       |    |    |       |    |    |   |   |     |    |   |   |
| Parents                          | 202(72.1)| 258(79.1)| 7.736| 0.021*| 152(81.3)| 306(83.3)| 4.628| 0.099|
| Grandparents                     | 43(15.4)| 48(14.7)| 23(12.3)| 27(7.4)| | | | | |
| Others                           | 35(12.5)| 20(6.2)| 12(6.4)| 34(9.3)| | | | | |
| **Respondents’ Family Characteristics and prevalence of stunting by school location** | | | | | | | | |
| **Mothers’ socio-demographic characteristics and stunting by location** | | | | | | | | |
| Educational Status               |       |    |    |       |    |    |   |   |     |    |   |   |
| Lower                            | 221(78.9)| 270(82.8)| 1.485| 0.223| 126(67.4)| 238(64.9)| 0.352| 0.553|
| Higher                           | 59(21.1)| 56(17.2)| 61(32.6)| 129(35.1)| | | | | |
| Marital Status                   |       |    |    |       |    |    |   |   |     |    |   |   |
| Currently Married                | 224(80.0)| 262(80.4)| 0.013| 0.910| 156(83.4)| 311(84.7)| 0.163| 0.687|
| Not currently married            | 56(20.0)| 64(19.6)| 31(16.6)| 56(15.3)| | | | | |
| Occupation                       |       |    |    |       |    |    |   |   |     |    |   |   |
| Civil Servants                   | 7(2.5)| 3(0.9)| 2.316| 0.200†| 9(4.8)| 25(6.8)| 0.859| 0.354|
| Traders, Artisans, Farmers       | 273(97.5)| 323(99.1)| 178(95.2)| 342(93.2)| | | | | |
| **Fathers’ socio-demographic characteristic and stunting by location** | | | | | | | | |
| Educational status               |       |    |    |       |    |    |   |   |     |    |   |   |
| Lower                            | 213(76.1)| 246(75.5)| 0.031| 0.861| 119(63.6)| 201(54.8)| 3.993| 0.046*|
| Higher                           | 67(23.9)| 80(24.5)| 68(36.4)| 166(45.2)| | | | | |
| Occupation                       |       |    |    |       |    |    |   |   |     |    |   |   |
| Civil servant                    | 11(3.9)| 22(6.8)| 17(9.1)| 52(14.2)| 2.930| 0.087|
| Traders/artisans/farmers         | 269(96.1)| 304(93.2)| 170(91.9)| 315(85.8)| | | | | |
| Number of wives                  |       |    |    |       |    |    |   |   |     |    |   |   |
| 1-4                              | 276(98.6)| 317(97.2)| 1.273| 0.400†| 185(98.9)| 358(97.5)| 1.217| 0.349†|
| ≥5                               | 4(1.4)| 9(2.8)| 2(1.1)| 9(2.5)| | | | | |

* - Statistically significant
† - Fisher’s Exact Test

Table 2: Bivariate associations by school location and nutritional status
Overall, 467 (40.3%) pupils were stunted. Mean weight and height for the respondents were 26.97 ± 5.2 (kg) and 132.6 ± 7.9 (cm) respectively (Table 1). Significantly more respondents with birth order of over 5 and living with grandparents, stunting, reduced weight, reduced height were more likely to be residing in the rural areas (p = 0.02, p= 0.05, p<0.001, p<0.001, p<0.001 respectively) compared to the urban counterparts. As regards the mothers of respondents, even though primary education (as the highest educational status attained) and occupation (as trader, artisans, or farmers) were observed in both rural and urban regions, the effect was significantly more likely to be observed in the rural areas compared to the urban (p<0.001, p<0.001). This pattern was also found in fathers as primary education and occupation as traders/artisans/farmers were more likely in the rural regions compared to the urban (p<0.001, p<0.001) (Table 1).

For both the rural and urban pupils, age 11-12 years were more likely to be stunted compared to other age groups (p<0.001). In the both rural and urban regions, stunting was more likely to be observed in pupils who were currently living with both parents, however significant only in rural areas (p=0.021) (Table 2).

Stunting was significantly more likely to be found in urban children if children by mother (p=0.046) and father (p=0.046) exceeded 5. Likewise, lower educational status of fathers in urban schools showed significant association with stunting in children (p=0.046) (Table 2).

The odds of finding a child stunted in the rural schools was significantly less among ages less than 10 (OR: 0.088; 95CI: 0.052-0.150) and 11-12 years (OR: 0.534; 95CI: 0.322-0.886) when compared with 13 years of age and above (Table 3). Likewise among urban pupils, the odds of stunting was significantly less among ages less than 10 (OR: 0.065; 95CI: 0.036-0.121) and 11-12 years (OR: 0.300; 95CI: 0.174-0.520) when compared with 13 years of age and above (Table 3).

Though not a significant finding, the odds of stunting amongst rural students living with either parents (OR: 0.545; 95CI: 0.285-1.044) or grandparents (OR: 0.623; 95CI: 0.287-1.349) was less compared to the students that stayed with other family members. Contrary to the findings in the rural schools, the odds of stunting in the urban schools was about 2.5 times and 4 times more likely when students stayed with parents (OR: 2.545; 95CI: 1.162-5.576) and 4 times more likely when students stayed with grandparents (OR: 4.032; 95CI: 1.498-10.855) respectively compared to the urban counterparts.
2.545; 95CI:1.162-5.576) and grandparents (OR: 4.032; 95CI:1.498-10.855) respectively (Table 3).

DISCUSSION

Majority of our participants were between the age range of 10 – 12 years, which is comparable with age estimates of the 2013 Nigerian Demographic Health Survey (NDHS) report it is quite disturbing that some pupils over the age of 13 years could still be found in 4th grade of selected primary schools in Nigeria.

The overall prevalence of stunting in our study was high compared to other countries such as Russia where prevalence of 3.3% and 17.9% respectively were reported. Our findings are also much higher than seventeen percent in another study, the difference must however be interpreted cautiously as the methodology and standards utilized to generate statistics essentially vary from one another. The most widely used being the Centers for Disease Control and Prevention 2000 (CDC-2000) and World Health Organization 2007 (WHO-2007) criteria. The study mirrors what is documented in literature. The increased odds of stunting among children living with either parents or grandparents negates what obtains from literature and which necessitates deeper research as to why this is so. Busy schedules that are much more associated with urban parents is arguably proposed in by Pandey, et al (2016) as factors that could predispose children to mal-nutrition.

Factors associated with stunting among school-age children in our study were rural location, respondents’ age. The odds of stunting among rural primary school pupils was almost twice its occurrence among the urban pupils. This significant higher levels found among rural compared to urban pupils offers credence to findings from literature that also report stunting more among children in rural than urban locations. Godoy and colleagues argue that rural ubiquity of stunting is probably because children as a result of lower productivity may tend to attract less medical attention when compared to adults. This higher prevalence of stunting may be as a result of a greater burden of intestinal parasitic infections in rural areas compared to urban or the increased risk of stunted mothers that is commoner in rural areas compared to the urban. The increased likelihood of stunting with increased age which was a significant finding in our study mirrors what is documented in literature. In this study, child aged 10–14 years had a 2.9 fold risk of stunting compared to younger age group. The increased likelihood of stunting associated with this age group could be due to increased risk of helminth infections that is associated with lesser degrees of cleanliness or hygienic practices.

Our study substantiates the literature which indicate a positive association between birth order over 5 and child malnutrition, nevertheless, the birth order (or children more than 5 in a family) was found to be commoner in rural compared to their urban areas in our study. Furthermore, the educational status of both parents as demonstrated in our study findings to be significantly associated with stunting buttresses existing literature and emphasizes the importance of educational status on stunting. The increased focus on younger age groups for school feeding programs such as the FRESH initiative (Focusing Resources on Effective School Health) may contribute to the protective effect of stunting among younger age groups as portrayed in our study. Furthermore, the occurrence of child labour that is commoner with older age groups or adolescents and its impact on under-nutrition is also a documented possibility that is extensively substantiated in literature and a plausible explanation for the stunting which is noticed to be increased with age in our study. The increased odds of stunting among children living with either parents or grandparents negates what obtains from literature and which necessitates deeper research as to why this is so. Busy schedules that are much more associated with urban parents is arguably proposed in by Pandey, et al (2016) as factors that could predispose children to mal-nutrition.

The findings from this study ought to be considered in view of some limitations. First, just as in studies using cross-sectional study design, we can only deduce associations but we could not establish causality or temporality of events. Secondly, there is a strong possibility that our estimates of stunting could be underestimated. Primarily because some of our respondents were excluded due to lack of parental informed consent and also because all our respondents were recruited only from schools. Estimates provided by this study would have to be applied cautiously to populations outside the primary school students thus reducing the generalizability of our findings. Studies have been conducted to estimate prevalence of stunting in various settings and countries, however to the best of our knowledge, this is one of the first studies to be conducted among school age children in Abeokuta, Nigeria and that provide factors that influence stunting exclusively with special cognizance of rural-urban dichotomy. Notable strengths of our study include the selection of a large and representative sample of school children and a high participation rate of children.

CONCLUSION/POLICY ISSUES

In conclusion, we found that the prevalence of stunting was higher among pupils from rural schools. Thus, the need for urgent feasible and effective nutrition programs for primary school children especially those in rural schools cannot be over-emphasized. The study also confirms location and age of pupils as significant predictors of stunting. In order to reduce the burden of stunting among pupils and eradicate malnutrition in all its forms (under Goal 2 of the sustainable
development goals), we advocate the need for focused and concerted efforts by the government to stimulate innovative policies that can stem the occurrence of stunting. Public health campaigns that promote consumption of balanced diets, discourage unhealthy lifestyle habits are advocated for to improve interventions for stunting. Furthermore, proper education of parents are also required to enhance acceptability of health interventions that are implemented to improve the nutritional status of children.

DECLARATIONS

Ethics Approval and Consent to Participate
Ethical approval to conduct the study was obtained from Federal Medical Centre ethics review board – FMCA/238/Vol III. Proper community entry was later observed by obtaining approval from the appropriate community leaders. The study was thoroughly explained to participants. Verbal and written consents to participate was obtained before commencement of the study.

Consent for Publication
Not Applicable

Competing Interests
None declared

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Authors’ Contributions
WU and MC conceptualized the study, drafted the study protocol. WU supervised the data collection. WU and TA carried out the data analysis. KO conducted the literature search. TA wrote the initial draft manuscript. All authors read and approved the final manuscript.

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